IEA Bioenergy Task 39 Commercializing 1st- and 2nd- Generation Liquid Biofuels from Biomass

Update on implementation agendas 2009

A review of key biofuel producing countries

A REPORT TO IEA BIOENERGY TASK 39

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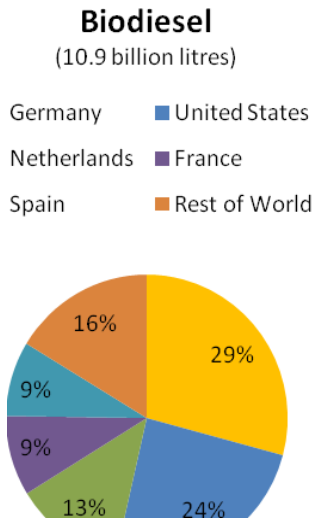
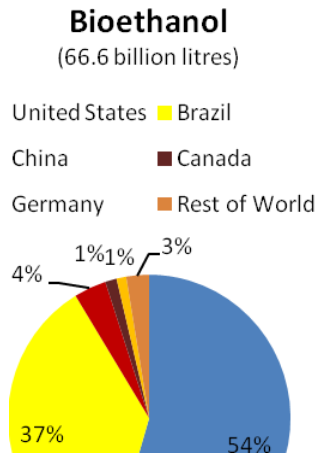
Executive Summary

Biofuels for use in the transportation sector have been produced on a significant scale since the 1970's, using a variety of technologies. This report examines the implementation agendas of 21 of the most significant biofuel producers and/or consumers in the world today, including many members of the International Energy Agency's Bioenergy Task 39 'Commercializing 1st and 2nd-generation liquid biofuels for transport'. In 2008, biofuel production capacity across the 21 countries considered in this study totalled 10.9 billion litres of biodiesel, and 66.6 billion litres of bioethanol. Over 99% of this production is considered 1st-generation, including both sugar- and starch-based bioethanol, and oilseed- and waste oil-based biodiesel. Dominant biofuel producers are shown in the figures and tables below.





Country	Biodiesel (million L/a)
Germany	3,180
United States	2,650
Netherlands	1,372
France	991
Spain	926
United Kingdom	347
Australia	260
Austria	252
Portugal	227
Brazil	110
Belgium	108
Denmark	103
Canada	100
Poland	91
Ireland	63
China	60
Norway	39
Japan	10
Finland	0

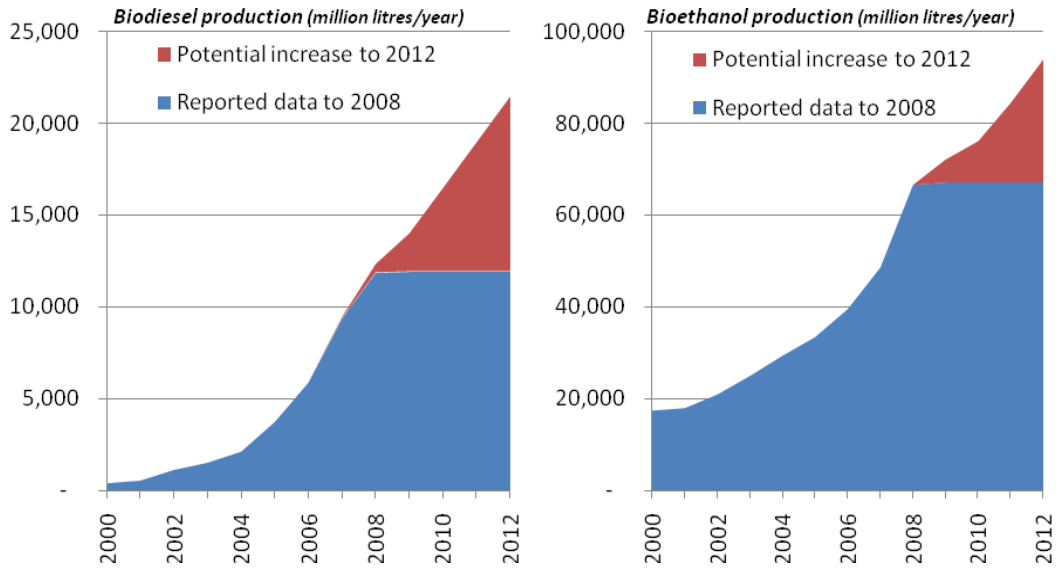
Country	Bioethanol (million L/a)
United States	36,300
Brazil	24,497
China	2,448
Canada	870
Germany	730
France	578
Spain	578
Australia	164
United Kingdom	153
Poland	151
Ireland	85
Austria	13
Finland	3
Belgium	0
Denmark	0
Japan	0
Netherlands	0
Norway	0
Portugal	0

As the graphs and tables on the previous page indicate, biofuel production continues to be dominated by a very short list of countries. Just five countries provide 84% of the biodiesel production covered in this study, with Germany and the United States providing more than 50% of that total. Two countries, the United States and Brazil, make up 91% of the bioethanol production covered in this report. The fact that so much of the world's production capacity is located in such a short list of countries, each of which has aggressively pursued biofuel alternatives to petroleum-based fuels, is an indication of the strong role that policy can play in developing alternative fuel systems.

Outside of this report, a few other countries (notably India, Malaysia, and Indonesia) are developing biofuel production capacity; these countries will be considered in future iterations of this report.

This report has also highlighted the rapid growth in the biofuels sector, with data provided in most country analyses on the evolution of biofuel production. The sum of 21 countries biofuel production since 2000 is shown in the graphs below. Across these countries, biodiesel production has risen from less than 1 billion litres per year to over 10.9 billion litres per year in just eight years; this is an increase of over 1000%. Bioethanol production has risen from just less than 20 billion litres per year to 66 billion litres per year in the same period, an increase of over 300%. As discussed above, much of the explosive growth that has been observed has been in just three countries – Germany, the United States, and Brazil.

In the figures below, the sum of biofuel growth across 21 countries is shown from 2000 to the present. The blue area indicates the biofuel capacity reported to be online; the red area projects growth in capacity to 2012, when the first iteration of biofuel mandates in many Task 39 countries will reach their end point. It can be seen that, if current trends continue, the production of biodiesel will top 20 billion litres per year by 2012, while the production of bioethanol will exceed 90 billion litres.



An appropriate question to ask might be, can current trends continue? If the three major biofuel producing nations are considered, signs may be seen that policy directions – so long focused simply on biofuel production capacity – are now being corrected to address more nuanced questions of economic and ecological sustainability. A strong move towards 2nd-generation biofuel production may be seen in the United States'. In Germany, a growing emphasis on sustainability is becoming apparent, and this theme is being taken up by the USA and many other European nations. Only in Brazil does the 'business-as-usual' case of sectoral growth seem to apply.

United States: The most significant policy development in the United States in recent years is the legislation of a Renewable Fuel Standard (RFS) as part of the Energy Independence and Security Act (EISA) of 2007. The RFS

requires 136.3 billion litres of biofuel in the transportation fuel mix by 2022, and includes specific provisions for advanced biofuels, including cellulosic ethanol and biomass based diesel contributions that pave the way for advanced technologies. Classifications for biofuels include conventional (1st-generation) biofuels, as well as advanced biofuels (including cellulosic ethanol and 'green gasoline, green diesel, and other synthetic fuels all of which can be classified as 2nd-generation biofuels). Under the RFS, ethanol production from conventional corn-based systems will be capped at 56.8 million litres per year as of 2015, which is about 22 million litres additional capacity over 2008 figures. New conventional bioethanol facilities will be held to tight environmental performance regulations. At the same time, advanced biofuel production (including 2nd-generation cellulosic-based biofuels) is expected to rise dramatically. In 2009, 2.3 million litres of biofuel produced in the United States must be classified as advanced biofuels. The ability of the industry to meet the RFS for advanced biofuels is limited, with only one or two projects under construction for production of these fuels, and with little active capacity to meet the 2009 requirement. It should be noted that requirements for advanced biofuels only rise after 2009, and would exceed conventional biofuels by 2021.

Germany: Until 2006, Germany biodiesel production enjoyed a complete tax exemption. Since August 1, 2006, the former complete tax exemption on biofuels has been reduced, allowing neat biodiesel to be taxed at an increasing rate. Blends of 1st generation biofuels are also fully taxed --- with the exemption of E85. Taxation of pure plant oil started later, but will reach the same peak. In October 2008 the government presented a draft for the amendments in the biofuel quota act, which will go into force presumably in March/April 2009. Recently, the German parliament's lower house gave its final approval to the government proposals to cut the 2009 blending target to 5.25% biofuel content in fossil fuel in 2009 from the 6.25% originally intended

Introducing tax on domestic biofuel production has had two effects. One effect is the reduction in biofuel production. Germany biofuel production peaked in 2007 at 3,560 million litres of biodiesel, 580 million litres of bioethanol, and 790 million litres of pure plant oil. By 2008, production capacity for biodiesel (which felt the most immediate impacts of the tax resumption) fell to 3,180 – a drop of about 12%. By March 2008, 85% of the existing biodiesel production capacity had been idled. About 70% of the companies engaged in the business had stopped production or gone bankrupt; 14% of filling stations stopped selling biodiesel. This devastating effect on the industry has been slightly ameliorated by increases in fuel prices over the summer of 2008, and again into the summer of 2009, but the industry remains off of its 2007 peak.

A second impact was the increase in biodiesel imports. Until 2005, the German consumption approximately equalled the production of biofuels. Due to more imported products, this is not true from 2006 onwards. About 66% of the biofuel needed to meet blend requirements set by the government are now imported. New regulations on the so-called 'splash blends' (i.e. 99% biodiesel) will reduce this amount somewhat, but a serious problem remains.

The evolution of the German biofuel market is relatively unique in that it shows the dramatic impact of removal of policy incentives, which is identified in the peak production in 2007 and the decline in production seen since then.

Brazil: Brazil is one of the world's largest bioethanol producers, and remains the largest exporter of bioethanol to other markets. Brazil produces bioethanol from sugar- or starch-based material in the form of sugar cane and sugar cane residues. Because of Brazil's optimal climate, two seasons of sugarcane growth can be achieved, adding greatly to the potential production of both sugar and bioethanol products. In response to the first oil crisis of the 1970's, Brazil invested heavily in fuel alcohol primarily as a means of increasing fuel security and saving foreign currency on petroleum purchases. Today, Brazil controls more than 75% of the world's export market, with primary exports going to the USA, Europe, Korea, and Japan. Many countries, including Japan and members of the European Union, have made Brazilian bioethanol a part of their renewable fuel strategies. Unlike the United States and Germany, Brazil has not made dramatic policy shifts in the past few years, and continues to develop a strong domestic and export market for bioethanol. Brazil is also rapidly growing its biodiesel sector, primarily for domestic use at this time.

The Update on Implementation Agendas report reinforces the concept that successful policy options to support biofuel implementation may take a number of forms, including targets and mandates, exemption of biofuels from national excise taxation schemes, direct government funding of capital projects to increase capacity or upgrade distribution networks, or consumption mandates for government or corporate vehicle fleets. These

policies can be differentiated by their relative emphasis on government, industry, or consumer actions. This report also indicates that some of the major producers of biofuels are beginning to rethink their biofuel strategies, largely with an eye towards moving away from food-based feedstocks and towards residues, energy crops, and other cellulosic material. At this point in time, there is very little cellulosic biofuel being produced, with less than 0.1% of total production across 21 countries attributed to cellulosic feedstocks.

Our findings indicate that successful implementation agendas can take many forms. Countries reaching the carrying capacity of food-based systems may investigate new and different policies to support the next phase of biofuel development. Growth in individual countries seems to depend upon feedstock availability, an active industry, and competitive energy prices; however, political will clearly plays an important role, as many countries have the other attributes but have not built the industry that Germany, the USA, or Brazil have done.

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1 Australia

Warren Mabee *with notes from* ***Les Edye****, Queensland University of Technology, Australia*

1.1 Introduction

In the short term, the situation is bleak for biofuels production; lack of government support for the market has resulted in overcapacity and a move towards offshore production of biofuels. However, overall environmental policy (particularly related to climate change) has improved since the last federal election, and long-term outlook is healthy considering the level of funding for R&D. Assuming full auctioning of emissions permits and the return of some revenue to RD&D, the long-term deployment of biofuels remains bright in Australia.

1.2 Biofuels policy

1.2.1 Biofuel targets

Not available.

1.2.2 Excise tax reductions

Not available.

1.2.3 Biofuel obligations

Not available.

1.2.4 Fiscal incentives and investment subsidies

- Renewable Energy Showcase
  - 5 grants totalling $10m, e.g. $3m to Rocky Point
- Renewable Energy Commercialization Program
  - Grants of up to $5m (totalling $50m between 1998 and 2001)
- Renewable Energy Industry Development
  - 49 grants totalling $6m, mostly associations and not-for-profits for road maps, project development guides & biomass resource atlas
- Low Emissions Technology & Abatement
  - $8m component supporting renewables
- Renewable Energy Development Initiative
  - $100m over 7 years, targets R&D, proof of concept and early stage commercialization, e.g. Strategic well location for landfill gas extraction, high yielding sugarcane for ethanol biofuel, hydrocarbons from algae

1.2.5 Other measures stimulating the implementation of biofuels

<u>Feedstock resources for biofuels</u>

- Australia has been in the grip of drought for 7 of the last 10 years
- Current grain crop is failing again, and grain prices are very high
- Australia is not a large producer of oilseeds (although 450,000 tonnes of canola are exported), tallow and waste cooking oils are generally less expensive but limited supply for biodiesel
- Dryland grain and oilseed production can vary by +- 40% from mean values
- Drought increases demand and price of molasses
- Potentially large lignocellulosic resource, awaiting commercial technologies
  - Sugarcane bagasse
  - Woody weeds
  - Coppice eucalypt
  - Production on marginal land
  - Marine algae

<u>RD&D</u>

- Sugarcane: University of Queensland/CSR partnership – 'Sugarbooster' high sugar GM cane
- Sugarcane: Queensland University of Technology/Farmacule BioIndustries/ /Syngenta partnership – (1) controlled expression of cellulases in sugarcane

- Tropically adapted sugar beet: Syngenta – trials in several sugar-producing regions, not initially for ethanol production
- Queensland University of Technology/Farmacule BioIndustries partnership with Syngenta: (2) Integrated biorefinery based on bagasse-to-ethanol
- South Australian Research and Development Institute: photobioreactors for biodiesel from algae
- Private consortium: development of low cost ethanol recovery technology
- Ethtech (Apace Research): pilot plant demonstration of strong acid process for ethanol production from lignocellulosic biomass
- Three universities in the Sydney area provide support to biofuels researchers
    - University of NSW - Fermentation systems development
    - Macquarie University - Microorganism & enzyme discovery
    - Sydney University - Thermochemical processes development
    - Upgrade of existing infrastructure
    - Provide new equipment
    - e.g. Tower & stirred tank fomenters at UNSW
    - Provide human resource to facilitate access

National Collaborative Research Infrastructure Strategy – Biofuels capability facilitation

- Business case for investment in biofuels R&D infrastructure
- Assessed of existing capabilities
- Assessed of R&D infrastructure requirements
- Identified novel approaches of particular relevance to Australia » geographical advantage
    - Tropical agriculture
    - Marine biodiversity
- Building world-class capabilities & open access
    - Two nodes for the development and demonstration of biofuels production from lignocellulosic and microalgae biomass, along with upgrades to research infrastructure at three universities to support research and development activities at the nodes.
- $14,555,000 investment over 5 years

Queensland University of Technology biorefinery pilot plant

- Biomass fractionation & lignin recovery process
- Saccharification, fermentation & distillation
- Integrated process control
- Full mass balance
- On-site laboratory
- Chemical storage
- Capacity
    - 800 kg/day biomass
    - 60 L/day ethanol
    - 30 kg/day lignin
- Completion by March 2009

1.2.6 Promotion of second generation biofuels

- Gen 2 Scheme (soon to be announced)
    - $15m for demonstration projects, probably in a single round of funding

Algal biofuels

- Algal culturing & harvesting pilot plant
- Transportable laboratory
    - Real-time monitoring of health and productivity of algae, and photosynthetic yield
- Culture maintenance facility
- Location: SA Aquatic Sciences Centre
- NCRIS funded staffing to facilitate access
- Completion date:
    - Labs – May 2009
    - Raceway ponds – June 2009

- Demonstration facility – June 2010

1.3 Market development and policy effectiveness

Table 1-1 - Biofuel development and market share, Australia

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002						
2003						
2004						
2005		125				
2006		125				
2007		125				
2008	260	164				

Producers (ethanol):

- CSR (cane molasses): 55 million litres per year (services the industrial solvent market). CSR has a 15 million litres per year contract with BP, and has received government assistance to install molecular sieve dehydration at their Sarina (Qld) ethanol distillery
- Manildra (Wheat): 50 million litres per year from waste starch, 50 million litres per year from grains. Manildra has recently contracted with BP for 40 million litres per year of product.
- Heck Group (cane molasses): 3-9 million litres per year., supplies some independent outlets in Brisbane
- Dalby Biorefinery (sorghum): Contract to supply Caltex, 100 million litre per year plant construction nearing completion
- Primary Energy (grains): Announced off take agreements with BP. First plant will be Kwinana in W.A. (160 million litre per year capacity), with 2 more intended for the eastern states.
- Agri-Energy (grains): Swan Hill plant postponed indefinitely after completing the engineering design. Now looking offshore.

Producers (biodiesel)

- BP: has installed production capacity for >100 million litres per year at Bulwer refinery in Brisbane (hydrogenation of tallow)
- Australian Renewable Fuels: 2 plants, both recently 'mothballed'
- Australian Biodiesel Group: largest producer has recently placed its Narangba, Brisbane factory (160 million litres per year) 'on standby', citing high input costs and no off take at profitable prices
- Natural Fuels Australia: Exports to EU have commenced from their Darwin factory, converting imported palm oil
- In July 2006 the Government introduced Energy Grants Credit Scheme
  - Hydrocarbon diesel received the same excise rebate as biodiesel when used for mining, agricultural, stationary power or other off-road use – no financial incentive for biodiesel
  - Some listed biofuels producers have had severe reductions in share price and market capitalisation

Biofuel retailers

- BP: has contracts in place for 55 million litres per year of ethanol, and can produce >100 million litres per year of diesel from hydrogenated tallow. >100 retail outlets for biofuels blends
- Shell: has ca. 10 outlets in each of Melbourne, Sydney and Brisbane selling E10 blends
- Caltex: has E10 outlets in NSW and Queensland but number is uncertain. Sells a range of biodiesel blends to contract customers (B5 to B20)

2 Austria

***Dina Bacovsky**, ABC Energy, Austria*

2.1 Introduction

The share of renewable energy sources has permanently been rising since the 1970s and finally amounted to 22% of total final energy consumption in 2004. The most important part in the mix of renewable energy sources has always been hydropower (share of 9.4%), basing on the alpine region and a great number of run-of-river power stations situated on the Danube. In comparison with other EU Member States, Austria is ranking on the first place according to the use of renewable energy sources in the generation of electricity because of the large use of hydropower. Other sources of renewable energy are for the most part covered by fuel wood (share of 4.4%) and biogenic heating fuels and biofuels for transport (5.5%).

2.1.1 Main drivers for biofuels policy

Following the Kyoto Protocol, which requires Austria to reduce its greenhouse gas emissions by 13% with 1990 as a reference during the period 2008-2012, the "Austrian Climate Strategy 2010" was developed in 2002. With this program an annual reduction of 17 million tonnes of CO_2-equivalents should be achieved. It includes a wide range of measures in all relevant sectors; space heating and transport measures account for more than 50% of the total projected emission cuts. Additionally, joint implementation, clean development mechanisms and international emission trading are expected to reduce further emissions of about 3 Mton of CO_2-equivalents by the first Kyoto period.

2.2 Biofuels policy

2.2.1 Biofuel targets

The EU Biofuels Directive, which provides for the mandatory use of biofuels in the transport sector, was transposed into Austrian national law in November 2004. Austria is aiming to achieve the biofuel targets indicated in the Table below (for more information, see 'Biofuel obligations'). For reaching the objective to replace 5.75% of fuels with biofuels in Austria, up to 14.6 PJ of biofuels should be on the market by 2010, requiring about 482,000 tonnes of biodiesel and 150,000 tonnes of bioethanol.

Table 2-1 – Biofuel target as % of energy

Target year	Petrol	Diesel	Petrol + Diesel
2005			2.5% [A]
2006			
2007			4.3% [A]
2008			5.75% [A]
2009			
2010			5.75%

[A] as of 1 October 2007

2.2.2 Excise duty reductions

In 1999, an amendment of the Austrian tax law was published according to which there is no mineral oil tax anymore on biodiesel and bioethanol. The "Austrian Decree on Transportation Fuels" allows to blend up to 3% biodiesel with fossil diesel. Blends more than 5% in gasoline are taxed in full amount. Also if the biodiesel produced in small-scale plants is exclusively used in the farms themselves, it is free of mineral oil tax.

Together with the amendment to the Fuels Ordinance in 2004, the Mineral Oil Act has been revised (Mineral Oil Tax Law, BGBl. I Nr 180/2004). Accordingly, tax concessions will now be granted for fuels with a biofuel share of at least 4.4%. However, to be able to benefit from the tax concessions, the fuel must also be sulphur-free (less than 10 mg sulphur per kg of fuel). The use of pure biofuels as fuel is exempted from mineral oil tax since 1 January 2000. The Bioethanol Blending Order which entered into force on 1 October 2007 furthermore allows refunding of the mineral oil duty for E75 blends.

By Decision of the National Council of 24 April 2007 the 1995 Mineral Oil Duty Act (Mineralölsteuergesetz) (BGBl. No 630/1994), as last amended by Federal Act BGBl. I No 180/2004), was amended by means of the 2007 Finance Act (Budgetbegleitgesetz, BBG 2007). The following rates of duty per 1 000 litres were laid down therein:

Petrol (after 30 September 2007):

- containing at least 44 l of biogenic substances and with a sulphur content of no more than 10 mg/kg: €442
- other: €475

Diesel (after 30 June 2007):

- containing at least 44 l of biogenic substances and with a sulphur content of no more than 10 mg/kg: €347
- other: €375

Biofuels:

- Pure biofuels are completely exempt from mineral oil duty.

2.2.3 Biofuel obligations

The "Fuels Ordinance" of 1999 defines technical specifications for motor fuels as well as substitution regulations for biofuels, primarily with regard to environmental aspects. In the following amendment on 30 December 1999, biodiesel is specifically defined as FAME (fatty acid methyl ester) with a sulphur content up to 0.003 mg/kg. It is allowed to use FAME as a blending component up to an amount of 3% (volume) to diesel fuel. Biodiesel has to be produced exclusively out of vegetable oils.

On 4 November 2004, the Biofuel Directive was transposed into Austrian national law with an amendment to the Fuel Ordinance of 1999. This amendment stipulates that all companies putting fuels on the market (e.g. OMV, Österreichische Mineralöl-Verwaltung) must, from 1 October 2005, replace 2.5% of the total energy quantity by biofuels. From 2007, this percentage will be increased to 4.3%, and in 2008 the target of 5.75%, as stipulated in the Directive, should be achieved. The term "committed to substitution" comprises everybody or every enterprise that introduces Otto or Diesel fuels within the federal territory, or brings them into the federal territory, except in the fuel container of the vehicle. Persons subject to the substitution requirement are therefore those who place petrol and diesel fuels on the market for the first time in Austria.

2.2.4 Fiscal incentives

Not available.

2.2.5 Investment subsidies

Not available.

2.2.6 Other measures stimulating the implementation of biofuels

<u>Platform stimulating the use of biogas for transport</u>

In Austria about 600 natural gas cars are in use up to now. A new platform "Biogas-CNG Transport" has been founded in 2006, consisting of several partners like OMV, klima:aktiv biogas, the Chamber of Agriculture of Austria and the Austrian Biomass Association. The target of this platform is to enlarge the use of biogas as component in transport fuels (20%) in 100,000 cars by 2013. Tax reductions by 2020, like the reduction of the VAT to 10% or a mineral oil exemption, should be one of the factors that make this program successful. New natural gas / biogas filling stations will be built. Currently only 31 stations offer compressed natural gas as fuel, 200 should be the final number in 2010 where the new mixture of CNG / biogas will be offered.

<u>Platform stimulating the use of E85 for transport</u>

In Austria a platform has been founded in 2007, consisting of several partners like OMV, Agrana, the Chamber of Agriculture of Austria, the Union of Austrian sugar beet farmers, RWA AG/Genol, Ford Motor Company Austria, Volvo Car Austria and General Motors Austria. The target of this platform is to enlarge the use of ethanol as E85 transport fuel in Austria. The 5 main points to reach this target are to continue the tax exemption for bioethanol blends after 2010, increase the number of FFVs, increase the number of E85 filling stations, apply sustainability criteria to the production of bioethanol, and to support the standardization of E85 blends on EU level.

<u>Austrian Plant Oil Association (Bundesverband Pflanzenöl Austria)</u>

The aim of the Austrian Plant Oil Association is to deploy the use of plant oil (a) as a transport fuel, (b) for Bioenergy (electrity, heat) production, and (c) as a material for applications other than Bioenergy.

Austrian Association of liquid-biofuel manufacturers (ARGE Biokraft)
The aim of the Austrian Association of liquid-biofuel manufacturers is to represent the interests of the Austrian manufacturers and processors of liquid biofuels, to enhance biofuel marketing and to communicate with other organizations pursuing similar interests. ARGE Biokraft monitors the production and use of liquid biofuels in Austria.

OMV Future Energy Fund
As a wholly owned subsidiary of OMV (the Austrian mineral oil company), the Future Energy Fund identifies renewable energy and emissions reduction projects within the OMV group, supports their implementation and provides funding for them. It promotes: (1) the development of new business opportunities for OMV in the renewable energy field; (2) the acquisition of know-how and experience in the renewable energy field; (3) the achievement of reductions in greenhouse gas emissions.

Task Force Renewable Energy (Task Force Erneuerbare Energie)
In Reaction to the EU Burden Sharing on Renewable Energies, the Austrian Federal Ministry of Agriculture has initiated a Task Force Renewable Energy. The aim was to evaluate the Austrian Bioenergy potential and how a share of 34% of renewable energy could be accomplished. As a result the Task Force will provide a sound data basis and a package of recommended measures.

Energy and climate protection fund
For the implementation of government goals on climate protection and renewable energy, the Energy and Climate Protection Fund has been founded. 500 million euros are available to fund projects for:

- Energy research and development of renewable sources of energy
- Development of new technologies towards economic maturity
- Support of market penetration of these technologies
- Increase in the security of supply with available resources
- Strengthening of the business location in the fields of energy and environmental technologies

2.2.7 Promotion of second generation biofuels

The Austrian government is funding different R&D projects on second generation biofuels.

2.3 Market development and policy effectiveness

Table 2-2 - Biofuel development and market share, Austria

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002						
2003						
2004	56	0				
2005	73	0				
2006	126	0	12			
2007	252	13				
2008						

Source: Federal Environment Agency reports: Biofuels in the transport sector in Austria 2005, 2006, 2007, 2008
NB: 1 tonne Pure Plant Oil = 1,087 L = 37.0 GJ; NB: 1 tonne bioethanol = 1,262 L = 29.5 GJ;
1 tonne biodiesel = 1,136 L = 40.6 GJ

Biodiesel
Production: According to ARGE Biokraft, the Austrian association of liquid-biofuel manufacturers, there were 14 biodiesel plants operating in Austria in 2007, with a total capacity of approximately 468 500 tonnes. Capacity is expected to increase to 676 500 tonnes in 2008 as one new plant will start production and four existing plants are set to increase their capacity.

According to the information provided by ARGE Biokraft's members, 241 381 tonnes of biodiesel were produced in Austria in 2007 (by nine biodiesel producers). Of this amount, 161 467 tonnes were sold in Austria, 102 531 tonnes of which were supplied to the mineral oil industry for blending. Disregarding any variations in stocks, some 80 000 tonnes of biodiesel were exported in 2007. 59 000 tonnes were used in the Austrian transport sector either as pure biofuel or as diesel with a higher, non-standard proportion of biofuel.

Use: In 2007, a total of 6 296 057 tonnes of diesel was sold, 96.3% of which (6 063 717 tonnes) had an average of 4.7% by volume of biodiesel added. Altogether, 288 828 tonnes of blended biodiesel were placed on the market. Furthermore, 71 218 tonnes of biodiesel in the pure form or diesel with a higher biogenic component were sold through producers and dealers in Austria.10 So the amount of biodiesel placed on the market in 2007 came to a total of 370 046 tonnes.

Bioethanol

Production: The only plant for bioethanol production (Pischelsdorf, Lower Austria) was completed in autumn 2007. The plant, which according to information provided by the operator is to produce approximately 240 000 m3 of ethanol per year (an annual output of about 190 000 tonnes), did not go into production immediately as planned, however, due to the high cost of raw materials.

In the fourth quarter the plant was brought into service for test runs. According to the operator a total of 12 189 tonnes of bioethanol were produced in 2007, some 10 000 tonnes of which were supplied to the mineral oil industry for blending.

Use: Blending of bioethanol with petrol started in the last quarter of 2007. In the reporting year a total of 1 966 086 tonnes of petrol was sold, including 406 780 tonnes with a biogenic content averaging 4.7% by volume. Therefore, with the addition of the quantities marketed as superethanol, 20 401 tonnes of bioethanol were sold.

Pure Plant Oil (Vegetable oil)

Production: In recent years, the use of vegetable oil as a fuel has been increasing. However, it is difficult to estimate the quantities involved, as the records of the quantities produced cannot be sufficiently distinguished according to purpose of use. Another problem is the fact that there are various different distribution channels for this fuel, e.g. sale through private fuel pumps. It can nevertheless be assumed on the basis of the regional distribution patterns that the 3 578 tonnes of vegetable oil used in agriculture are from domestic production.

Use: As in the previous year, 3 578 tonnes of vegetable oil were used in the agricultural sector in 2007.11 Apart from its use in agriculture, increasing use is being made of vegetable oil in Austria's road haulage industry. Judging by the number of grant applications received for converting vehicles to run on vegetable oil, a figure of at least 14 403 tonnes of vegetable oil seems likely, indicating an assured total of 17 981 tonnes of vegetable oil for fuel purposes in the reporting year.

Biogas

Production: In Austria, almost all of the biogas produced from biomass is used to generate electricity and heat. As at 31 March 2006, there were 325 licensed biogas plants in Austria with a total maximum capacity of 80.96 MW. In 2006, 358 GWh of electricity from biogas and 52 GWh of electricity from landfill gas or sewage gas were fed into the grid.

There is no information available on the amount of biogas actually produced, because, in practice, the engine generator draws the gas straight out of the digester vessel for burning. According to experts' estimates, the total amount of biogas produced in Austria is between 265 and 414 million cubic metres.

Biogas upgrading and grid injection is implemented in Pucking, Upper Austria, (pressure swing absorption, 6 m^3/h, operational since 2005), in Bruck/Leitha, Lower Austria, (membrane technology, 100 m^3/h, operational since 2007) and in Eugendorf, Salzburg, (pressure swing absorption, 40 m^3/h, operational since 2008). At least 3 further projects are planned. A biomethane fuelling station is in operation in Margarethen/Moos with a capacity of 35 m^3/h biomethane.

Use as a transport fuel: No estimations available.

SNG (Synthetic Natural Gas)
Production: A demonstration facility for the production of BioSNG has been constructed in Güssing, Burgenland with a capacity of 100 m^3/h. The facility is currently under start up.

Market Share of Biofuels
According to the reports submitted by the persons subject to the substitution requirement under Section 6a of the Fuel Order on the quantities of biofuels placed on the market or used by them in calendar year 2007, the 2.95% substitution target for that year was reached and substantially exceeded at 4.23%. As much as 4.85% of fossil fuels was replaced by biofuels In the last quarter of 2007.

2.4 Sources

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3 Belgium

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3.1 Introduction

Belgium has a very low domestic availability of energy sources. This is why since the early 1970s, Belgium's overall policy objectives have concentrated on security of supply based on diversification of geographical sources and fuels (especially for electricity production), energy efficiency, transparent and competitive energy pricing and environmental protection.

Since the 1990s the three regions (Flanders, Wallonia, Brussels-Capital) are responsible for a large share of the energy policy. Nuclear energy remains a federal competence, and in 2003, Belgium decided to phase out nuclear power between 2015 and 2025. This will be a significant challenge as nuclear energy supplies about 55% of the country's electricity.

The three regions have their own energy policy goals, which creates some fragmentation of energy policy within the country. Electricity and gas markets are regulated. The regions are generally promoting the efficient use of energy, both in the residential sector as in industry and the service sector. Also the use of renewable energy and CHP is promoted. The overall goal is to have 6% of the electricity production from renewables by 2010 (responsibility of the regions to reach this).

Fuel consumption in road transport in Belgium amounts 345 PJ in 2006 (275 PJ diesel and 70 PJ petrol). Diesel consumption is expected to increase, while petrol consumption is expected to decline by 2010.

3.1.1 Main drivers for biofuels policy

There are various drivers for biofuel policies in Belgium, also depending on the policy level. Mainly the regional policy level is supportive for the introduction of biofuels, however the main actions to bring biofuels on the market (tax reductions and quota) are federal competence. This diversion (regional interest versus federal competence) is one of the reasons for the delay in the introduction of biofuels in Belgium.

The main driver for biofuel policies is to decrease the CO_2 emissions from transport to reach the Kyoto targets. While all sectors showed a decrease in CO_2 emissions in the past years, the transport sector was the only one with ever increasing CO_2 emissions. The second driver is support to the agricultural sector and the agro-industry and to create chances for these sectors in the future. Security of supply has been mentioned as a driver (mostly on federal level, also related with the recent increase of crude oil prices) but seems to be of less importance.

3.2 Biofuels policy

3.2.1 Biofuel targets

The table below shows the biofuel targets the federal government in Belgium is aiming to achieve. The government relies on a quota system to realise these targets (for more information, see Excise duty reductions'). It is expected that the use of pure plant oil will remain marginal (< 1.0 PJ/year).

In October 2006, the production quota eligible for tax exemption were assigned. The next six years, three companies (BioWanze, Alco Bio Fuel and Tate & Lyle) will be allowed to put on the Belgian market under tax exemption a yearly amount of 250 million litres of bioethanol in total. The bioethanol will be produced from wheat and sugar beet. The first quota for biodiesel of 286 million litres was divided among four biodiesel producers (Proviron, Flanders Bio Fuel, Oléon and Néochim) for a duration of 11 months (November 1, 2006 until September 30, 2007). The quota for the second phase (October 2007 until 2012) of 380 million litres per year was assigned in December 2006 to four biodiesel producers (Bioro, Néochim, Oleon, Proviron).

Table 3-1 - Quota expressed in energy [PJ]

Year	Biodiesel (PJ)	Bioethanol (PJ)	Total biofuels	Target published by the federal government
2005				2.0%
2006	1.7		1.7	2.75 %
2007	12.5	1.0	13.5	3.5 %
2008	12.5	5.3	17.8	4.25 %
2009	12.5	5.3	17.8	5.0 %
2010	12.5	5.3	17.8	5.75%

3.2.2 Excise duty reductions

Until 2005 biofuels could be exempted from excise duties in pilot demonstration projects. Apart from that, biofuels had the same tax as their mineral counterparts.

In February 2004 the Belgian Government announced a defiscalisation of biofuels, to achieve the European targets. In March 2005 the Belgian federal government accepted in a Royal Decree the implementation of the European Directive 2003/30/EC, hereby also accepting the target of 2% biofuels by the end of 2005, with a linear increase (yearly 0.75%) up to 5.75% in 2010. At that time no concrete incentives were announced.

In July 2005 the Belgian Parliament approved a new programme law ("programmawet"), which included a tax reduction for blended biofuels (biodiesel and bioethanol) and a full tax exemption for pure plant oil. This proposal was sent to the European Commission for approval. After some additional questions and some adjustments, the European Commission approved the proposed measures in December 2005. In June 2006 the 'Law on Biofuels' was signed and a European tender for biofuel producers was launched. From November 2006 until September 2013 tax exemption will be given to low sulphur diesel fuels blended with a minimum level of biodiesel, and from October 2007 until September 2013 for low sulphur petrol fuels blended with a minimum level of bio-ethanol (or ETBE). The tax reduction will only be applied for a specific quota, which is assigned via tenders.

Rapeseed oil is exempt from fuel tax from 3 April 2006 (Royal Decree of 10 March 2006, valid for 6 years), under the condition that it is sold directly from the producer of the oil (based on his own production of rapeseed) to the end user.

The legal text of the tax reduction mentions the specific GN codes for biodiesel/FAME (GN-code 3824 90 99), ethanol (GN-code 2207 10 00), ETBE (GN-code 2909 19 00) and rapeseed oil (GN-code 1514).

The federal government always indicated that the introduction of biofuels should be a budget neutral operation for them, so tax reduction for biofuel blends is compensated by a tax increase on fossil fuels. Tax reductions for biofuels may be subject to revisions to prevent overcompensation.

Table 3-2 - Tax reduction in Euro/litre biofuel

Year	Ethanol / ETBE	Biodiesel (FAME)			Rapeseed Oil
	E7 *	B3.37 **	B4.29 **	B5 **	Pure
2005					
2006		0.352(B.1)			0.341 (C)
2007	0.623 (A.1)		0.352 (B.2)	0.352 (B.3)	0.341 (C)
2008	0.623 (A.2)			0.352 (B.3)	0.341 (C)
2009	0.623 (A.2)			0.352 (B.3)	0.341 (C)
2010	0.623 (A.2)			0.352 (B.3)	0.341 (C)
2011	0.623 (A.2)			0.352 (B.3)	0.341 (C)
2012	0.623 (A.2)			0.352 (B.3)	0.341 (C)

* reduction for higher ethanol blends only possible for public transport companies (De Lijn, MIVB, TEC). Tax reduction is however limited to the special excise tax (0.35€/litre for petrol fuel).

** tax reduction for higher biodiesel blends only possible for public transport companies (De Lijn, MIVB, TEC). Tax reduction is however limited to the special excise tax (0.14€/litre for diesel fuel).

A.1 From October 2007 – September 2013 Tax reduction of € 0.0436 per litre for low sulphur gasoline containing minimum 7 vol-% ethanol (can be in the form of ETBE, where the ethanol fraction is calculated as 47 vol-% of the ETBE). No tax reduction for lower percentages. Valid for an ethanol volume (quota) of 250,000 m³ per year.
B.1 From November 2006 – December 2006: Tax reduction of € 0.0119 per litre for low sulphur diesel containing minimum 3,37 vol-%l FAME. No tax reduction for lower percentages. Valid for a biodiesel volume (quota) of 52.000 m³.
B.2 From January 2007 – September 2007: Tax reduction of € 0.015 per litre for low sulphur diesel containing minimum 4.29%vol FAME. No tax reduction for lower percentages. Valid for a biodiesel volume (quota) of 234.000 m³.
B.3 From October 2007 – September 2013: Tax reduction of € 0.0176 per litre for low sulphur diesel containing minimum 5 vol-% FAME. No tax reduction for lower percentages. Valid for a biodiesel volume (quota) of 380.000 m³ per year.
C Only valid under the condition that the rapeseed oil is sold directly from the producer of the oil (based on his own production of rapeseed) to the end user. Exception are the public transport companies (De Lijn, MIVB, TEC), who can buy their plant oil free from tax from industrial producers.

3.2.3 Biofuel obligations

At the moment no obligation system is prepared.

3.2.4 Fiscal incentives

Not available.

3.2.5 Investment subsidies

Not available.

3.2.6 Other measures stimulating biofuels

Promotion of biofuels in adapted vehicles
The regional governments are promoting the use of pure rapeseed oil, by information dissemination to the agricultural sector. Financial support is also given for oil pressing installations, vehicle conversions and demonstration projects.

Promotion of second generation biofuels
So far, actions concerning second generation biofuels are focused on research scale. No measures are foreseen yet to promote the introduction of second generation biofuels.

3.3 Market development and policy effectiveness

Following the announcements of the biofuel tax reduction and quota, a number of industrial players have announced to be interested to produce biodiesel of bio-ethanol. When counted together the announced production capacities are much higher than the quota, which were assigned in October 2006 and December 2006.

Table 3-3 - (Announced) capacity of biofuel production in Belgium vs quota (up to 2013)

	Capacity (tonnes/yr)	Capacity (m^3/yr)	Quota (m^3/yr)
Total amount biodiesel	770,000 t/yr	875,000 m³/yr	380,000 m³/yr
	677,000 toe/yr		300,000 toe/yr
	28.3 PJ/yr		12.4 PJ/yr
Total amount bioethanol	392,000 t/yr	490,000 m³/yr	250,000 m³/yr
	250,000 toe/yr		127,000 toe/yr
	10.4 PJ/yr		5.3 PJ/yr

There was serious delay in the decision process to assign the quota, also leading to delays in the construction of the facilities. So in 2006 there was hardly any biodiesel available, in 2007 till mid 2008 there was practically no ethanol available from the companies with quota.
While most biodiesel factories are operational in 2008, only a limited share of the quota finds its way to the market. Only few fuel distribution companies seem to be prepared to blend biodiesel in their diesel fuel, while there is no obligation system in Belgium (as in France, Germany or the Netherlands) and the tax reduction does not seem enough to compensate the extra cost.

The blending of ETBE in gasoline only started in September 2008 with a first fuel distribution company. It is very likely that the quota for ethanol will also have problems to reach the market in the following years.

Meanwhile the support for biofuels is fading on political level with the discussion of food vs. fuel. The Flemish Minister of Mobility in May 2008 even suspended a project of the public transport company De Lijn, to blend 5% biodiesel in the diesel use of their bus fleet.

Table 3-4 - Biofuel development and market share, Belgium

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002						
2003						
2004						
2005						
2006	1.3	0				
2007	107.6	0				
2008						

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4 Brazil

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4.1 Introduction

The oldest example of widespread biofuel development is found in Brazil, which produces ethanol from sugar- or starch-based material in the form of sugar cane and sugar cane residues. In response to the first oil crisis of the 1970's, Brazil invested heavily in fuel alcohol primarily as a means of increasing fuel security and saving foreign currency on petroleum purchases. The National Ethanol Programme, Proálcool, was launched at this time. Several policies were introduced to promote biofuel consumption, including the development of vehicles capable of utilizing anhydrous (E100) fuels. In the late 1990s price regulation was removed, while Law 8.723 established the anhydrous ethanol blended in the gasoline ranging between 20% and 25%.

4.1.1 Main drivers for biofuels policy

The original policy choice was to create direct funding sources to create biofuel capacity. In 1975, a diversification program for the sugar industry called Proálcool was created with large public and private investments supported by the World Bank, allowing expansion of the sugarcane plantation area and construction of alcohol distilleries, either autonomous or attached to existing sugar plants.

The second group of policies introduced in Brazil provided a subsidy for bioethanol use. Two related financing schemes were organized to guarantee fuel sale price; the FUPA program guaranteed US$ 0.12 L-1 ethanol for E22, E23, and E24 (a blend of 22-24% ethanol in gasoline), while the FUP program provided US$ 0.15 L-1 for E100 (or pure, anhydrous ethanol) fuel. By 1996/97, the total subsidy delivered via these programs reached about US$ 2 billion per annum, with most subsidy in recent years delivered through the FUPA program.

Lately, development of a biodiesel industry has been observed. This industry uses soybean as a feedstock in 85% of its production (as of 2009), with other oilseed and waste oils providing the remainder. This industry has largely been driven by a renewable fuel obligation (see section 4.2.3).

4.2 Biofuels policy

4.2.1 Biofuel targets

Brazil has introduced mandatory blending targets for both bioethanol and biodiesel (for more information, see section 4.2.3 'Biofuel obligations').

4.2.2 Excise duty reductions

Not applicable.

4.2.3 Biofuel obligations

Brazil's domestic market still utilizes the single largest portion of fuel ethanol capacity in the country. The presence of a Renewable Fuel Standard means that all Brazilian gasoline has a legal alcohol content requirement that has ranged between 20% and 25%. As of November 2006, the RFS stands at 23%. Brazil has also introduced a mandatory blending target for biodiesel: 2% as of early 2008, with a target of 5% by 2013. As of the 1 July 2009, the compulsory biodiesel blend has risen from 3% (B3) to 4% (B4).

Table 4-1 - Biofuel targets (% by volume)

Year	Ethanol in Petrol	Biodiesel in Diesel	Petrol + Diesel
2005	20-25%		
2006	23%		
2007	23%		
2008	23%	2%	
2009	23%	4%	

4.2.4 Fiscal incentives

Not available.

4.2.5 Investment subsidies

Not available.

4.2.6 Other measures stimulating the implementation of biofuels

Not available.

4.2.7 Promotion of second generation biofuels

Not available.

4.3 Market development and policy effectiveness

The presence of a renewable fuel standard and of strong subsidies to E100 production, combined with the second oil shock of the early 1980's, resulted in the successful adaptation of engines to E100 fuel use. By 1984, E100 vehicles accounted for 94.4% of domestic automobile manufacturers' production, and in 1988 participation in the E100 program reached 63% of total vehicle use in the country. The upward trend ended, however, when high global sugar prices led to a crash in availability of fuel alcohol, resulting in a consumer shift away from E100 vehicles. Most vehicles today are being run on E23, but sales of flex-fuel vehicles (FFV) capable of operating on E85 blends are strong, accounting for almost 80% of all vehicles sold. Brazil has developed a unique distribution infrastructure for this fuel, with a network of more than 25 thousand gas stations with E23 pumps.

Brazil is the world's largest exporter of fuel-grade bioethanol, with approximately 3.5 billion litres (from total production of about 19 billion litres) offered for export in the 2007/08 harvest, and expectations that 2008/09 totals could exceed 4 billion litres. Today, the primary destinations for ethanol exports are the USA, Europe, and Korea and Japan, which together accounted for estimated total exports of 3.1 billion in 2006. Many countries that lack significant biomass resources, such as Japan, have made Brazilian ethanol a part of their renewable fuel strategies.

Domestic use of bioethanol remains strong. Rising demand for bioethanol - in part caused by policies in other countries - has created an impetus for new product capacity. Recently, it was reported that UNICA plans to open 77 new ethanol plants by 2013, adding to the existing 248 plants. When complete, this will raise the country's production capacity to about 35.7 billion litres.

By comparison, the biodiesel capacity across much of the country is idle. According to the latest data from the Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (ANP), the country's biofuel regulator, in February 2009 more than 75% of the nation's authorised production capacity of 4.1 billion litres was idled. The increased biodiesel mandate (B4) will require about 1.8 billion litres over 12 months. In 2008, biodiesel production was at record levels, reaching more than 1.1 billion litres (a growth rate of nearly 190% over 2007).

Table 4-2 - Biofuel development and market share, Brazil

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000		11,000				
2001		11,000				
2002		12,500				
2003		13,690				
2004		15,638				
2005	12	16,216				
2006	50	17,273				
2007	402	18,997				
2008	1,100	24,497				

Source: F.O. Lichts, Biodiesel Magazine, Brazillink.org

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5 Canada

Jody Barclay, *Natural Resources Canada*

5.1 Introduction

Canada currently produces about 800 million litres annually, almost a 4-fold increase in three years. Recently, the federal government announced the proposed Clean Air Act, which was tabled on October 19 2006 and which passed in June of 2008. This Act provides a renewable fuel obligation and funding to develop biofuels within the country, but remains focused on first-generation biofuel options.

5.1.1 Main drivers for biofuels policy

Under Liberal federal governments (1993-2005), the primary driver for the development of biofuels in Canada was linked to the federal government's environment strategy. Funding programs were derived from environment-related monies and included tax exemptions and project funding to expand domestic biofuel capacity, as well as innovation funds for research and development. This strategy has evolved with the ascension of a Conservative minority federal government in 2005. Tax exemptions remain in place, but no new project funding has been announced. The primary driver being discussed by policymakers today seems to be rural diversification.

5.2 Biofuels policy

5.2.1 Biofuel targets

The Conservative minority federal government made a campaign promise to introduce a 5% biofuels mandate across Canada (as did the outgoing Liberal government). An agreement with provincial governments on the 5% mandate was reached in May, 2006 which will see this mandate take full effect by 2010 (for more information, see 'Biofuel obligations').

5.2.2 Excise duty reductions

In Canada, exemptions from both federal and provincial fuel excise taxes have been provided for ethanol blends. These taxes essentially act as a rebate for producers. The federal excise tax applies across the country; provincial excise tax exemptions for E10 blends are available in five jurisdictions and may be considered as additional incentives. Note that some provincial exemptions - in Quebec, Saskatchewan, and Manitoba - apply only to ethanol that is produced within that particular jurisdiction.

Table 5-1 - Tax exemptions by province (Total fuel excise tax rate, Exemption for E10 fuel blends) (¢/litre)

Province/Territory	Federal		Provincial		Total	
	Tax rate	Exemption	Tax rate	Exemption	Tax rate	Exemption
Alberta	10.0	1.0	9.0	0.9	19.0	1.9
British Columbia*	10.0	1.0	14.5	0.0	24.5	1.0
Manitoba	10.0	1.0	11.5	2.5	21.5	3.5
New Brunswick	10.0	1.0	14.5	0.0	24.5	1.0
Newfoundland	10.0	1.0	16.5	0.0	26.5	1.0
Northwest Territories	10.0	1.0	10.7	0.0	20.7	1.0
Nova Scotia	10.0	1.0	15.5	0.0	25.5	1.0
Nunavut Territory	10.0	1.0	6.4	0.0	16.4	1.0
Ontario	10.0	1.0	14.7	1.47	24.7	2.47
Prince Edward Island	10.0	1.0	14.0	0.0	24.0	1.0
Quebec	10.0	1.0	15.2	2.0	25.2	3.0
Saskatchewan	10.0	1.0	15.0	1.5	25.0	2.5
Yukon Territory	10.0	1.0	6.2	0.0	16.2	1.0

* British Columbia offers a full rebate (14.5 ¢/litre) on E85 blends

5.2.3 Biofuel obligations

Canada has proposed a national mandate for biofuels, along with proposed provincial mandates which vary from region to region across the country. A summary of federal and provincial regulations is shown in Table 5-2.

Table 5-2 - Biofuel mandates in Canada

Region	Mandate	Announcement / Legislation	Regulation Approved	Date Effective
Bioethanol regulations				
CAN	Average 5% based on gasoline pool by 2010 - ~2.2 billion litres	Bill C-33, July 3, 2008	TBD	2010
BC	Provincial annual average 5.0% renewable content in gasoline pool	Bill 16, April 18, 2008	08/12/2008	2010
SK	Blend average 7.5% ethanol in gasoline pool 11/01/05 - 01/14/07: 1.0% ethanol 01/15/07 – 12/31/07: 7.5% ethanol 01/01/08 – forward: 7.5% ethanol	Ethanol Fuel Act, July 15, 2002	updated over the years	01/01/2007
MB	Blend average 8.5% ethanol in gasoline pool [Blend average 5% for first quarter of 2008]	Biofuels Act, December 4, 2003	12/12/2007	01/01/2008
ON	Blend average 5.0% ethanol in gasoline pool	Announcement November 2004	7/10/2005	01/01/2007
QC	Target: average 5.0% ethanol in gasoline pool	Target only, no regulation planned	N/A	2012
AB	5.0% ethanol content in gasoline by 2010	Provincial Energy Strategy, December 11, 2008	TBD	2010
Biodiesel regulations				
CAN	Average 2% based on gasoline pool by 2012 - ~0.7 billion litres	Bill C-33, July 3, 2008	TBD	2010
BC	Provincial annual average 5.0% renewable content in diesel pool	Bill 16, April 18, 2008	08/12/2008	2010
MB	Expected: 2.0% renewable content in diesel pool by 2010	Biofuels Amendment Act: November 8, 2007	TBD	2010
AB	2.0% renewable content in diesel by 2010	Provincial Energy Strategy, December 11, 2008	TBD	2010
Low carbon fuel standards				
BC	Weighted average of the carbon intensities of fuels supplied in accordance with the regulations	Bill 16, April 18, 2008	TBD	TBD
ON	Reduce the carbon content of transportation fuels by 10%	Part of Ontario's Action Plan On Climate Change, August 2007	TBD	2020

5.2.4 Fiscal incentives

The following is a list of the major incentives offered to the biofuels sector. There are also a number of programs offered at the provincial level.

- Producer Incentive (Natural Resources Canada)
- $1.5 billion ecoENERGY for Biofuels Program
- Renewable gasoline alternatives: 2.0 B L
- Renewable diesel alternatives: 0.5 B L
- Capital Incentive (Agriculture and Agri-Food Canada)
- $200 million ecoAGRICULTURE Biofuels Capital Program based on farmer ownership

5.2.5 Investment subsidies

Previous governments have provided more substantial support to biofuels, including a cumulative investment of $2.7 billion CDN into the implementation of the former Climate Change Plan for Canada, which included incentives for the development and use of environmentally-friendly technologies including bioethanol. The federal Canadian government provided direct funding for the industry through two rounds of the Ethanol Expansion Program (announced 2003), which in 2004 and 2005 provided a total of $118 million in direct funding for eleven projects.

5.2.6 Other measures stimulating the implementation of biofuels

Canada has developed significant expertise in the development of technologies to convert non-food based feedstocks to ethanol. Examples of key players and current focus:

- UBC - pretreatment
- Lignol – organic solvent (wood residues)
- Iogen – enzymatic hydrolysis (agricultural residues)
- Enerkem – gasification (municipal residues)
- Greenfield – integration of grain based and cellulosic based ethanol production
- Vaperma - Vaperma Siftek™ hollow-fiber polymeric membrane

The Cellulosic Biofuel Network (CBN) was announced in January of 2009. The CBN will focus on the sustainable production of ethanol and associated bio-products from cellulosic material. The economics of crop production and the conversion of plants to ethanol will be assessed. Network researchers will also address larger issues such as the use of byproducts in cattle feedlots, the reduction of greenhouse gas emissions and optimal nutrient flow/balance.

The recipients of this $19.9 million in funding include Concordia University, University of Ottawa, University of British Columbia, University of Saskatchewan, Université de Montréal, University of Alberta, University of Toronto, Ryerson University, University of Ontario Institute of Technology, FPInnovations as well as Agriculture and Agri-Food Canada and other government research centres supporting the network.

There is also a Strategic Network in the Bioconverison of Lignocellulose to Ethanol funded by the Natural Science and Engineering Research Council (NSERC), which provides $5 million in total funding. There is as well an emerging National Centre of Excellence on Biorefining which will consider biofuels as a primary output, which will be funded if successful at about $30 million in total.

5.2.7 Promotion of second generation biofuels

The programs listed above in section 0 may apply to second generation biofuels. Other programs exist which are specifically targeted at this class of fuel. They include the following:

- Next Generation Biofuels (Natural Resources Canada and Environment Canada; managed by Sustainable Development Technology Canada)
- $500 million to invest with the private sector in large-scale demonstration of next generation biofuels production
- Support of flex-fuel vehicle sales/R&D as well as engine optimization for ethanol.

5.3 Market development and policy effectiveness

There are currently at least 19 ethanol and 11 biodiesel plants operating or planned in Canada. In Table 5-3 and

Table 5-4 is a list of plants currently active or under construction within Canada.

Table 5-3 - Canadian ethanol production

Plant Name	City	Province	Feedstock	Capacity*
Collingwood Ethanol LP	Collingwood	ON	Corn	50
Enerkem Inc.	Westbury	PQ	Wood Waste	5
GreenField Ethanol	Johnstown	ON	Corn	200
GreenField Ethanol	Varennes	PQ	Corn	120
GreenField Ethanol	Tiverton	ON	Corn	26
GreenField Ethanol	Chatham	ON	Corn	150
GreenField Ethanol**	Hensall	ON	Corn	200
GreenField Ethanol - Enerkem Inc.**	Edmonton	AB	Municipal Landfill Waste	36
Husky Energy	Lloydminster	SK	Wheat	130
Husky Energy***	Minnedosa	MB	Corn	130
IGCP Ethanol Inc.	Aylmer	ON	Corn	150
Iogen Corporation	Ottawa	ON	Cereal (wheat) straw	2
Kawartha Ethanol**	Havelock	ON	Corn	80
NorAmera BioEnergy Corp.	Weyburn	SK	Wheat	25
North West Bio-Energy**	Unity	SK	Wheat	25
Permolex International, L.P.	Red Deer	AB	Wheat	40
Pound-Maker Agventures Ltd.	Lanigan	SK	Wheat	12
Suncor St. Clair Ethanol Plant****	Sarnia	ON	Corn	200
Terra Grain Fuels Inc.	Belle Plaine	SK	Wheat	150

* capacity noted in MMly.
** plant currently under construction
*** 10 MMly plant originally started in 1981
**** producing at 200 MMly, planning to double capacity

Table 5-4 - Canadian biodiesel production

Plant Name	City	Province	Feedstock	Capacity*
Bifrost Bio-Blends Ltd.	Arborg	MB	Canola Oil	3
Bio-Diesel Quebec Inc.	St-Alexis-des-Monts	PQ	Yellow Grease	10
Biox Corp.	Hamilton	ON	Multi-Feedstock	66
Canadian Bioenergy **	Sturgeon Cty	AB	Canola	225
Eastman Bio-Fuels Ltd.**	Beausejour	MB	Canola	11
Greenway Biodiesel**	Winnipeg	MB	Canola	20
Kyoto Fuels**	Lethbridge	AB	Multi-Feedstock	66
Methes Energies Canada Inc.**	Mississauga	ON	Multi-Feedstock	5
Milligan Bio-Tech Inc.	Foam Lake	SK	Canola	1
Rothsay Biodiesel	Montreal	PQ	Tallow/Yellow Grease	30
Western Biodiesel Inc.	Calgary	AB	Multi-Feedstock	19

** plant currently under construction

Overall, biofuels occupy approximately 1.6% of the total fuel market in Canada by volume, and slightly more than that by energy share. The bioethanol capacity online can meet about 2% of Canada's gasoline requirements, while biodiesel capacity can only meet about 0.5% of Canada's diesel requirements. Development of the industry over the past decade is shown in Table 5-5.

Table 5-5 - Biofuel development and market share, Canada

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000		222			17	
2001		222			17	
2002		222			17	
2003		222			17	0.4%
2004		222			17	0.4%
2005	90	222			17	0.6%
2006	90	389			17	0.9%
2007	100	800			17	1.6%
2008	100	870			17	
2009	150	1,400			17	

Source: Canadian Renewable Fuels Association.
Note: All grain based; main production is in Ontario, Quebec, Saskatchewan and Manitoba

5.4 Sources

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6 China

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6.1 Introduction

China has grown its bioethanol production sector rapidly since 2000 to become the third-largest single bioethanol producer after the United States.

6.1.1 Main drivers for biofuels policy

China's stated objectives for biofuel development are (1) improving rural economies and the welfare of rural inhabitants; (2) energy security, specifically reducing dependence on foreign oil; (3) the mitigation of emissions noxious to the environment. Over the past two decades, China's vehicle market has been the fastest growing in the world. In addition, more and more people in China are purchasing privately owned vehicles requiring fuel. According to data from the national Bureau of Statistics of China, the number of automobiles owned nationwide reached 26.94 million in 2004 (passenger cars: 17.36 million; trucks: 8.93 million; others: 0.65 million). The average growth rate between 1986 and 2004 was 11.8 percent. In Beijing alone, authorities report 1,000 new cars are added each day to the city's roads.

6.2 Biofuels policy

Biofuels legislation was first passed in April 2001, when China released laws on the use of denatured fuel ethanol (GB18350-2001) and bioethanol-gasoline blends for automobiles (GB18351-2001). These laws established standards for the production of E10. A year later on March 22, 2002, the government launched a model to introduce E10 into specified areas of China. The second phase of biofuel development established a legal system for biofuel (and for the relevant raw materials required) production, transportation and sales. The Bioethanol Utilization Plan was included in the 11th Five-Year Plan (2001-2005).

6.2.1 Biofuel targets

The government of China has stated that the biofuel sector will meet 15 percent of China's transportation energy needs by 2020. According to the goal set in 'Mid-Long Term Development Plan for Renewable Energy' (prepared by the National Development and Reform Commission), the use of bio-fuel ethanol will reach 12.7 billion liters by 2020. By that year, automotive ethanol gasoline (E10) usage will be 100%, and annual consumption of bio-diesel will reach 2.3 billion liters.

6.2.2 Excise duty reductions

The government has implemented preferential taxation policies for the bioethanol industry, exempting plants from a fuel ethanol consumption tax of 5%.

6.2.3 Biofuel obligations

Some Chinese provinces have announced biofuel mandates, although the national government has not yet made any decision about legislating biofuel use.

6.2.4 Fiscal incentives

In order to support the production of fuel ethanol, the Chinese government introduced a number of preferential policies, including the investment of US$ 70.6 million in a treasury bond fund for the construction of fuel ethanol plants in Henan, Anhui, and Jilin provinces. The Central Financial Authority has also allocated US$ 294 million to subsidize losses within the industry, which effectively protects the normal production and operation of fuel ethanol enterprises.

The Chinese government continues to provide subsidy support and monetary payments to the ethanol industry. There are consumption tax and value-added tax exemptions, as well as direct subsidies and low interest loans. Total subsidies to the ethanol producers reached US$ 114 million in 2006, or about US$ 0.06 per litre. By 2007-08, the subsidy for the sale of fuel ethanol had risen to about US$ 0.16 per litre. The total subsidy level is expected to go up to US$ 616 million by 2020.

6.2.5 *Investment subsidies*

See 'Fiscal incentives', section 6.2.4 above.

6.2.6 *Other measures stimulating the implementation of biofuels*

Not available.

6.2.7 *Promotion of second generation biofuels*

The 'Mid-Long Term Development Plan for Renewable Energy' acknowledges that it is necessary to proactively develop cellulosic biofuels. The Ministry of Finance has stated that the production of cellulosic bioethanol should be encouraged by the combination of production, study and research, and the expansion of the pilot- and demonstration-scale plants.

6.3 Market development and policy effectiveness

Although diesel fuels are the most widely used fuels in China today, the lack of a standard for biodiesel use has restricted uptake of biodiesel products. Thus, most development has focused on bioethanol. At present, China has built five state certified fuel ethanol production plants. By 2008, bioethanol production capacity for transportation fuel reached about 1.94 million tons (2,448 million litres). Most of this biofuel is sold as an E10 blend with gasoline. There are currently pilot ethanol production projects in Heilongjiang, Jilin, Liaoning, Henan, Anhui, Shandong, Jiangsu, Hebei, and Shanxi provinces.

Table 6-1 - Biofuel development and market share, China

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002						
2003						
2004						
2005	59	1,300				
2006	60	1,800				
2007	60	1,960				
2008	60	2,448				

Note: All grain based; main production is in Ontario, Quebec, Saskatchewan and Manitoba

6.4 Sources

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7 Denmark

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7.1 Introduction

Denmark has a multi-faceted energy supply based on a variety of energy sources, a high degree of efficiency in energy consumption and a significant auto-production of oil, natural gas and renewable energy. According to the Government's national Energy Strategy 2025 from June 2005 the goal is to improve the use of market mechanisms and to promote more cost-effective initiatives. The Danish electricity and natural gas markets have been completely liberalised. With the implementation of the CO_2 allowance system in the European Union, a step has been taken towards flexibility in climate protection. It reduces energy costs and increases freedom of choice. Finally, developments in the energy system are to a large extent to be based on Danish knowledge and technology.

Renewable energy is increasingly used to produce electricity and heat. 28% of the electricity supply alone is based on renewable energy sources and 15% of the total energy consumption in all sectors is covered by renewable energy sources – mainly biomass like straw and wood. It is the Government's intention to use the market as a basis for continued and increased use of renewable energy. An increased use of renewable energy in step with market needs for new capacity will be far more cost-effective than politically forced increased use of renewable energy by the use of for example quantitative targets.

7.1.1 Main drivers for biofuels policy

The main driver for biofuel policies in Denmark is to contribute to the European security of supply and decrease in the CO_2 emissions from transport. Furthermore, the potential for national economical growth due to a fast growing international market for especially bioethanol is a driver. The Danish enzyme industry are global market leaders within enzymes to the production of biofuels and the farmers are looking for alternative markets for their products under the impression of the increased international competition with regards to agricultural products.

7.2 Biofuels policy

7.2.1 Biofuel targets

Denmark considers that the use of biomass for combined heat and power production, which is widely implemented in the Danish energy supply, is a more cost-effective way to use the biomass resources than the present technology (first generation) for the production of biofuels. However, it is also important to bend to the upward-sloping curve of fossil fuel consumption in transport. Thus the aim of the Danish Government is to increase the share of biofuels and other renewables to 5.75% in 2010 and 10% in 2020. This is in agreement with the EU target.

7.2.2 Excise duty reductions

Tax exemptions for biofuels in Denmark are of recent date. Since 1 January 2005, there is given a general minor tax-reduction according exactly to the normal CO_2-tax on fossil fuels of 0.03 €/L (0.22 – 0.24 DKK/L). The CO_2 advantage for the society is considered to be the only one that can be quantified. The tax reduction is proportional to the blend; in practise, only a 5% bioethanol blend is used in Denmark.

7.2.3 Biofuel obligations

There is no biofuel obligation in Denmark.

7.2.4 Fiscal incentives

Not available.

7.2.5 Investment subsidies

Not available.

7.2.6 Other measures stimulating the implementation of biofuels

Biodiesel demonstration programme
The Government has launched a limited biodiesel programme for 2006-2008 of 60 million DKK. The programme´s aim is to demonstrate the use in practise of biodiesel in selected and limited fleets of vehicles – for instance public busses. The main part of the programme budget is expected to be used to compensate the project hosts for the higher prices on biodiesel compared to mineral diesel during the project period. The implementation of the programme is for the time being under consideration.

7.2.7 Promotion of second generation biofuels

The Government has launched a new national Danish programme for the development of cost- effective second-generation technology for the production of bioethanol of 200 million DKK for 2007-2010 with focus on large-scale demonstration. The programme support will be in the form of R&D grants to pre-commercial investments in and operation of pilot- and demo-plants. The implementation of the programme is for the time being under consideration.

7.3 Market development and policy effectiveness

Up to 2006 the use of biofuel in Denmark was marginal. In May 2006, the first and so far only oil company Statoil introduced a 5% bioethanol blend – Bio95 – on a voluntary basis on the Danish market to a neutral price per litre for the consumer. Other companies may follow in the near future leading to a more than marginal domestic use of biofuels.

Denmark has one RME-factory producing approximately 100,000 tons biodiesel per year mainly for the profitable German market. One other factory exists for the production of approximately 55 million litres of biodiesel based on animal fat from slaughterhouses. A range of private and farmer initiatives (possible factories) exists for large-scale production of bio-ethanol based on wheat and sugar beet. Decisions to build some of these plants are awaiting the market response to the Statoil initiative and the investor's judgement of other relevant market conditions.

Table 7-1 - Biofuel development and market share, Denmark

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002	13 (A)					
2003	53 (A)					
2004	94 (A)					
2005	95 (A)					
2006	103 (B)					
2007	103 (B)					
2008						

NB: 1 tonne bioethanol = 1,262 L = 39.5 GJ. 1 tonne biodiesel = 1,136 L = 40.6 GJ.
(A) Statistics from the European Biodiesel Board
(B) Statistics from the Danish Energy Agency

7.4 Sources

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- Law no. 1391 of 20 Dec. 2004 on adjudgements of CO_2-taxes for certain energy products etc., § 7.4 regarding biofuels ("Lov om ændring af CO_2-afgift for visse energiprodukter mv.").
- www.ens.dk (Danish Energy Authority – Ministry of Transport & Energy)

8 Finland

Lauri Kujanpää *and* ***Tuula Mäkinen****, VTT (Technical Research Centre of Finland), Finland*

8.1 Introduction

Bioenergy is the most important renewable energy source in Finland, with abundant domestic raw material available. Bioenergy consumption in Finland in 2006 was approximately 315 PJ. The most important bioenergy sources are effluents produced in the forest industry, industrial wood residues such as sawdust and bark as well as forest chips and recycled fuels. Bioenergy is used for heat and power production for industry and municipalities in general. Its use has increased by over 80% since the early 1990s. Bioenergy currently covers 21% of total energy supply, one of the highest figures among the industrialised nations. There are currently around 400 plants using solid biofuels in Finland ranging in size from less than 1 MW to nearly 600 MW.

In 2005, the National Climate Strategy (Ministry of Employment and the Economy) was revised taking into account the enforcement of the Kyoto Protocol and emission trading system. A new revision of the National Climate Strategy is expected to be presented by the end of 2008. Wood is the major biofuel for large-scale energy production. In 2007, a significant increase in the use of bioenergy was one of the targets written into the programme of the current Finnish government. EUR 40 million was at the time earmarked for the promotion of renewable energy. The promotion of new biofuels for use in transportation was set to focus on second-generation technologies and domestic production. Tekes, the Finnish Funding Agency of Technology and Innovation, launched a five-year technology programme "BioRefine - New Biomass Products" in the spring of 2007. The on-going programme has a total budget of EUR 137 million.

8.1.1 Main drivers for biofuels policy

The main drivers for biofuel policies in Finland are the reduction of the dependence of fossil fuel imports and reduction of greenhouse gas emissions.

8.2 Biofuels policy

8.2.1 Biofuel obligations

An obligation law entered into force on 1st January 2008. The table below shows the set biofuel shares. This biofuel obligation applies to all companies supplying transport fuels to the Finnish market. However, each supplier is free to decide how it will deliver the required biofuel percentage of all transport fuels supplied, and what biofuels it will use. A distributor is allowed to transfer all or part of its obligation to another distributor on contractual basis. The 2010 obligation will separately enter into force if enabled by the biofuel quality requirements.

Table 8-1 - Obligatory biofuels shares

Year	Petrol	Diesel	Petrol + Diesel
2005			
2006			
2007			
2008			2%
2009			4%
2010			5.75%

8.2.2 Excise duty reductions

Under Directive 92/81/EEC on fuel taxation, partial excise duty relief was granted in Finland in 2002 for biofuels intended for research and experimental use. Two projects were run in 2002-2004 whereby tax on the bioethanol component in bioethanol and petrol blends was reduced by 30 cents/litre. The period set for the projects ended on 31st December 2004 and the projects were not extended.

In 2007, the Finnish authorities agreed to give Neste Oil Oyj biodiesel product NExBTL exceptional support in form of exemption from excise duty during the first six months of production. After the initial period, a lowered energy tax rate of 0.0446 €/L will apply to the product until 31st December 2010. Normal supply security charge of 0.035 €/L applies during the lowered energy taxation. The Commission of the European Union approved the support policy in September 2008.

In accordance with Article 15 of the Directive on the taxation of energy (2003/96/EC), natural gas and liquid gas may be exempted from tax where they are used as motor fuel. The Article has been taken as covering also

methane of biological origin. Both fossil methane and biogas for use as motor fuel are therefore exempt from excise duty in Finland.

8.2.3 Fiscal incentives

Tax benefits for methane-fuelled vehicles
In Finland, it is generally considered that the basis of implementation of biofuel directive should be in large-scale use of biofuels in current vehicles and fuel distribution channels. Supporting biofuel systems which require special vehicles and new distribution channels has not been considered sensible in the Finnish climate. Since gas-engine vehicles have high possibilities to decrease fine particle emissions especially in densely-populated areas, there are support actions in place for gas-engine vehicles and methane.

Taxation of personal and commercial vehicles running on methane was changed by the law on fuel taxation (1280/2003) which came into force in early 2004, so that gas consumption is no longer subject to the punitive fuel tax previously applying. In addition to methane-using vehicles being exempted from fuel tax, personal and commercial vehicles have correspondingly been granted exemption also from the power output taxation imposed under the vehicle taxation law (1281/2003), which otherwise is charged on all motor vehicles using fuels taxed less heavily than petrol, e.g. diesel-driven vehicles.

8.2.4 Investment subsidies

Energy support
The aim of investment support payments and other forms of funding with the energy support granted by the Ministry of Employment and the Economy to businesses and companies is to promote the use of renewable energy sources such as bioenergy, energy saving and the associated commercialisation of new technology. The amount of energy support granted in 2006 was €34.1 million. In recent years, the most notable target of support has been wood energy use, followed by energy efficiency and wind power.

8.2.5 Other measures stimulating the implementation of biofuels

Not available.

8.2.6 Promotion of second generation biofuels

In Finland, research and development work on transport biofuels is focused on the development of production technologies for second generation biofuels. The task force suggested a special development programme for developing Finnish technologies for second generation biofuels and introducing the technologies and the biofuels to the market. The Finnish government suggested a €9 million grant over three years for this programme in its second supplementary budget for 2006. The grant is used to launch a Tekes/Ministry of Employment and the Economy development programme, including pilot and demonstration projects.

8.3 Market development and policy effectiveness

The data below (Table 8-2) shows the current use of biofuels in Finland. In 2004 the consumption of transport biofuels was based on two experimental projects, in which 5 vol-% ethanol was mixed with petrol. In Finland there is also small-scale production and use of first generation FAME biodiesel and biogas as transport fuel, but the actual use of such biofuels is extremely restricted (a few cars only).

A NExBTL biodiesel plant of Neste Oil Oyj entered into production in May 2007. The plant can produce up to 170 000 t/a of high-quality transport fuel based on hydrotreatment of imported palm oil and domestic animal fat feedstock. Neste Oil Oyj is currently working on doubling the production capacity, all situated at the company's Porvoo refinery.

Table 8-2 - Biofuel development and market share, Finland

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002		1.4				0.02%
2003		7.5				0.1%
2004		8.0				0.1%
2005		n/a				n/a, <0.1%
2006		1.5				0.02%
2007	0.14(A)	3.0				0.04%
2008	Biofuel obligation applies					2%
2009						4%
2010						5.75%

NB: 1 tonne bioethanol = 1,262 L = 39.5 GJ. 1 tonne biodiesel = 1,136 L = 40.6 GJ.
(A) Consists of NExBTL biodiesel

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9 France

***Dave de Lang**, SenterNovem with comments by **Jean-Christophe Pouet**, ADEME, France*

9.1 Introduction

The total energy consumption in France is divided as follows: 41.8% nuclear power, 32.7% oil, 14.4% percent natural gas, 4.4% coals and 6.7% sustainable energy. France produced a total of 62 TWh of sustainable electricity in 2006, compared to 56.8 TWh in 2005, an increase of 9.2%. Due to this, the portion of sustainable electricity in relation to total electricity consumption is 12.1% in 2006 compared to 11.0% in 2005. The increase of sustainable energy arose from the legislative measures obliged by the French electricity supplier named EDF, to decentralize purchase produced energy with favourable tariffs in July 2006. The share of total energy consumption for transport is 25%, 28% for industry and agriculture and finally 47% inside the built environment.

France is progressive when it comes to development of sustainable energy. For decades France is producing electricity by hydropower and biomass. The share of sustainable energy to the total energy consumption is 6.7% in 2006. This is high comparing to other countries: Germany (3.5%) and the Netherlands (2.6 %). France remains the second largest European producer and consumer of biofuels, encouraging production and utilization with tax rebates and penalties. In 2007, biofuels reached the targeted incorporation rate of 3.5% of total fuel consumption in France. There was a consumption of 1.15 MT of biodiesel and 420,000 T of bioethanol in 2007. This represents 3.5% of French fuel consumption, in line with national objectives.

9.1.1 Main drivers for biofuel policy

The French government is committed to the production of biofuels and electricity out of biomass. A national treatment with ambitious objectives for biofuels started in 2005. An objective is to increase the use of biofuel by 5.75% of the total energy consumption in 2008. This objective supports the EU objective to reduce the effects of climate change. This will contribute into growth, job creation and increase the energy security.

9.2 Biofuels policy

The increasing demand for biofuels is conceived as the cause of the rising food prices in France. With little attention paid to other factors, such as reduced supply following short harvests, high demand from emerging markets, speculation and high energy prices. In light of the public and political concern over the environmental and economic benefits of biofuels in the context of high world food prices, the government will likely withdraw its 10% incorporation rate target for 2015 and will not introduce new production incentives. Nevertheless, the French biofuel industry is advancing, spurred by financial incentives to reach targeted objectives of 7% biofuel incorporation by 2010 with production quotas set at 3.18 MT biodiesel and 1.1 MT bioethanol.

So far two different types of biofuels are used in France: biodiesel or VOME (vegetable methyl oil ester) based on vegetable oil and ETBE (ethyl tertiary butyl ether) based on bioethanol. They are used in the following blends:

- Up to 5% biodiesel is blended in diesel fuel. This is allowed without special notification at the refuelling pump. In 2008 the allowed biodiesel share was increased to 7% by volume.
- Under special agreements that must improve urban air quality as a background, 30% biodiesel in diesel fuel is used in captive fleets like city buses.
- Until 2004, it was not allowed to blend bioethanol directly in conventional fuels. Bioethanol is converted into ETBE before it is blended in gasoline, to maximum of 15%. Since 2004 direct blending of ethanol is allowed, but so far it occurs only on a very limited scale.
- From 2007, the use of E85 is promoted, however so far the success is very modest.

9.2.1 Biofuel targets

In 2005, France declared to triple the biofuel production capacity within four years. Biofuels are important for the French government and it was determined that the mix percentage of biofuels for the transport sector, must be 7% in 2010.

The French government has set targeted levels of biofuels incorporation in transportation fuel, in energy value. Their correspondence in volume of biodiesel and bioethanol, since 2005, is as follows:

Table 9-1 - Targeted mandate for biofuels

Year	Biodiesel (%)	Bioethanol (%)	Volume equivalent (1000 MT, BD/BE)	Objective (% Net calorific value)
2005	1.3	1.9		1.2
2006	1.9	2.7		1.75
2007	3.8	5.3		3.5
2008	6.3	8.8	2,154 / 756	5.75
2009	6.8	9.5	2,387 / 772	6.25
2010	7.6	10.7	2,724 / 814	7

9.2.2 Excise duty reductions

To develop the biofuel industry, the French government established tax reductions for bioethanol and biodiesel relative to gasoline and diesel with the tax rate revised annually. Only plants officially approved by the French government qualify, thereby limiting import potential. However, biofuel plants located outside of France can qualify for tax cuts on products marketed in France. Some plants close to its borders (Germany, Spain, Italy, and Belgium) did qualify.

To motivate fuel blending companies to reach the above mentioned targets, each biofuel production company receives favourable tax treatment (since 2000) on a limited quantity of biofuel (biodiesel, ETBE and ethanol (since 2004)) blended at the targeted incorporation rate. This allows them to put a certain amount of biofuel (quota) on the market under reduced tax.

Companies must pay an environmental tax for failure to reach the targeted incorporation rate. Since 2005, industrial operators who sell fuels containing a rate of biofuels less than fixed national incorporation levels have to pay an additional amount for the general tax for polluting activities (TGAP). The rate of this additional payment is reduced according the proportion of incorporated biofuels for sale in % PCI.

The closed system of authorised quota has protected the French market from worldwide competition of a.o. subsidized American biodiesel.

The tax reduction is yearly revised to avoid overcompensation.

Table 9-2 - Tax reductions in Euro per hectolitre biofuel

Year	Biodiesel	Bioethanol
2005	33	38
2006	25	33
2007	25	33
2008	22	27
2009	15	21
2010	11	18
2011	8	14

The introduction of the quota system from 2000 has been effective in maintaining the production and consumption to the predefined levels.

Nevertheless the system had the following side effects:

- There was no incentive for the market to go beyond the quota. Because of this, total biofuel consumption has remained merely constant between 2000 and 2004, while other countries have seen serious increases in the same period. In that period France lost its leading position in biofuel applications.
- There was a lack of private initiatives (investments, capacity building), as the market was 'controlled' by the government.
- The authorized quantities were monopolised. In 2005, Total controlled 100% of the ETBE quota, while Diester controlled 97% if the biodiesel quota. There was an administrative burden for the other parties to join the market.

In light of the concerns about the first generation biofuels and financial constraints, the French government proposed a 2009 budget bill to the Parliament that includes a provision drastically reducing the tax incentive

for biofuel consumption and elimination it in 2012. The bill has been adopted by the Parliament at the end of 2008, and the figures agreed to are shown in Table 9-2.

9.2.3 Fiscal incentives

The French government stimulates biofuel supply with tax regulations, like partial exemptions named Tic (French fuel excise). The sector for agriculture has arrangements with the government, which exempts an extra 80.000 tons of biofuel by Tic. The French minister of agriculture and minister of Industry had a joint agreement about three new stimulation measures. Tax incentives were the main policy instrument, creating an incentive for the fuel industry to participate.

9.2.4 Investment subsidies

Not available.

9.2.5 Other measures stimulating the implementation of biofuels

The French President recently extended a bonus/penalty system currently in place to 2009 and to flex-fuel cars running on E-85. Under this system, an additional sales tax is imposed on highly polluting cars while "environmental friendly" vehicles get a tax rebate.

In January 2009 the government authorised the distribution of the new fuel SP95-E10 (containing up to 10% ethanol in volume) in order to raise the proportion of renewable energy in transportation. The commercial distribution will begin in April 2009.

9.2.6 Promotion of second generation biofuels

The French Prime Minister said that second-generation products will need to have an increasing share of the fiscal benefits biofuels get relative to first-generation products.

9.3 Market development and policy effectiveness

Table 9-3 - Biofuel development and market share, France

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002	416	114				
2003	406	103				
2004	395	128				
2005	559	126				
2006	844	250				
2007	991	578				
2008			25[(A)]			
2009						

NB: 1 tonne bioethanol = 1,262 L = 39.5 GJ. 1 tonne biodiesel = 1,136 L = 40.6 GJ.
[(A)] Production of 23,000 tonnes includes farmers and industrial sites.

Biodiesel

In France, Diester Industry, a farmer-owned cooperation, produces most of the biodiesel at 8 plants capable of producing 1.7 MT (expected to increase to 2.15 MT by 2010) biodiesel. Ineos (200,000 T production capacity) entered the market in 2007; Biocar (200,000 T), Centre Ouest Cereales (120,000 T), and SICA Atlantique (50,000 T) will have approved production facilities in 2008 and 2009. French biodiesel production is based primarily on vegetable oil (70-80 percent rapeseed oil, blended with sunflower seed oil, soybean oil and palm oil). However, in 2008, some plants received tax benefits for a specified quota of biodiesel produced from animal fats (Saria, Daudruy, SCA Petrole et derives) and recycled oils (Sarp industries). This production is expected to remain marginal compared to vegetable-oil based production.

Pure Vegetable Oil

In 2008, the production of pure rapeseed oil is approximately:

- 20,000 T of industrial sites

- 1,000 to 3,000 T by rapeseed farmers

Farmers production is used for their own consumption, a main part used as biofuels. Only 10 to 20% of the industrial production is used for biofuels. The total production for biofuels is estimated to be 5,000 T. In addition, soybean oil and palm oil are blended by fuel companies at the rate of about 5% each into diesel.

Bioethanol

Due to a strong French preference for diesel based transportation, the demand for bioethanol is significantly less than for biodiesel. In 2007, approximately 80% of ethanol production was derived from sugar beets and 20% from cereals. Five companies produce bioethanol in France: Tereos, Cristanol, Roquette, Abengoa and Soufflet.

2nd generation biofuels

In the following of Grenelle de l'Environnement debate in 2007, operational measures have been decided. Among them is the willingness to intensify R&D activities and accelerate the set up of industrial pilot plants for 2nd generation biofuels.

The table below gives the quantities annually allowed for biofuels production by industrials.

Table 9-4 - Quantities permitted for biofuel production, MT

Year	Biodiesel	Bioethanol
2003	333	109
2004	401	111
2005	417	202
2006	677	306
2007	1343	561
2008	2478	941
2009	2728	1091
2010	3148	1091

R&D programs

In this aim, a new R&D program has been launched by the French National Research Agency (ANR) in 2008 for 3 years (2008-2010), called Bioénergies. This program follows the National Research Program on Bioenergy (PNRB), a previous ANR program administered by ADEME, that took place from 2005 up to 2007. PNRB focuses especially on research for second-generation biofuels and in the longer term for other "third-generation" bioproducts such as lipids and hydrogen derived directly from micro-organisms. A wide range of topics has been studied:

- study of lignocellulosic resources, thermochemical processing of lignocellulosic biomass to obtain synthetic fuels, and biological conversion leading to fermentation of selected sugars to produce ethanol.
- hydrogen production by physical and chemical processes, and biological pathways for obtaining methane, hydrogen and lipids.
- Treatment or co-treatment processes for organic feedstocks and bioproducts in integrated bioenergy systems, combining several phases of different processes

Bioenergies focuses especially on the development of gaseous biofuels, 2nd and 3rd generation biofuels. For 2nd generation, the objectives are to strengthen technological know-how needed to the future achievement of competitive and efficient units of processing of biomass through thermochemical ways, at pilot or semi-industrial scale. Concerning 3rd generation, the objectives are to improve the knowledges indispensable for the appearance of innovative production concepts and technological breakdown.

France is also involved in the ERAnet Industrial Biotechnology. In 2008, a call for projects has been organised on the thematic "Biotechnological processes for chemistry and energy", with some projects concerning 2nd generation biofuels.

Demonstration projects

The creation of a special fund for financing demonstration projects for New Energy Technologies has been decided in February 2008. ADEME is in charge of the management of this fund. A call for interest has been launched by ADEME in October 2008 about the production of 2nd generation biofuels by thermochemical way. The final selection of projects will be effective in the spring 2009.

In parallel, a demonstration project called Futurol concerning the production of bioethanol from lignocellulosic biomass by the biological way has been accepted by Oséo (formerly the French Agency for Industrial

Innovation). It begins in the end of 2008. - Project duration: 8 years – Budget: 74 Meuros (29,9 Meuros financed by Oséo) – Location: Pomacle-Bazancourt (Marne) - 11 partners (research, industry, finance)

9.4 Sources

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10 Germany

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10.1 Introduction

The main factors for the political motivation to promote the use of biofuels are the protection of the climate, the security of fuel supply, and the development of rural areas. In view of a fast-paced price development of crude oil and increasing geopolitical uncertainties, the security of energy supply does not only govern politics in Germany but around the globe. At present, energy policy (security) is the most important topic in foreign affairs. As an element of the national energy supply, the German potential of biomass gains more and more in importance which is supposed to be reflected both in the biomass action plan announced by the German Government, which has to be published at the end of June 2009 and the national overall strategy concerning any future energy policy. Germany begins to transpose the so called RED-directive into national law.

10.1.1 Main drivers for biofuels policy

According to experts' opinions, for now, only biofuels (as an alternative to fossil fuels) will be able to contribute note worthily to mobility in the short to medium term. At the round table meetings on biofuels on 17th January and 5th July 2007, a roadmap was agreed for the further promotion of biofuels between the automotive industry, the mineral oil industry, medium-sized mineral oil traders, agriculture and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV). The roadmap contains the measures necessary in the intermediate term to increase the share of biofuels within Germany and the EU. In order to make the fulfilment of the declared targets possible and cost-efficient (of 6.25 % in the year 2009 and 6.75 % in the year 2010, as well as the EU targets of 8 % by the year 2015 and 10 % by the year 2020 in relation to the energy content), the admixture limits for biodiesel to diesel and bioethanol to petrol are to be increased within the technical possibilities. These fuels with a higher proportion of biogenic components are to be suitable for use in both old and new vehicles. But the German government changed this policy of quota commitments due to the public discussion to run elder imported cars with B10. The government presented in autumn also an interim report concerning the proof of the overcompensation of the tax relief for biodiesel and plant oil.

10.2 Biofuels policy

10.2.1 Biofuel targets

See 'Biofuel obligations', section 10.2.3.

10.2.2 Excise duty reductions

Since August 1, 2006, the former complete tax exemption on biofuels is reduced. Since then, neat biodiesel is taxed to a certain amount which is increasing almost every year, until almost the full tax for fossil diesel fuel will have been reached. Blends of 1st generation biofuels are also fully taxed --- with the exemption of E85. Taxation of pure plant oil started later, but will reach the same peak. In October 2008 the government presented a draft for the amendments in the biofuel quota act, which will go into force presumably in March/April 2009.

Table 10-1 - Tax exemptions in Euro per liter (€/l) biofuel (new numbers marked in blue)

Year	Ethanol	ETBE		Biodiesel		Plant Oil	BTL[C]	EtOH	
	E85[A]	Blend	blend	B100	blend	pure	blend	2nd gen[C]	
2003									
2004	0.65	0.65	0.65	0.47	0.47	0.47	0.47		
2005	0.65	0.65	0.65	0.47	0.47	0.47	0.47		
2006	0.65	0.00[B]	0.00[B]	0.38[B]	0.32[B]	0.47	0.47		
2007	0.65	0.00	0.00	0.38	0.00	0.47	0.00	0.47	0.65
2008	0.65	0.00	0.00	0.34	0.00	0.39	0.00	0.47	0.65
2009	0.65	0.00	0.00	0.27/0.30	0.00	0.30	0.00	0.47	0.65
2010	0.65	0.00	0.00	0.21/0.24	0.00	0.22	0.00	0.47	0.65
2011	0.65	0.00	0.00	0.15/0.18	0.00	0.15	0.00	0.47	0.65
2012	0.65	0.00	0.00	0.02/0.05	0.00	0.02	0.00	0.47	0.65
2013	0.65	0.00	0.00	0.02	0.00	0.02	0.00	0.47	0.65
2014	0.65	0.00	0.00	0.02	0.00	0.02	0.00	0.47	0.65
2015	0.65	0.00	0.00	0.02	0.00	0.02	0.00	0.47	0.65

[A]Ethanol (E85) remains fully tax exempt until 2015
[B]Since Aug 1, 2006, tax on use of pure biodiesel is € 0.09 per liter, and tax exemptions for 1st generation biofuels in blends were withdrawn (besides ethanol as E85)
[C] 2nd generation biofuels will be examined annually by overcompensation calculations
[D]Use of biofuels by farmers remains fully tax exempt

The energy tax regulation - overview
Preconditions for tax privileges for:

- Biodiesel – DIN EN 14214
- Vegetable Oil – DIN V 51605

Biodiesel generated from animal fats for pure fuel use: tax privileges are limited until December 31, 2011

No taxation until 2015 for:

- Synthetic biofuels (biomass to liquid – BTL)
- Bioethanol based on hemicellulose
- E85 (blend of 85 % bioethanol, 15 % gasoline)

Subject to an annual revision regarding overcompensation

Consensus essential of the Ministries of Agriculture (BMELV), Environment (BMU), Traffic and Economy concerning minimum criteria for a sustainable farming of agricultural areas or/and the conditions to save carbon dioxide/CO_2.

10.2.3 Biofuel obligations

Since January 1, 2007, a quota for admixture of biodiesel into diesel fuel and ethanol into petrol was introduced. These biofuels are fully taxed. A summary of biofuel obligations is shown in Table 10-2. Recently, the German parliament's lower house gave its final approval to the government proposals to cut the 2009 blending target to 5.25% biofuel content in fossil fuel in 2009 from the 6.25% originally intended

The fact that biodiesel and vegetable oil producers are also obliged to meet quantity targets, should they bring biofuels into the free market, leads to a so-called "fictitious" quota (4.4 cal %). As a result, 5 % (v/v) of any sold biofuel are fully taxable (0.47 €/L) which leads to an additional "tax burden" of about 0.023 €/L of biodiesel or vegetable oil. In case the quota is not reached then a fine of 0.60 €/L for biodiesel and 0.90 €/L for bioethanol, respectively, will apply. Biofuels derived from palm oil or soy oil are not accounted on the quota commitment and cannot get the tax relief. B99 is also not accounted on the quota commitment and cannot get the tax relief.

Table 10-2 - Biofuel obligation, percentage by energy (new numbers are marked in blue)

Year	Petrol	Diesel	Petrol + Diesel
2006			
2007	1.2	4.4	
2008	2.0	4.4	
2009	2.8	4.4	5.25/6.25
2010	3.6	4.4	6.25/6.75
2011	3.6	4.4	6.25/7.00
2012	3.6	4.4	6.25/7.25
2013	3.6	4.4	6.25/7.50
2014	3.6	4.4	6.25/7.75

Climate Protection Quota	
2015 - 2016	Reduction of the GHG emissions by 3.0% is required
2017 - 2019	Reduction of the GHG emissions by 4.5% is required
2020	Reduction of the GHG emissions by 7.0% is required

10.2.4 Fiscal incentives

The agriculture and forestry remains fully tax exempted.

10.2.5 Investment subsidies

In the Eastern part of Germany the regions that suffer from high unemployment rates are subsidized by funds of the European Structure Fonds (Europäischer Struktur-Fonds). These subsidies may also be used for installation of biofuels plants and infrastructure.

10.2.6 Other measures stimulating the implementation of biofuels

Biogas and the use of renewable electricity for cars can be accounted on the quota commitment. Germany will implement in 2009 the ordinance for sustainable biomass production for biofuels and electricity production.

10.2.7 Promotion of second generation biofuels

Full tax exemption until 2015 and charging on the quota commitment apply to these fuels. Pre-condition: annual check of over-compensation.

10.3 Market development and policy effectiveness

Biofuels used in Germany are shown in Table 10-3. Until 2005, the German consumption approximately equalled the production of biofuels. Due to more imported products, this is not true from 2006 onwards. The evolution of the German biofuel market is relatively unique in that it shows the dramatic impact of removal of policy incentives, which is identified in the peak production in 2007 and the decline in production seen since then.

Table 10-3 - Biofuel development and market share, Germany

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000	375					0.5%
2001	510					0.7%
2002	625					0.8%
2003	910					1.2%
2004	1,330	25				1.7%
2005	2,100	165	270	0[A]	0[B]	3.3%
2006	2,725	405	650	0	0	5.5%
2007	3,560	580	790			Diesel:12.1% Gasoline:2.1%
2008	3,180	730	400			Diesel:10.9% Gasoline:2.7%

NB: 1 tonne bioethanol = 1,262 L. 1 tonne biodiesel = 1,136 L. 1 tonne Pure Plant Oil = 1,087 L.
[A] Biogas is used in stationary applications. Utilization in the transport sector begins 2009.
[B] Second generation biofuels are not yet available on the German market.

10.4 Sources

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11 Ireland

***Jerry Murphy**, University College Cork, Ireland*

11.1 Introduction

In Ireland the contribution of fossil fuels to the total energy consumption was 96.4% in 2007. Oil was responsible of a share of 56.1%, natural gas 26.6%, coal 9.3% and peat 4.6%. The share of renewables was 2.9% (0.4% hydro and 1.0% wind) [16].

The total contribution from renewable energy to gross electrical consumption in 2006 was 8.6% (compared with 6.8% in 2005 and 4.9% in 1990). The transport sector consumes 34% of Ireland's primary energy demand, is responsible for 34% of Ireland's energy related emissions, and is 99% dependent on imported oil [8]. Energy use in transport grew 7.2% in 2007 as compared to 2006 [8].

11.1.1 Main drivers for biofuel policy

Between 1990 and 2006 the emissions from the transport sector have risen from 5083ktCO_2/a to 16,189 ktCO_2/a [8]; the emissions are a factor of 3.2 higher in 2006 than in 1990. By using biofuels, Ireland wants to stop this trend.

Next to lowering the emissions from the transport sector, Ireland wants to be more independent when it comes to fossil fuels. Ireland is the 7th most oil-dependent economy in the world, and the third most dependent in the EU (after Portugal and Greece) [9]. Oil makes up 60% of Ireland's primary energy consumption, compared to an EU average of 43%. For example, Ireland is more dependent on oil for its energy than the United States.

Finally, Ireland wants to stimulate it agriculture. Ireland's bioenergy programme is designed to stimulate the demand for biomass products, including energy crops, wood chips and wood pellets, thereby providing valuable economic potential for rural economies supporting sustainable jobs and growth [3].

11.2 Biofuels policy

11.2.1 Biofuel targets

The Biofuels Directive sets targets of 5.75% of petrol and diesel to be replaced by biofuels in 2010 on an energy value basis [15]. Ireland aims at the establishment of these targets by the introduction of a biofuel obligation in 2009.

11.2.2 Excise duty reductions

In March 2005 aid approval had been received from the European Commission for the Scheme for Excise Relief for Pilot Projects in the area of Biofuels (Mineral Oil Tax Relief (MOTR) scheme I). The Scheme was legislated for in Section 50 of Finance Act 2004 and allows relief from excise duty for biofuel used in approved pilot projects [11]. 11 projects have been approved.

In November 2006, it was announced that sixteen biofuels projects were granted excise relief under a excise relief programme valued at over €200m [13]. Four distinct types of biofuels were supported under the new scheme (MOTR II). These include:

- Biodiesel made from pure plant oil, used cooking oil and tallow, blended with fossil diesel and sold at regular diesel pumps;
- Biodiesel in higher blends of up to 100% in specific fleets of vehicles whose engine warranties cover these blends;
- Bioethanol made from wheat, barley, whey and other feedstocks, blended with petrol and sold at regular petrol pumps. Bioethanol in blends of up to 85% in petrol, which can be used in flexible fuel vehicles will also be placed on the market as a result of this initiative. The 2005 Finance Act allowed for a 50% VRT reduction in such vehicles and a number of companies have now launched flexible fuel vehicles on the Irish market;
- Pure plant oil made from the oilseed rape crop and used in modified diesel engines.

There were 102 applications under the Scheme; 16 were successful. Full excise relief was granted for these applications. So, there is an excise exemption of 36.8c/l for biodiesel and 44.3c/l for ethanol

Table 11-1 - Total tax exemption granted (million Euros)

Year	Ethanol	ETBE	Biodiesel	Pure Plant Oil
2003				
2004				
2005				
2006	3.43		14.72	2.88
2007	12.47		19.06	5.02
2008	26.52		21.08	5.02
2009	26.52		21.08	5.02
2010	26.52		21.08	5.02

The market penetration of biofuels in 2006 was 0.06%. This figure has doubled since 2005 and is increasing since the launch of the second biofuels Mineral Oil Tax relief scheme in November 2006. The 2007 share was 0.45% [15].

11.2.3 Biofuel obligations

In February 2007, Ireland announced a move to a biofuels obligation from 2009. Under this scheme, fuel suppliers to the Irish market will be required to ensure that biofuels represent a certain percentage of their annual fuels. With targets as high as 5.75% and 10%, the obligation will provide enhanced opportunities for farmers to contribute to this emerging market. The obligation will also give all market players the necessary long-term certainty to make appropriate investment decisions. Targets of 5.75% for 2010 and 10% by 2020 have been announced as part of the obligation. The obligation will require legislation and a consultation on the obligation will be rolled out in 2007 [4]. At the moment of compiling this report, discussions in Ireland on lowering the targets and using renewable fuels rather than biofuels in cars are going on.

11.2.4 Fiscal incentives

Since Vehicle Registration Tax (VRT) relief was introduced for environmentally sustainable vehicles, almost 2,000 hybrid vehicles, over 500 flexible fuel vehicles, and 4 electric vehicles have been registered on the Irish market [4]. The Government's Bioenergy Action Plan [5] and White Paper "Delivering a Sustainable Energy Future for Ireland" [1] commit to the rebalancing of vehicle registration tax and motor tax, supported by mandatory labelling to provide more information on CO_2 emissions and fuel economy. From 2008, the basis for assessing both vehicle registration tax and motor tax will be more closely aligned with CO_2 emissions [4].

11.2.5 Investment subsidies

Not available.

11.2.6 Other measures stimulating the implementation of biofuels

The Department of Transport and Marine and the German-Irish Chamber of Commerce have introduced a pilot project "Biofuels for Transport" to incentivise the use of Pure Plant Oil biofuel among transport operators, in particular those with fleets of vehicles. The scheme was launched early in 2007 and over 40 vehicles have been selected to receive a 75% grant to modify their engines. All selected vehicles will have engines modified and be running on PPO by the end of July 2007 [4].

Ireland's Bioenergy Action Plan, published in March 2007, commits to public bus companies moving as soon as possible towards a 5% blend in all their existing diesel fleet and to ensure that all of their new fossil fleet purchases are capable of using biofuels at blends of at least 30% [5].

In addition to measures to increase the penetration of biofuels, Irish farmers are also being incentivized by a new €6 million bioenergy scheme to top-up the EU energy crop premium by the Department of Agriculture,

Fisheries and Food. Under this scheme, farmers will receive an additional €80 per hectare on top of the existing €45 premium. The Department is providing an additional €6m in the 2007 - 2009 period to support the supply of raw materials from the emerging energy crops sector for biofuel production. The €80 payment is limited to a maximum ceiling of 37.5 hectares per producer in 2007. It is anticipated this threshold will be increased further.

The Department of Agriculture and Food has also introduced a new Bioenergy Scheme providing establishment grants to farmers for up to 50% of the costs associated with establishing Miscanthus and willow on set-aside land and on areas, which have been subject to the EU Premium of €45 per hectare. €8m is being allocated over the period 2007 to 2009 for the grant scheme. The scheme will allow up to 1,400 hectares of willow and Miscanthus to be grant aided in the first year. Miscanthus has proved the most popular crop accounting for up to 90% of applications [4].

11.2.7 Promotion of second generation biofuels

Not available.

11.3 Market development and policy effectiveness

It is evident that the growth of biofuel share in the total amount of transport fuel coincides with the introduction of tax relief support for biofuels, with slow growth from 2004 to 0.06% in 2006 followed by an increase to 0.45% in 2007.

Table 11-2 - Biofuel development and market share, Ireland

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002						
2003						
2004						
2005						
2006	44	11	8.6			0.06
2007	57	40	15			0.45
2008	63	85	15			
2009	63	85	15			
2010	63	85	15			

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12 Japan

Warren Mabee *with notes from* ***Shiro Saka****, Kyoto University and* ***Masahiro Samejima****, University of Tokyo*

12.1 Introduction

Government and private sector research and investment in biofuels have been on the rise since Japan's first biomass plan, "Biomass Nippon Strategy," was unveiled in December 2002. That Strategy was updated in 2008, and the Government of Japan's (GOJ's) current thinking, given limited agricultural resources, is to focus very determinedly on cellulosic biofuel as the future for Japan's biofuel production. Ethanol production for fuel in 2008 was 90,000 L while biodiesel production was roughly 10 million litres; bio-based ETBE imports were roughly 6.5 million litres.

12.1.1 Main drivers for biofuel policy

Key drivers for biofuel policy in Japan are environmental, focusing on the reduction of CO_2 emissions as a countermeasure against global warming. There is some public support for biofuel development, as various sectors see benefits for producers and consumers. Finally, the government has targeted reductions in oil dependency as a means of increasing national energy security, and biofuels support this goal.

Because it is costly for oil distributors to renovate infrastructure to permit direct blending of ethanol with gasoline, most industrial efforts in Japan have focused on the use of ETBE (ethyl-tert-butyl-ether). The government has slowly begun to accept this approach in order to secure the distribution channel for domestically produced bio-ethanol. Hokuren, the federation of agricultural cooperatives in Hokkaido, plans to sell the bio-ethanol they produce to PAJ for blending with ETBE.

12.2 Biofuels Policy

12.2.1 Biofuel targets

In 2002, the Japanese government released the 'Biomass-Nippon Strategy'. This plan had four pillars: 1) Preventing global warming; 2) Formulating a recycling society; 3) Nurturing strategic industry, and 4) Revitalizing rural communities. In May of 2006, the Ministry of Economy, Trade and Industry released the 'New National Energy Strategy' (also referred to as the 'Biomass Nippon Strategy', but not to be confused with the 2002 initiative). This strategy set a goal to replace fossil fuels with 500 million litres of biofuels by 2010, with 50 million litres of domestic biofuel production. In February 2007, the executive committee of the Biomass Nippon Strategy released a report entitled 'Boosting the Production of Biofuels in Japan', which indicated that Japan could be able to produce 6 billion litres of 2nd-generation biofuels domestically by 2030, if appropriate technological development were to occur. These biofuels would be sourced from rice straw, wood, and resource crops. This report suggested that that oil dependency in the transportation sector, which is currently almost 100 %, should be reduced to less than 80% by such a move.

To initiate this project, the 'Biofuel Technology Innovation Conference' was established in November, 2007 and a 'Biofuel Technology Innovative Plan', consisting of the specific goals, technology development, and a roadmap, was formulated in March, 2008. It is estimated that a three percent ethanol gasoline blend (E3) mandate would require around 1.8 billion litres of ethanol annually. Japan's blend limit of E3 is very low; it is partly due to auto manufacturers, who have pushed back against higher blends, and partially due to the use of ETBE instead of neat alcohol in fuels.

As mentioned above, the petroleum association of Japan prefers the use of ETBE over ethanol in fuel blends. The association has announced a long term contract with Copersucar, the Brazilian supplier of bioethanol, to purchase 200 million litres of ethanol per year. The ethanol will be shipped to the U.S. to produce ETBE, and then exported to Japan. It is likely that up to 200 million litres of ETBE will be imported from the U.S. in 2009, with the sales of ETBE-gasoline blends rising to 210 million litres by 2010.

12.2.2 Excise duty reductions

In 2008 the government of Japan introduced tax incentives to encourage the use of bioethanol. If a fuel contains 3% bioethanol, the gas tax is lowered by ¥1.6 per liter (approximately USD .02). This tax measure is effective until March 31, 2013. In order to guarantee biofuel blend quality, the GOJ has implemented a registration system for blenders.

12.2.3 Biofuel obligations

The government of Japan has introduced a reverse obligation, having decided that the blending ratio of biodiesel (Fatty Acid Methyl Ester or FAME) into light oil should be less than 5 percent, in order to ensure that the fuel meets safety and gas emissions standards for existing vehicles in the market. In Japan, because 100 percent bio-diesel fuel (B100) is not subject to the light oil transaction tax, many regional governments have initiated measures to use competitive B100 for their official vehicles, such as garbage trucks; because B100 is not blended, it does not fall under the reverse obligation.

12.2.4 Fiscal incentives

On May 21, 2008 the government approved legislation to promote the use of biomass resources to produce biofuels. The legislation includes tax breaks and financial assistance for biofuel manufacturers and farmers producing feedstock, such as agricultural cooperatives and private businesses. Under the scheme, the fixed property tax for newly built biofuel facilities will be reduced in half for three years. Interest-free loans for a redemption period of ten years will be provided to farmers producing feedstock. No information is available on the upper limit of these incentives.

12.2.5 Investment subsidies

The Japanese Ministry of Agriculture, Forestry and Fisheries has offered a subsidy program which can pay for up to 50% of the cost of building new biofuel plants. Two facilities to date have utilized this subsidy, both in Hokkaido; one is based on rice, while the other uses wheat and sugar beets.

12.2.6 Other measures stimulating the implementation of biofuels

Not available.

12.2.7 Promotion of second-generation biofuels

The emphasis in Japan has recently shifted to research and development towards cellulosic technology. The budget request that MAFF submitted for fiscal 2008 was 3.2 billion (approximately US$ 34 million). Three projects were selected focusing on production of ethanol from rice straws and husks and wheat straw. The Ministry of Agriculture, Forestry and Fisheries contributes 50 percent of the project costs.

12.3 Market development and policy effectiveness

Total production of biofuels in Japan is still fairly low. The most widely used bio-based fuel, bio-ETBE, is completely supplied through imports. Domestic biodiesel and bioethanol production is beginning to rise, as shown on the next page in Table 12-1.

Table 12-1 - Biofuel development and market share, Japan

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002						
2003						
2004						
2005						
2006	5[(A)]	0.03				
2007	5[(A)]	0.09				
2008	10[(A)]	0.2				

[(A)] Ministry of Agriculture, Forests and Fisheries estimate

Future bioethanol production will increase dramatically. Two mills, one based on rice and the other on sugar beet and wheat, are planned for the northern island of Hokkaido. These facilities each have a planned annual production of 15 million litres per year, which will in turn be used to produce ETBE. There is also a pilot or small demonstration plant using high yield rice grown specifically for biofuel production, and producing about 1 million litres of bioethanol annually; this facility started up in 2009. The ethanol produced from this facility is used as an E3 blend and sold at 20 affiliated gas stations near the plant. There are ten more pilot-scale ethanol facilities nationwide, using a variety of feedstocks including sugar cane, sugar beet, rice, and wheat.

Municipal and regional governments are also engaged in pilot-scale biodiesel projects; there are now 12 such projects in 2009, up from 7 in 2007. By 2010, Nippon Oil aims to develop a commercially viable biodiesel derived from palm oil that performs comparably to gasoline.

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13 Luxembourg

***Dave de Lang**, SenterNovem with comments by the Customs and Excise Administration of Luxembourg*

13.1 Introduction

Almost all energy supply in Luxembourg is dependent on import. The majority of energy imports are oil and natural gas, with the latter contributing substantially to electric generation since 2002. Oil use increased from 3.7 Mtoe to 4.7 Mtoe between 2000 and 2004. While Luxembourg exhibited a significant share of solid fuels in energy supply in the early 90s (32%), solid fuels have been almost totally replaced by natural gas. The demand for natural gas has increased by 56% between 1990 and 2000. This has replaced oil use within the industry and residential and commercial sectors, although total oil demand did increase because of increasing energy demand in the transport sector.

The share of transport in total final energy consumption is around double that of the EU-27 average. The share of all biofuels in the transport sector in 2006 was 0.026% based on the energy content.

Biomass and waste amounted to 44 ktoe (1.2%) of the total primary energy supply (TPES), hydropower 10 ktoe (0.3%) and solar & wind energy 2 ktoe (0.1%) in 2000. In spite of their small share in TPES, renewables have been an important source of domestic electricity generation. The indicative target established in the context of the EU Renewables Directive (77/2002/EC) is to increase the share of electricity generated from renewables to 5.7% of the total by 2010. The key measures to promote renewables are investment subsidies and minimum feed-in tariffs.

13.1.1 Main drivers for biofuels policy

Energy demand per capita in Luxembourg is among the highest in the IEA; in 1999 it was 7.88 toe (8.2 toe in 2000) compared to the 5.1 toe IEA average. According to the Kyoto Protocol of December 1997 and the Burden-Sharing Agreement of the EU of June 1998, Luxembourg is committed to reducing its total GHG emissions by 28% between 1990 and 2008–12.

13.2 Biofuels policy

13.2.1 Biofuel targets

Table 13-1 below presents the actual biofuel targets adopted by Luxembourg, in line with the European Directive on Renewable Fuels.

Table 13-1 - Biofuel targets (percentage by energy)

Year	Petrol	Diesel	Petrol + Diesel
2005			
2006			
2007	2%	2%	
2008	2%	2%	
2009	2%	2%	
2010			5.75%

13.2.2 Excise duty reductions

Budget Law 2006 introduced a new provision to reduce taxes on biofuels blended in petrol and diesel. The budget law stipulates that: biofuels when blended to petrol or diesel can benefit from a reduced excise tax. This reduction cannot go beyond 23 € per 1.000 litres when blended with unleaded petrol and 100 € per 1000 litres for diesel. Concerning bioethanol, the blending must be at least 2.93% by volume and for biodiesel at least 2.17%. Pure vegetable oil will be tax-free from 2007 to encourage captive fleets to switch. In 2007 an obligation is in place that substitutes the excise tax reduction for blended biofuels. Instead, a tax exemption of 100% for pure biofuels (B100/E100) consumed on the Luxembourg territory is in place.

13.2.3 Biofuel obligations

The 2007 budget law contains an obligation on fuel suppliers to incorporate in 2007 at least 2% biofuels in transport fuels consumed in Luxemburg (calculate by energy content). This obligation equals to a consumption of around 52 million litres of biofuels combined with consumption in road transport estimated at 2.6 billion litres in 2007. If the target value of 2% is not met, a pollution tax of €1.2/L has to be paid.

13.2.4 Fiscal incentives

There are no other fiscal incentives in place then the ones mentioned above

13.2.5 Investment subsidies

There are no investment subsidies in place directed at biofuels.

13.2.6 Other measures stimulating the implementation of biofuels

Not available.

13.2.7 Promotion of second generation biofuels

Not available.

13.3 Market development and policy effectiveness

Since Luxembourg has no refineries, there is no physical blending done in Luxembourg. The biofuels are imported from the Netherlands, Belgium and Germany. The Directorate in charge of Excise Duties compile the biofuel balance for Luxembourg, based on the certificates summarizing the quantities of biofuels purchased by the importing companies. To do so, there needs to be a bi-lateral agreement in place between Luxembourg and the exporting country to make sure that the CO_2 emissions saved are discounted from the national balance of the exporting country.

In 2007 all importers met their obligation. Whether Luxembourg can reduce its national Kyoto balance by the CO_2 emissions saved through having paid for 2% of biofuels in the fuel put on its market is not clear yet.

13.4 Sources

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14 The Netherlands

SenterNovem - GAVE team, The Netherlands

14.1 Introduction

In comparison with other European countries, natural gas plays a very important role in the Dutch energy supply system. Both on-land and in the North Sea, large natural gas reserves are exploited. As a result, natural gas is the major fossil fuel for production of electricity and heat.
The national energy policy aims to secure energy supply for the future and reduce emissions from the energy sector. The Netherlands has adopted the following official policy goals:

- A share of 9% renewables in electricity production in 2010 (according to EU Renewable Electricity Directive). In 2007, the share of renewables was 5.8%.
- A share of 10% renewables in overall energy supply in 2020. Currently (2007), this share is 2.7%.

14.1.1 Main drivers for biofuels policy

The main driver for biofuel policies in Netherlands is to decrease CO_2 emissions from transport. For all sectors except transport, CO_2 emissions have decreased over the last years. Other drivers like security of supply and an opportunity for people in rural areas have been mentioned but are of less importance in the Netherlands.

14.2 Biofuels policy

14.2.1 Biofuel targets

Recently, the Dutch government lowered the biofuel targets on the short term (for more information, see 'Biofuel obligations', section 14.2.3). The table below presents the actual biofuels targets adopted by the Netherlands.

Table 14-1 - Biofuel targets (percentage by energy)

Year	Petrol	Diesel	Petrol + Diesel
2005	-	-	-
2006	-	-	2%
2007	2%	2%	2%
2008	2.5%	2.5%	3.25%
2009	3%	3%	3.75%
2010	3.5%	3.5%	4%

14.2.2 Excise duty reductions

Since 2003, a tax exemption has been granted on a project basis for pure biofuels (three projects on pure plant oil and one on biodiesel). The total amount of PPO and biodiesel that can benefit from this exemption is limited to 7.5 million litres per year. New projects cannot apply for this tax exemption. The period of tax exemption will end in 2010.

In 2006, a general tax reduction was given for maximum of 2 vol% of biodiesel and ethanol, blended in diesel and petrol, respectively. This tax reduction ended per 31-12-2006 as it was replaced by a mandatory market share.

Table 14-2 - Tax exemption in €/litre biofuel (ended per 31-12-2006)

Year	Ethanol		ETBE	Biodiesel		Pure Plant Oil
	E85	blend	blend	B100	blend	
2003						0.365[(B)]
2004				0.365[(A)]		0.365[(B)]
2005				0.365[(A)]		0.365[(B)]
2006		0.505[(C)]	0.505[(C)]	0.365[(A)]	0.305[(D)]	0.365[(B)]
2007				0.365[(A)]		0.365[(B)]
2008				0.365[(A)]		0.365[(B)]
2009				0.365[(A)]		0.365[(B)]
2010				0.365[(A)]		0.365[(B)]

[(A)] Tax exemption granted for one project, maximum about 0.5 million litres per year
[(B)] Tax exemption granted for three projects, maximum 7 million litres per year
[(C)] Ethanol with GN-code 2207 10 00, tax reduction was €10.10 per 1000 litres fuel containing 2 vol% ethanol or more, lower percentages received a proportionally lower tax reduction.
[(D)] Biodiesel with GN-code 3824 90 99, tax reduction was € 6.10 per 1000 litres fuel containing 2 vol% biodiesel or more, lower percentages receive a proportionally lower tax reduction.

14.2.3 Biofuel obligations

As of 1-1-2007, a biofuel obligation is in place in the Netherlands. Obliged parties are the oil companies that bring petrol and diesel from excise warehouses onto the Dutch fuel market. In 2007 the obliged parties had to show administratively that 2% (by energy) of their total amounts of petrol and diesel sold consist of biofuel. Back then it was the intention that in 2008, 2009 and the percentage would gradually increase to 3.25%, 4.5% and 5.75% respectively. In October 2008, it was decided to lower the obligation to 3.75% and 4% in 2009 and 2010 respectively. This was motivated by the 'food vs. fuel' discussion plus the fact the certification of biofuels (by which sustainability of biofuels can be shown) is only introduced slow, causing that in the coming years the sustainability of biofuels cannot be guaranteed. The obligation of 3.25% in 2008 is still in place.

The obligation refers to an overall market share and is not a blending obligation. The obligation must be met for petrol and diesel separately to ensure that biofuels will be developed in both markets. Suppliers must maintain records, which show they are complying with their obligations.

Obliged parties may administratively buy biofuel rights from other obliged parties and also from non-obliged parties, which have brought biofuels (like B100, PPO, E85 or biogas) onto the Dutch fuel market. The obligation has to be fulfilled within a calendar year, meaning that it is not allowed to use surpluses in a next period or to partly fulfil the obligation of a given year with biofuels brought onto the market in the first months of the next year. If suppliers do not comply with the obligation, they will be subject to a financial penalty.

It was announced that phase 2 of the regulation (all mentioned above is phase 1), will implement Dutch policy on innovation, sustainability and certification. This will be harmonised closely with international developments. At the end of 2008 the Dutch government is preparing to add a regulation to its obligation, which will allow for double-counting of some specific biofuels, for instance those produced from lignocellulosic biomass. This Dutch government aims have this regulation in place early 2009.

Table 14-3 - Biofuel obligations (percentage by energy)

Year	Petrol	Diesel	Petrol + Diesel
2007	2%	2%	2%
2008	2.5%	2.5%	3.25%
2009	3%	3%	3.75%
2010	3.5%	3.5%	4%

14.2.4 Fiscal incentives

Not available.

14.2.5 Investment subsidies

In 2008, the subsidy 'Subsidieprogramma Tankstations Alternatieve Brandstoffen' was published. This project aims at generating a nationwide network of fuel stations where CNG and biofuels like ethanol can be purchased. A total amount of €1.8 million was granted. This first tender is closed, for the year 2009 a second tender has been announced.

14.2.6 Other measures stimulating the implementation of biofuels

Not available.

14.2.7 Promotion of second generation biofuels

Obligation

The Dutch government policy will be directed towards seeing that more innovative biofuels, which are often based on waste streams or woody crops, are commercialised as quickly as possible. This will initially be stimulated through the a subsidy for innovative projects (see below). For the future, the Dutch government intends to create a viable market for more advanced biofuels by rewarding biofuels with a good life cycle CO_2 performance in the proposed system. This can be done by giving greater weight to more advanced biofuels in the biofuel obligation, or by specifying that part of the obligation must comprise more advanced biofuels.

Subsidy

Starting end of 2006, a subsidy was available for projects aimed at production of second generation biofuels, including biofuels that are not themselves second generation but represent a step towards the second generation (IBB). A sum of € 50 million was reserved for the period 2006 to 2010. It is the intention to select projects which are innovative and should be better than the traditional first generation biofuels on the criteria CO2-reduction and landuse-reduction. Also other sustainable criteria are set. In the first tender €12

milion was granted. In 2008. the programme is closed. After an evaluation the programme will be opened again in 2009.

14.3 Market development and policy effectiveness

Up to 2005, the development in biofuel use in the Netherlands was limited to the four biodiesel and PPO projects that received a tax exemption. The amount of biofuels on the Dutch market was a few million litres per year. The tax exemption in 2006 caused that one of the large Dutch oil companies blended 2% of biofuel in both petrol (as ETBE) and diesel (as biodiesel according to standard EN 14214). The obligation in 2007 has caused a share of exactly 2.0% biofuels.

Many initiatives exist for production of bioethanol (several 100 Ml/year) and biodiesel (several 100,000 tons/year). At the moment there are 9 initiatives to build bioethanol plants and 14 to build a biodiesel factory. However, due to the food vs. fuel discussion and the adjustment of the biofuel obligation, it is the question if all initiatives will be realised.

Table 14-4 - Biofuel development and market share, the Netherlands

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000						
2001						
2002						
2003						
2004						
2005			2.7			
2006	82		2.7			
2007	407		6.5			
2008	1,372		6.5			

14.4 Sources

- Tax law, article 72a on biofuels ("Wet op de accijns m.b.t. biobrandstoffen, art. 72a)
- Policy letter on biofuels of Government to parliament - March 2006.
- *www.senternovem.nl/gave*
- www.biofuel-cities.eu
- Besluit van 20 oktober 2006, houdende regels met betrekking tot het gebruik van biobrandstoffen in het wegverkeer (Besluit biobrandstoffen wegverkeer 2007)
- Policy letter on biofuel obligation to the goverment – October 2008

15 Norway

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15.1 Introduction

Half (50%) of the primary energy consumed in Norway was electricity in 2007, while petroleum products, coal and fuel wood represented respectively 36%, 5% and 5% of the primary energy consumption. This was closely followed by natural gas (3%) and direct heating (1%) (source: statistics Norway).

Renewable energy

In 2006 the total use of bioenergy in Norway amounted to approximately 14,5 TWh (aprox. 8% of the total stationary energy consumption). Over 7 TWh of this was used by households (mainly wood fuel), 4,4 TWh by industry and 2,7 TWh was converted to electricity and heat in larger installations (1,4 TWh in remote heating plants, 1 TWh in combined heat and power units and 0,3 TWh in thermal power plants). The annual production from hydroelectric power stations amounts to approx. 120 TWh.

The aim of the Norwegian government is to increase the annual use of bioenergy by 14 TWh by 2020. Furthermore the government aims at contributing to the following long-term goals:

- Cut global greenhouse gas emissions corresponding to 30 % of Norwegian emissions in 1990 (including CO_2 binding by forests and by contributing to reductions in other countries).
- Norway shall be carbon-neutral in 2050

Energy consumption in the transport sector

Energy consumption for transport purposes increased by 2.5 per cent in 2007 and now accounts for more than one quarter of the total end consumption of energy. The consumption of auto diesel in particular is increasing, while the use of gasoline has declined. The sale of biodiesel was five times higher in 2007 than in the previous year, with an increase from 7.1 million litres in 2006 to 39 million litres in 2007. There was also a strong increase from the first to the second half of 2007. Still, the total sale of biodiesel did not account for more than 1.6 per cent of the diesel used in road transport. About 9 per cent of this was sold as pure biodiesel, while the remaining was mixed into traditional diesel, with a share up to 5%.

In 2007, the use of gasoline was on about the same level as in 1980. This is partly due to the fact that diesel cars account for an increasing share of new car purchases, but it is also a result of increased transport of goods and public transport, mainly on diesel vehicles. Furthermore, the use of LNG (liquid natural gas) in boats was four times higher than in 2006, due to the fact that a large number of ferries use LNG. Nevertheless, LNG accounts for a small share of the energy used for transport purposes. The sale of bioethanol doubled from 2006 to 2007. However, this is less common than biodiesel, and only accounted for a few per thousand of the total sale of gasoline.

15.1.1 Main drivers for biofuels policy

The Norwegian energy consumption has increased by 40% during the last 30 years. This has lead to an increasing focus on renewable energy sources that can decrease the lack of energy while not giving increased emissions of greenhouse gases. Besides, by applying biofuels the energy portfolio will be diverdified and rural development can be supported. Finally, the Norwegian government wants to retain the national position as a major energy nation.

15.2 Biofuels policy

15.2.1 Biofuel targets

In 2007, the Government has proposed to introduce legislation which makes it mandatory to mix at least 2% biofuel in all fuels used in road transport from 2008, with an increase to 5% in 2009. However this has not become operative mostly due to food vs. fuel debate. Norway is waiting for the European certification system before any mandatory blending come into force.

Table 15-1 - Biofuel targets (percentage by energy)

Year	Petrol	Diesel	Petrol + Diesel
2008			2.0 %[(A)]
2009			5.0 %[(A)]
2010			7.0 %[(A)]

[(A)]Not operative at the moment due to the food vs. fuel discussion

15.2.2 Excise duty reductions

There is no excise duty on bioethanol/biodiesel and no CO_2 duty on biofuels, as opposed to petrofuels in place. In low mix blends, the CO_2 duty is reduced according to the amount of biofuel added. The autodiesel excise duty is also reduced according to the amount of biodiesel in lowmix diesel blends.

15.2.3 Biofuel obligations

No obligations exist today.

15.2.4 Fiscal incentives

A reduced nonrecurring duty on vehicles able to utilize E85-E100, by 10 000 NOK (approx. 1 200 €) is applied.

15.2.5 Investment subsidies

No investment subsidy regulations are applicable to biofuel projects.

15.2.6 Other measures stimulating the implementation of biofuels

There are no other measures.

15.2.7 Promotion of second generation biofuels

There is a National strategy for increased R&D on second generation biofuels and support for selected demo projects.

15.3 Market development and policy effectiveness

The ambition of introducing biofuels in Norway is low. There is no obligatory biofuel blending in Norway. Biodiesel receives a tax exemption from 1999 even in B5. The tax exemption includes mineral oil tax (3.02 NOK/L) and CO_2 tax (0.54 NOK/L). Since 2006, bioethanol E85 receives tax exemption from petrol tax (4.17 NOK/L) and CO2 tax (0.80 NOK/L) but this tax exemption is only valid if the ethanol content is higher than petrol content in the fuel, and then the tax exemption includes the petrol part of the fuel as well. E5 only receives a tax exemption of CO_2 tax, which is only valid for the ethanol part of the fuel. This is the main reason of the sales of bioethanol is much lower than the sales of biodiesel. Although it was doubled between 2006 and 2007, the bioethanol sale remained only a couple of per thousands of the 2007 petrol use. There is only a small amount of biofuels sold in clean or high-blends. Biogas drives 23 vehicles in Norway.

Table 15-2 - Biofuel development and market share, Norway

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2003						
2004						
2005						
2006	7.1	n/a				
2007	39	n/a[(A)]		Gas for 23 vehicles		Gasoline:-% Diesel:1.6%
2008						
2009						
2010						

[(A)]See text above

15.4 Sources

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- *http://www.regjeringen.no/en/dep/md/press-centre/Press-releases/2007/new-measures-to-reach-norways-ambitious-.html?id=473402*
- http://www.pfi.no/biodrivstoff/Veikart%20for%20biodrivstoff.pdf
- Statistics Norway: *www.ssb.no*
- *http://www.climatestrategy.org/images/stories/CfCSmedia/LUU_Statusrapport_2008.pdf*
- Report on the bio-energy market in the Nordic Countries: *http://www.nordicenergy.net/_upl/1_r-2007-091_mza_the_expanding_bio-energy_market_in_the_nordic_countries_-_possibilities_and_consequences.pdf*
- Laws and regulations (unfortunately mainly in Norwegian): *http://www.lovdata.no/*

16 Poland

***Anna Wrobel**, IpieO, Warschaw, Poland*

16.1 Introduction

Poland has relatively large resources of solid fuels (hard coal and brown coal), modest reserves of natural gas, insignificant of crude oil, small hydroenergy potential and considerable resources of geothermal energy. Biomass is the most promising source of renewable energy in Poland. The technical potential of biomass amounts to 755 PJ/year, and the greatest opportunities for biomass technology implementation has been recognized in forestry, wood processing and agriculture sectors.

Hydro power will probably remain the second largest renewable energy source with limited possibilities of further growth. The total installed capacity of large hydro-electric power stations is around 340 MW and 185 MW of small hydro stations. Poland has a good technical potential for wind energy development and local manufacturing. There is currently 204 MW of wind energy capacity in Poland. The best sites are in the southern mountainous region and along the Baltic coast. Poland has a sizable reserve of geothermal energy. Current installed capacity is approximately 69 MWt, of which 26 MWt is from heat pumps, which collectively generate 274 TJ of energy on an annual basis [8].

16.1.1 Main drivers for biofuels policy

Biofuels is an area that appears to be developing, especially for the agriculture community. It has therefore been a political priority of the Polish government to develop the use of biofuels. Besides, the growing prices of fossil fuels and the necessity find solutions for this problem is a major driver for Poland.

16.2 Biofuels policy

16.2.1 Biofuel targets

The EU Biofuels Directive, which provides for the mandatory use of biofuels in the transport sector, was transposed into Polish national law in June 2006. Poland is aiming to achieve the biofuel targets indicated in the table below. The indicative target share of 5.75% in 2010 for the exploitation of biomass-based road transportation fuels would correspond to 568 000 t biodiesel and 370 000 t of bioethanol in 2010 in Poland. The national indicative target for 2006 amounts to 1.5%. The fulfilment in 2006 was 0.92%

Table 16-1 - Biofuel targets (percentage by energy)

Year	Petrol	Diesel	Petrol + Diesel
2005			0.50%
2006			1.50%
2007	2%	2%	2.30%
2008			3.45%
2009			4.60%
2010			5.75%
2011			6.20%
2012			6.65%
2013			7.10%
2014			7.55%
2020			10.00%

16.2.2 Excise duty reductions

The law concerning excise tax allowances for biofuels production was introduced by the Polish Government in May 2004 to economically facilitate biofuels production. The law aimed to ensure the profitability of bio-components production compared to the production of traditional liquid fuels. In order to bring the national regulations in line with European Union law, a new regulation was implemented in January 2007 by the Ministry of Finance. This resulted in weakening he support mechanism for biocomponents added to diesel. Another law (Excise Duty Act and certain other Acts (Dz.U. No 99, item 666) passed in May 2007, has created more favourable conditions.

Right now, the excise tax exemption applies to bio-components intended for use in liquid fuels and liquid biofuels produced from agricultural raw materials, by-products and waste meeting the relevant quality requirements. The minimum bio-components content required in liquid fuels in order to qualify for exemption is 2%. The Excise Duty Act and certain other Acts (Dz.U. No 99, item 666), which includes amongst its provisions the following reductions of excise duty rates for the products listed below [2]:

- For products made by blending petrol with bio-components and containing over 2% of bio-components, excise duty charged on the petrol (1,565 PLN/1000 l) shall be reduced by 1,565PLN for

each litre of bio-components added to the petrol, subject to the minimum excise duty payable being 10.00 PLN/1000 l.

- For products made by blending diesel with bio-components and containing over 2% of bio-components, excise duty charged on the diesel (1,048 PLN/100 l) shall be reduced by 1.048 PLN for each litre of bio-components added to the diesel, subject to the minimum excise duty payable being 10.00 PLN/1000 l,
- For components used as direct fuel in internal combustion engines – 10 PLN/1000 l.

The above solutions shall be implemented as from the date of publication of European Commission decision confirming compliance of the state aid envisaged by them with the common market.

16.2.3 Biofuel obligations

An obligation is imposed on producers and importers of fuels to ensure at least minimal share of biocomponents in overall quantity of liquid fuels placed on the market. The minimal share of biocomponents equals the national indicative targets as described above.

16.2.4 Fiscal incentives

In July 2007 the 'Long-term Program for Biofuels Promotion from 2008-2014' has been accepted by the Polish Government [3]. The strategy aims at strengthening the progress of biofuels to ensure the Polish Government fulfils the agreements in the EU directive on the promotion of biofuels. The programme envisages that fiscal solutions will continue to play a major role in ensuring cost-effectiveness of biocomponents and liquid biofuels production. For example, corporation tax relief was introduced which allowed corporation tax relief for biocomponents manufactures

16.2.5 Investment subsidies

The main support of biofuels is provided by implementing two operational programmes: 'Infrastructure and Environment' and 'Innovative Economy'. Priority Axis IX of the Operational programme 'Infrastructure and Environment' is aimed at increasing the amount of energy produced from renewable sources, including biofuels. Higher use of renewable energy sources shall be implemented through implementation of investments concerning construction or modernization of entities producing biocomponents and biofuels, support will be provided particularly for installations used for the production of: esters, synthetic hydrocarbons biohydrogen, synthetic biofuels.

Operational Programme 'Innovative Economy' provides grants and subsidies for the research scientific projects in the field of biofuels. It is also possible to gain financial support within the Regional Operational Programmes. Environmental Protection Bank (BOŚ) is supporting RES investments (the interest rate of 0.5 of the rediscount rate). The soft loans are provided to geothermal plants, small hydro stations, biomass boilers of installed power less than 5 MW, biofuels production, heat pumps and solar collectors. Moreover, The National Fund for Environmental Protection and Water Management supports air protection projects (reduction of CO_2 NO_X production).

Poland has chance to use structural funds to improve its infrastructure as well. Goals listed in priorities of Operational Programme 'Infrastructure and Environment' refer to development of use of renewable energy sources, including biofuels.

16.2.6 Other measures stimulating the implementation of biofuels

Concerning the need to support use of biofuels and liquid fuels with an addition of bio-components some incentives mentioned in 'the Long-term Program for Biofuels and others renewable Fuels Promotion 2008-2014' [2] are being discussed:

- Areas of pro-ecological public transport – It is suggested that some areas in the cities shall be available only for public transport fleets which use biofuels of fuels with an addition of bio-components
- Parking fees exemptions – for vehicles in which biofuels are used
- Environmental fees exemptions – for the units/companies which are using biofuels in their vehicles the environmental fees (for gases and dust emission) are lower
- Preferences in acquiring of environmentally-clean vehicles
- The obligation for governmental organizations to use vehicles in which biofuels are used

16.2.7 Promotion of second generation biofuels

The support of development concerning second generation biofuels is provided on the base of the Ministry of Economy within the frames of The Long-term Program for Biofuels and others renewable Fuels Promotion 2008-2014. Besides, the Polish Technology Platform for Biofuels is working on Polish Strategic Research Agenda concerning Biofuel Development in Poland.

The production and use of biofuels is financially supported by the Operational programme 'Innovative Economy' within which it is possible to gain grants and subsidies for the projects and investments focused on the second generation biofuels.

16.3 Market development and policy effectiveness

Table 16-2 - Biofuel development and market share, Poland

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2003						
2004	0	45		45.4		
2005	114	64		50.7		
2006	132	164		93.8		
2007	91(A)	151(A)				
2008						
2009						
2010						

(A) Estimate based on data from EurObserv'ER

The situation for biofuels has changed markedly since 2005 when targets were achieved. In 2006 and 2007, biofuels production was well below targets, largely due to the alterations in supportive policy. The change to the legislation to be in line with EU law was enforced when no other supportive mechanisms were in place.
The industry in Poland has adopted a 'wait and see' strategy to biofuels. Industry approaches to new investments will likely demand very high returns and/or firm contracts that cover risks associated with policy shifts.

16.4 Sources

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  - KPK – The National Contact Point, *http://www.kpk.gov.pl/*,
  - NCBR - National Centre for Research ad Development, *http://www.ncbir.gov.pl/?lang=pl*,
  - The Polish National Energy Conservation Agency, *http://www.kape.gov.pl*, (visited April 2008)

17 Portugal

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17.1 Introduction

Primary energy supply in Portugal has increased by 45% between 1990 and 2007. This increase consists mainly of an increase in natural gas and oil (by 50%). Natural gas as a primary energy supply was first introduced in 1997 and the share of gas in total energy supply had reached 15% (remaining below the EU-27 average) in 2007. Although, natural gas is gaining an increasing share in energy supply and electricity generation, electricity generation depends to a great extent on hard coal (by 30%) and hydro energy (21%), which exhibits significant annual variation.

The share of renewable sources (mainly hydropower) in the total energy supply was 30,5% (real) and 41,9% (based year-directive 1997) in 2007, significantly higher than the EU-27 average of 6%. Portugal is moving toward the indicative target set by the electricity directive 2007/71/EC of 31% of the final consumption of energy in 2020. However, this target is not entirely realistic, due to the fact that the target was based on the exceptional hydropower performance of 1997. As a consequence, Portugal may not reach its target, even if measures are successful. In 2006, 74% of total RES-E production was from hydropower. The world's first wave power plant with a capacity of 2,5 MW is now operating, and a licence has been awarded for a photovoltaic power plant with forecast production of 76 GWh per year.

17.1.1 Main drivers for biofuels policy

A significant increase in final energy consumption has resulted in high import dependency for Portugal, given that domestic production is limited to renewable energy sources. Industry and transport are the major energy-consuming sectors. Energy and CO_2 intensity are above the EU average, although energy consumption and CO_2 per capita are below the EU average. Much debate on energy focuses on the future energy mix in the light of high dependency on imports and climate change.

17.2 Biofuels policy

17.2.1 Biofuel targets

The national indicative targets for the placing on the market of biofuels and other renewable energies for transport purposes are set by the Government. Council of Ministers Resolution No 119/2004 of 31 July 2004 approving the National Climate Change Programme (PNAC- 2004) set the target of 5.75% for 2010. However, the Government recently set a more ambitious target for 2010: 10% for biofuel penetration in the transport sector, as published in Council of Ministers Resolution No 1/2008 of 4 January 2008.

Table 17-1 - Biofuel targets (percentage by energy)

Year	Petrol	Diesel	Petrol + Diesel
2005			
2006	2%	2%	
2007	3%	3%	
2008	5.75%	5.75%	
2009	5.75%	5.75%	
2010			10%

17.2.2 Excise duty reductions

For its biofuels promotion strategy, Portugal chose to reduce petroleum taxes on the production of biofuels. First, with the passage of Decree 62/2006, the Government of Portugal formally adopted the 2003 EC biofuels directive. Secondly, Portugal passed Decree 66/2006, which established tax benefits for producers of biofuels in Portugal. This law provides for a total exemption (for dedicated small producers) or partial exemption from excise duty (the tax on oil and energy) up to a fixed annual rate of 100,000 tons per producer. Each producer will be allocated a quota for the tax-exempt production based upon factors such as the source of the raw materials and location of the production. The title 'dedicated small producer' applies to firms producing up to 3 000 tonnes annually from waste materials or by means of technological development projects based on products that are more environmentally friendly.

17.2.3 Fiscal incentives

Not available.

17.2.4 Other measures stimulating the implementation of biofuels

One possibility is the concept of imposing minimum quotas for the incorporation of biofuels in fossil fuels, particularly if biofuel incorporation the previous year was considerably lower than expected. Another measure takes the form of agreements for the use of biodiesel in public passenger transport and goods transport fleets, with a percentage rate of biodiesel incorporation in fossil fuels above 10%.

17.3 Market development and policy effectiveness

In 2007, no biofuels were produced for incorporation in petrol. A total of 195 884 t of FAME biodiesel was produced for incorporation in diesel, of which 189 836 t (6 986 883 GJ) were incorporated, accounting for almost 3.37% incorporation on the basis of energy content.

In total, biofuel incorporation in the transport sector in 2007 was 2.54%. It is expected that, in 2008, no more than 200 million litres of biodiesel will be released for consumption. The government of Portugal forecasts that by 2010, biofuel production capacity will be at about 600,000 tonnes per year.

Table 17-2 - Biofuel development and market share, Portugal

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2003						
2004	0.0					
2005	0.2					
2006	91.3					1.02%
2007	215.7					2.54%
2008	227.2					
2009						
2010						

NB: 1 tonne biodiesel = 1,136 L

17.4 Sources

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18 South Africa

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18.1 Introduction

Biofuels are a priority sector under the accelerated and shared growth initiative of South Africa, as biofuels have the potential to stimulate development in under-developed areas. The South African biofuels strategy will continue to evolve in light of international prices for crops and for oil, technology development, food security and food price inflation, water limitation in the country, poverty alleviation and job creation, and the need for state financial incentives. In the future, a 10-year R&D plan for biofuels is currently being developed. This plan focuses on advancing 2nd-generation biofuel technologies, developing energy crops, the science around biofuels, and sustainability (including life cycle analysis and policy). There is a need for a National Biofuels Platform.

18.1.1 Main drivers for biofuels policy

The primary drivers behind biofuels policy in South Africa including attracting investment into rural areas, promoting agricultural development, reducing import of foreign oil and improving current account, and overcoming agricultural trade distortion of South Africa with the developed countries.

18.2 Biofuels policy

18.2.1 Biofuel targets

In December 2006, a draft Strategy Document proposed a target of 4.5% biofuels penetration by 2013 (energy basis). This initiative was estimated to lead to 55 000 jobs in rural farming, adding $ 250 million per annum to GDP; it would contribute 75% of the country's renewable energy target. The South African Biofuel Strategy was launched in December 2007 after extensive consultation. This draft reduced biofuels penetration to 2% with non-mandatory blending. This translates into approximately 400 million litres per annum, and will contribute 35% of the country's renewable energy target. Under the latest draft, maize (corn) is excluded as a feedstock due to food security concerns. Jatropha is also excluded as it is an invasive plant. The approved crops for bioethanol include sugar cane and sugar beet; crops for biodiesel include sunflower, canola, and soya beans.

18.2.2 Excise duty reductions

Currently, biodiesel enjoys a 50% fuel tax exemption ($80/barrel crude oil equivalent), while bioethanol receives a 100 % fuel tax exemption ($65/barrel crude oil equivalent). The South African Biofuels Association and other role players have requested further incentives to stimulate the industry and rapid implementation of biofuels policy.

18.2.3 Biofuel obligations

Not available.

18.2.4 Fiscal incentives

Accelerated Depreciation Allowance for Biofuels Production:

An incentive to encourage the production of biofuels in South Africa was introduced in 2004. Plant and machinery used to produce biofuels qualifies for a 50:30:20 per cent write-off over a 3-year period. The exact wording of the incentive (taken from the Income Tax Act Handbook 2005-06) is as follows:

> 12B. Deduction in respect of certain machinery, plant, implements, utensils and articles:
> (1) in Respect of any –
>
> > (g) Machinery, plant, implement, utensils or article which was or is brought into use for the first time by the taxpayer for the purpose of his or her trade to be used for the production of biodiesel or bioethanol.
>
> (2) the deduction contemplated above shall be calculated on the cost to the taxpayer of the asset as referred to in Subsection 3.
> (Source: Income Tax Act Handbook 2005-2006).

In the 2009 budget, it was proposed that investments by companies in energy-efficient equipment should qualify for an additional allowance of up to 15 per cent on condition that there is documentary proof of the resulting energy efficiencies (after a two- or three-year period), certified by the Energy Efficiency Agency.

18.2.5 Investment subsidies

Not available.

18.2.6 Other measures stimulating the implementation of biofuels

Not available.

18.2.7 Promotion of second generation biofuels

Thermochemical RD&D Programs

Significant research is focusing on thermochemical routes to second generation biofuels. Fast pyrolysis is one avenue being explored; this involves the heating of biomass for few seconds to about 500°C in the absence of O2, followed by rapid cooling. The result is the formation of biogas, bio-oil from condensation of vapours during rapid cooling, and solids called char. Unfermentable products from bioethanol plants can also be converted by fast pyrolysis.

A research goal is to develop fast pyrolysis units that can handle 100,000 tons of biomass per year. After woody material has been converted to bio-oils, it can be readily transported to larger refineries, for e.g. PetroSA's Mossgas in South Cape.

The alternative is gasification at higher temperatures for longer in the presence of O_2, which yields syngas for Fischer-Tropsch synthesis (SASOL has experience in this area). A research goal is to adapt FT-technology by SASOL to accommodate biomass in addition to coal as fossil fuel for synthetic fuel production.

Bio-oils or biogas may be used directly to generate electricity of replace usage of crude oil or electricity in large industrial boilers.

Algal RD&D Programs

New interest has begun to focus on algal biofuels. Research has been applied to the isolation and identification of indigenous microalgae capable of producing oil. The process has been scaled up to lab scale open raceway ponds and closed photo bioreactor processes (5 to 15 L volume). It has been further scaled up to a pilot scale 3,000 litre raceway pond for growing and harvesting bulk quantities of biomass. This technology is being tested in a 300,000 litre volume raceway process for the next two years.

Initial study had challenges like contamination by bacteria, insects, over flooding caused by heavy rains, salt deposition caused by high water evaporation in summers and slow growth rate because of cold nights in winters.

Algal processes may help solve other environmental problems. The final sewage from wastewater treatment plant will be fed to the raceway process to grow algal biomass for biodiesel production. The residual biomass will produce organic fertilizer. Glycerol, the byproduct of biodiesel production, will be used to produce methane for power generation and for running the process.

18.3 Market development and policy effectiveness

- In 2006, Sasol Oil began evaluating a 112 million litre per annum biodiesel plant based on soya for completion in 2007. This facility was not built.
- In 2006 it was also announced that South Africa's first maize-to-ethanol plant would be built in the Free State province by the end of 2007. Seven similar size plants in the maize-growing area of South Africa would follow, each of which would produce ~470,000 litres of ethanol per day and 320 tons of Distillers Grain for livestock feed, and each of which would consume ~400,000 tons of maize per year grown on ~150,000 hectares within a 80 kilometre radius. However, maize-to-ethanol plants have been put on hold for several reasons, including:
  - Severe drought in the maize growing area
  - Lack of government support

    - Increase in maize price
    - Food security issues
- In 2008, Sasol Oil linked with the Central Energy Fund and Siyanda Biodiesel to build soya-based biodiesel plant but require government incentives for viability. The company still awaits a decision on this.
- J & J Bioenergy is evaluating the production of 100 million litres of ethanol per annum from sugar cane
- Other South Africa sugar producers are reluctant to invest in ethanol plants without government support

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19 Spain

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19.1 Introduction

The Spanish economy is characterized by a relatively higher energy intensity than the rest of Europe, by a high dependence on energy imports (Spain is scarce in domestic energy sources, only coal is produced domestically in significant amounts), but also by rapid changes of the energy system in the last few years. Approximately half (48.3%) of the primary energy consumed in Spain was oil based in 2007, while coal and gas represented respectively 13.8% and 21.5% of the primary energy consumption. Renewable energies covered 7.0% of the Spanish primary energy consumption and 19.8% (including large hydropower) of the power production. Renewables receive different types of State aids (premium prices for electricity production, fiscal support of investments and exemptions) to facilitate their penetration in the market and therefore their technological development. The promotion of renewable energy is one of the pillars of the Spanish energy policy that is translated in the existence of concrete objectives for each technology. The last document that gathers these objectives, as well as the required measures to reach them, is the "Plan for Renewable Energy 2005 – 2010" (PER). According to the PER, renewables must cover 12% of the primary energy consumption of the country in 2010, 29.4% of the power generation and 5.75% of petrol and diesel consumed in the transport sector.

The increase of the total energy consumption by the transport sector remained quite moderate (2.8% from 2006 to 2007), pursuing the stabilization trend observed since 2005. However, the consumption of biofuels by the transport sector strongly increased (128% from 2006 to 2007) and now represents 1.2% of the gasoline and diesel consumed by the transport sector (energy equivalent).

Table 19-1 - Fuel consumption by the transport sector

Year	Gasoline	Bio ethanol	Bio ethanol	Diesel	Biodiesel	Biodiesel	Gasoline + Diesel	Bioethanol + Biodiesel	Biofuels
	(ktoe)	(toe)	(%)	(ktoe)	(toe)	(%)	(ktoe)	(toe)	(%)
2003	8,282	96	1.2%	21,393	5	0,0%	29,675	101	0.3%
2004	7,945	107	1.3%	22,820	8	0,0%	30,765	115	0.4%
2005	7,478	112	1.5%	23,951	24	0,1%	31,429	136	0.4%
2006	7,248	113	1.6%	25,323	56	0,2%	32,571	169	0.5%
2007	6,867	126	1.8%	26,576	261	1,0%	33,443	387	1.2%

Source: own computation based on Industry Ministry (MITYC) and APPA
NB: 1 tonne of oil equivalent = 42-45 GJ = 1,920 L ethanol = 1,260 L biodiesel

19.1.1 Main drivers for biofuels policy

Main arguments for the use of biofuels are: reduction of greenhouse gas emissions, security of supply and development of the agricultural sector. These three factors have played a relevant role in the development of the bioethanol and biodiesel sector in Spain. The development of the agricultural sector may have been the most important one, not so much because of an agricultural lobby, but more from the viewpoint of regional development. However, the oil companies are reluctant to use bioethanol by direct blend with gasoline and so far only ETBE is used. The main reasons for such a resistance are the already existing gasoline production surplus in Spain due to the increase of the share of diesel vehicles in the Spanish fleet of vehicles, as well as the logistic concerns related to the direct blend bioethanol-gasoline.

19.2 Biofuels policy

19.2.1 Biofuel targets

After the adoption of the EU Biofuel Directive, Spain has notified the Commission that it has set its national indicative target at 2% for 2005. Also in line with the Directive, the country adopted in August 2005 the "Plan for Renewable Energy 2005-2010". According to this plan, the amount of biofuels will rise to 2.2 Mtoe in 2010, representing 5.8% of the foreseen amount of gasoline and diesel used in the Spanish transport sector in 2010.
The current feedstocks are barley, wheat, and wine alcohol for bioethanol production and waste vegetable oil as well as rape, soybean, sunflower and palm oils for biodiesel production.

19.2.2 Biofuel obligations

Act 12/2007 ("16th Additional regulation to the Act 34/1998 of the Hydrocarbons Sector") makes the blending of biofuels into petroleum fuel obligatory, establishing an interim target of 1.9% of biofuels to be blended into regular fuels in 2008, which will become mandatory proportions of 3.4% in 2009 and 5.83% in 2010 (the latter being included in the PER). Sanction could reach 30 millions€.

Ministerial Order 2877/2008, approved in October 2008, provides the framework for the application of Act 12/2007: in order to achieve the goals of the Act in a more efficient way, the MO distinguishes between biofuels mixed with gasoline and those mixed with gas-oil and imposes a minimum target for each of them separately, but using the same percentage: 2.5% in 2009 and 3.9% in 2010. These separate targets are expected to promote the development of both biofuels.

The MO 2877/2008 also includes the possibility to transfer assigned certificates (the amounts that each agent has sold or used, measured in toe) between the agents affected. Those agents that do not have enough certificates at the end of the period will have to carry out compensatory payments (fixed at 350€/certificate), that the authorities will then distribute between those agents that exceed the quantity of certificates assigned. Agents will be able to use these compensatory payments only up to 30% of the certificates assigned. After 2010, up to 30% of certificates can be transferred from the previous year.

Finally, the MO 2877/2008 excludes from the certification the biofuels introduced in the EU already mixed with fossil fuels (as a consequence, biodiesel from the USA won't be able to be accounted for in order to satisfy the target) and includes the government's commitment to raise the biofuel target to 7% by 2011. Targets associated with the mandate are shown in Table 19-2.

Table 19-2 - Biofuels mandate (based on energy content)

Year	(Act 12/2007)	Additional requirement (MO 2877/2008)
2008	1.9% (indicative)	-
2009	3.4% (compulsory)	Biodiesel: minimum 2.5% of diesel Bioethanol: minimum 2.5% of gasoline
2010	5.83% (compulsory)	Biodiesel: minimum 3.9% of diesel Bioethanol: minimum 3.9% of gasoline

19.2.3 Excise duty reductions

To reduce the final price of biofuels and make them similar to the prices of the conventional petroleum-based fuels, fiscal incentives for biofuels commercialization were established in Law 22/2005, which incorporates several European directives about energetic products: until the end of year 2012, the Hydrocarbons Tax for biofuels will be of zero (instead of 0.278 €/litre for diesel and 0.371 €/litre for gasoline).

It must be noted that biofuels are not exempted from two other existing taxes:

- The "tax on the retail sales of certain hydrocarbons" (IVMH), including a national component of 0.024 €/litre as well as a regional component of approximately also 0.024 €/litre;
- The "value-added tax" (IVA) of 16%.

19.2.4 Fiscal incentives

Detaxation for biofuel pilot plants

By a December 2002 change in the law on "Tax, Administrative and Social Measures", all biofuel pilot plants receive a full detaxation for five years and all industrial plants receive a full detaxation until at least December 2012.

Tax benefit for investment in biofuel production

Besides, Law 36/2003 created special fiscal deduction in the Company Income Tax. It can be deducted 10% in the down payment for investments made in equipments and installations to convert agricultural products in biofuels.

19.2.5 Investment subsidies

Subsidy to biodiesel R&D projects

The Spanish government has granted a subsidy of 22 million € to a biodiesel R&D project of a number of Spanish companies, including Repsol. The objective of the project is to reduce production costs and select and test new biomass feedstocks, including seaweed, waste cooking oils, and animal fats.

Subsidy to bioethanol R&D projects

The Spanish government has also granted a subsidy of 13.9 millions € to a bioethanol R&D project leaded by Abengoa. The objectives of the project are to promote the energy crop development, to make progress in the bioethanol thermochemical production, to develop the bioethanol market by introducing bioethanol-diesel mixtures, and to support the public research centers and universities to improve their knowledge and research capacities.

19.2.6 Other measures stimulating the implementation of biofuels

Support for farmers

Farmers can receive a grant of 45 €/ha for growing energy crops, until the total surface in the EU devoted to energy crops do not exceed 2 Mha. This subsidy covered 95601 ha for oil seeds production and 12478 ha for cereals production, in 2007 in Spain. The area used for energy crops in 2007 represents a small portion of the total arable land in Spain (0.6%) and also, a low portion of the total land used for energy crops in the EU (it has increased from 2.3% in 2004 to 3.86% in 2007, having experienced a peak of 16.6% in 2006). Cultivation of energy crops in Spain has not been very successful in comparison with other European countries due to the low productivity of land in Spain.

19.2.7 Promotion of second generation biofuels

Several R&D project have been funded by the Spanish research policy (1 in 2004, 2 in 2005, 3 in 2006 and 1 in 2007). Most of them are concentrated in the conversion of lignocellulosic biomass into ethanol and one has received funds for research in biohydrogen production. The more recent one has a subsidy of 1,999,269€ (over 2007-08) to do research on and develop biodiesel production from micro-algae.

Biocarburantes Castilla y Leon (Abengoa and Ebro Puleva) owns a biomass demonstration plant in Salamanca (Spain), with a production capacity of 5 million litres per year that converts wheat and barley straw to glucose for transformation to bioethanol using an enzymatic hydrolysis technology. The plant was planned starting operation in 2008.

19.3 Market development and policy effectiveness

Biofuels consumption in Spain in 2007 was around 550 million litres (387 ktoe), of which about 250 million litres was bioethanol and 300 million litres was biodiesel. This accounts for 1.16% of total consumption of transport fuels. Current installed capacity is 62% of what is necessary to fulfill the objective of 5.83% for year 2010.

The recent evolution of the production is shown in Table 19-3, while total biofuel development and market share is shown in Table 19-4.

Table 19-3 – Biofuel production and capacity evolution

Year	Biodiesel Production (million L/a)	Bioethanol Production (million L/a)	Biodiesel Capacity (million L/a)	Bioethanol Capacity (million L/a)
2003	6.8	202.8	40.9	328.3
2004	14.8	256.5	103.4	328.3
2005	83.5	304.2	171.6	328.3
2006	142.0	316.9	227.3	564.0
2007	169.1	360.1	925.7	577.9

Source: Computation based on CIEMAT and APPA.
NB: 1 tonne bioethanol = 1,262 L. 1 tonne biodiesel = 1,136 L

Table 19-4 - Biofuel development and market share, Spain

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2003	40.9	328.3				0.3%
2004	103.4	328.3				0.4%
2005	171.6	328.3				0.4%
2006	227.3	564.0				0.5%
2007	925.7	577.9				1.2%
2008						
2009						
2010						

Existing bioethanol capacity at the end of 2007 was 578 million litres (288 ktoe):

- Ecocarburantes españoles: IDAE (5%) and Abengoa (95%); stating in year 2000, uses cereals (barley and wheat, 300 kt/year) and wine alcohol, produces 150 million litres/y, REPSOL and CEPSA are main customers and production is directed to ETBE conversion.
- Bioetanol Galicia: Abengoa (90%) and XesGalicia (10%); starting in 2002, uses cereals (barley and wheat, 340 kt/year) and wine alcohol, produces 176 million litres/y, REPSOL and CEPSA are main customers and production is directed to ETBE conversion.
- Biocarburantes Castilla y Leon: Abengoa (50%) and Ebro Puleva (50%), starting in 2006, uses cereals (wheat and barley, 585 kt/y) and straw (60 kt/y), produces 200 million litres, REPSOL and CEPSA are main customers and production is directed to direct blend at 5% (E5).
- Bioetanol de La Mancha: Acciona Bioenergia (50%), uses wine alcohol and has an installed capacity of 33 million litres

Bioethanol projects planned for the next years:

- Ecobarcial Zamora: Encalsa (51%), Sniace (30%, Ecoteo (14%), will use cereals (barley and wheat 360 Mton/y), will produce 183 million litres.
- Sniace Biofuels Torrelavega: Sniace, will produce 159 million litres
- Albiex Badajoz will produce 140 million litres
- Bioner Energía Vizcaya: Abengoa and EVE, will produce 160 million litres.
- Bioetanol DosBio 2010, Miranda: Ebro-Puleva, will use sugar beet juices, will produce 82 million litres ethanol.
- Bio Europa 2, Puertollano will produce 190 million litres

Concerning biodiesel, there are currently (2009) 27 biodiesel conversion plants in operation with an installed capacity of about 1.26 billion litres per year. 170 million litres of biodiesel were imported from USA instead of produced by the available large installed capacity in Spain. The main reason is the lower prices of the USA biodiesel due to the US subsidies. As presented above, the recent MO 2877/2008 addresses this perverse trade effect by excluding from the certification the biofuels introduced in the EU already mixed with fossil fuels. Since the biodiesel imported from USA is a mix 99% of biodiesel, it won't be able to account for it in the satisfaction of the Spanish biodiesel target.

25 biodiesel production plants are currently under construction that will contribute 3,360 million litres to the already existing capacity. An additional amount of 2,420 million litres is planned but not yet under construction, representing 22 future projects.

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20 United Kingdom

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20.1 Introduction

With the resources available from the North Sea the UK has been a net exporter of crude oil and gas for a number of years. In 2005 the UK became a net importer of crude oil and gas. Renewable energy is an integral part of the UK Government's longer-term aim of reducing CO_2 emissions by 60% by 2050. In 2000 the Government set a target of 10% of electricity supply from renewable energy by 2010 introducing the Renewable Obligation, and in 2006 they announced our aspiration to double that level by 2020. The government is now holding a consultation, until 26 September 2008, seeking views on how to drive up the use of renewable energy in the UK, as part of our overall strategy for tackling climate change and to meet the UK's share of the EU target to source 20% of the EU's energy from renewable sources by 2020. In 2007, 5% of the UK's electricity supply came from renewable sources, with 4.9% from Renewable Obligation eligible sources.

20.1.1 Main drivers for biofuels policy

The main driver for biofuels policy in the United Kingdom is carbon reduction. In the UK the transport sector has seen a steady increase in carbon emissions whilst other sectors have been reducing their emissions.

20.2 Biofuels policy

20.2.1 Biofuel targets

See section 20.2.3, 'Biofuels obligation'.

20.2.2 Excise duty reductions

Tax reductions in for biofuels were first introduced in 2004 with a reduction for biodiesel. On the first of January 2005 a similar tax reduction was introduced for bioethanol. These are guaranteed for 3 years with annual review.

Table 20-1 - Tax reduction in Euro/litre biofuel

Year	Ethanol		ETBE	Biodiesel		Pure Plant Oil	....
	E85	blend		B100	blend		
2004				0.298	0.298		
2005	0.298	0.298		0.298	0.298		
2006	0.298	0.298		0.298	0.298		
2007	0.298	0.298		0.298	0.298		
2008	0.298	0.298		0.298	0.298		
2009[(A)]	0.298	0.298		0.298	0.298		

Exchange rate used £1 = €1.4895

[(A)] Tax incentive in place until April 2009, not guaranteed beyond

Table 20-2 - Obligation, % by volume

Year	Petrol + Diesel
2005	
2006	
2007	
2008	2.5%
2009	3.25%
2010	3.5%
2011	4%
2012	4.5%
2013	5%

20.2.3 Biofuel obligations

In April 2008 the UK government has introduced a biofuels obligation (Renewable Transport Fuel Obligation, RTFO) on fuel suppliers. The obligated parties are those companies currently paying fuel duty. The targets introduced are on a % volume basis and based on total sales. The obligated companies may discharge their obligation by supplying biofuels, by trading "certificates" with companies that have over supplied or by paying a buyout fee of £0.15 per litre. The obligated companies could supply just biodiesel so long as the volume was sufficient to cover all their petrol and diesel sales. A monthly reporting system has been imposed on the obligated companies and along with volumes, sustainability and carbon saving data must be reported. The system is administrated by the Renewable Fuels Agency (RFA), who are funded by the UK Government. The RFA publish data and performance on their website, see link at end of

report. In January 2009, the UK government had decided to lower the obligation for 2009/10 to 3.25%. The obligation of 5% for 2010 was postponed until 2013.

20.2.4 Fiscal incentives and investment subsidies

The UK Government are currently planning to introduce a system of enhanced capital allowances (ECA) which will enable investors to write off their capital invested in the first year. This system is currently under review by the UK Finance Ministry and has been submitted to the European Commission for state aid approval.

20.2.5 Other measures stimulating the implementation of biofuels

Not available.

20.2.6 Promotion of second generation biofuels

In the longer term, the Renewable Transport Fuel Obligation (RTFO) should be able to encourage and reward the development and use of those biofuels (including cellulosic ethanol) which deliver the maximum carbon savings with the minimum environmental impact. Currently, the Government is investigating carbon reduction targets instead of volume targets for the RTFO beyond 2010/2011. The Low Carbon Transport Innovations Strategy announced in the Energy Review will also act as a spur to low carbon transport technologies. The Ministry of Trade and Industry's Technology Programme is also supporting next generation transport biofuels and has supported the several projects to date, for example, projects by Imperial College of Science, Technology and Medicine, BLC Leather Technology Centre Ltd and TMO Biotec Ltd. The Department has also supported two Global Watch Missions on bioenergy and biofuels which have included work on next generation biofuels and been published in 2006.

20.3 Market development and policy effectiveness

Tax incentives were introduced in the UK during 2004 for biodiesel and 2005 for bioethanol. From these dates biodiesel and bioethanol entered the market. Early in 2006 10 E85 pumps were installed in the UK by a supermarket chain, Morrisons, 5 as part of the European BEST project. There are now a total of 21 locations in the UK selling E85. Morrisons are now supplying B20 (20% biodiesel, 80% mineral diesel) at a number of their locations in the UK. Two cities in the UK, Reading and Nottingham are running trials with Scania bioethanol busses. A number of others have low level trials using biodiesel in public transport.

Table 20-3 - Biofuel development and market share, UK

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2004	21	0				
2005	33	85				
2006	169	95				
2007	347	153				
2008						
2009						
2010						

20.4 Sources

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21 United States

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21.1 Introduction

The primary biofuel used in the United States is ethanol from starch (mostly corn). While no new oil refineries have been built in the U.S. since 1976, more than 200 ethanol production facilities have been built during this time, adding critical volume to the biofuel market. Today, there are 192 ethanol plants are operating in the United States, which produced about 36 billion litres in 2008. Biodiesel use has also risen dramatically, with about 2.6 billion litres of production in 2008.

21.1.1 Main drivers for biofuels policy

In the United States, the primary political drivers that support research programs and development of biofuel capacity are related to the economy and to energy security. Two agencies remain the primary implementing bodies for U.S. policies related to biofuels. The Department of Agriculture (USDA) has a mandate to increase rural employment, diversify agricultural economies and stimulate rural development by harnessing crops and crop residues and identifying new uses for this material. The Department of Energy (DOE) has a mandate to diversify the energy supply, expand the availability of renewable energy sources, and develop new technologies to exploit renewables in all forms.

The initial drivers for the industry were in part the oil shocks and rising prices of fuel, but today are dominated by a strong agricultural lobby which is interested in creating additional revenue streams for farmers. The US bioethanol industry uses corn, and to a lesser extent wheat, as a feedstock for wet- and dry-milling processes. A number of different policy options have been employed to help build the industry. Both federal and state governments have offered the industry direct funding in the form of public-private partnerships and research funds, as well as tax incentives and state-level renewable fuel mandates.

21.2 Biofuels policy

21.2.1 Biofuel targets

See 21.2.3 below.

21.2.2 Excise duty reductions

In the United States, both excise tax exemptions and sales tax exemptions are used as incentives for biofuel producers. Indiana offers the largest combined exemption on E10 fuels at $0.034 US per litre. Of the largest ethanol-producing states, South Dakota and Iowa are the only two producing states that offer an additional exemption on state excise taxes. It may be inferred that excise tax exemptions provide a benefit for producers, but are not the deciding factor in determining where to install capacity for production. A summary of excise and sales tax exemptions is provided in

Table 21-1 below.

21.2.3 Biofuel obligations

In his 2006 State of the Union Address, President Bush introduced the Advanced Energy Initiative (AEI), which included increased research funding for cutting edge biofuel production processes. In early 2007 President Bush announced the "Twenty-in-Ten" initiative, a plan to reduce gasoline consumption by 20% in 10 years. A major element of the plan was a request that Congress mandate an increase in domestic renewable and alternative fuels production to about 133 billion litres per year by 2017. Congress responded in December 2007 by passing a Renewable Fuel Standard (RFS) as part of the Energy Independence and Security Act (EISA) of 2007. The RFS requires 136.3 billion litres of biofuel in the transportation fuel mix by 2022, and includes specific provisions for advanced biofuels, including cellulosic ethanol and biomass based diesel contributions that pave the way for advanced technologies. The structure of the RFS is shown in

Table 21-2. In addition, many individual states have introduced fuel use requirements, including California, Iowa, and New York.

Table 21-1 - Tax exemptions by state (Total fuel excise tax rate, Exemption for E10 fuel blends) (¢/litre)

State	Excise tax (¢/L)		Sales tax (%)		Other fuels	
	Tax rate	Exemption	Tax rate	Exemption	Diesel	LPG
FEDERAL	4.9	1.4	n/a	n/a	6.4	3.6
Alabama	4.8	0.0	4.0	0.0	5.0	4.5
Alaska	2.1	0.0			2.1	
Arizona	4.8	0.0	5.6	0.0	6.9	4.8
Arkansas	5.7	0.0	5.1	0.0	6.0	4.4
California	4.8	0.0	6.0	0.0	4.8	1.6
Colorado	5.8	0.0	2.9	0.0	5.4	5.4
Connecticut	6.6	0.0	6.0	0.0	6.9	
Delaware	6.1	0.0			5.8	5.8
Dist. of Col.	5.3	0.0	5.8	0.0	5.3	5.3
Florida	3.7	0.0			7.0	7.0
Georgia	2.0	0.0	4.0	0.0	2.0	2.0
Hawaii	4.2	0.0	4.0	4.0	4.2	2.1
Idaho	6.6	0.7	5.0	0.0	6.6	4.8
Illinois	5.0	0.0	4.4	1.1	5.7	5.0
Indiana	4.8	0.8	6.0	0.0	4.2	
Iowa	5.4	0.3	5.0	0.0	5.9	5.3
Kansas	6.3	0.0	5.3	0.0	6.9	5.8
Kentucky	4.3	0.0	6.0	0.0	3.5	4.3
Louisiana	5.3	0.0	4.0	4.0	5.3	4.2
Maine	6.7	2.0	5.0	0.0	6.9	4.8
Maryland	6.2	0.0	5.0	0.0	6.4	6.2
Massachusetts	5.5	0.0	5.0	0.0	5.5	4.6
Michigan	5.0	0.0	6.0	0.0	4.0	4.0
Minnesota	5.3	0.0	6.5	0.0	5.3	4.0
Mississippi	4.9	0.0			4.9	4.5
Missouri	4.5	0.0			4.5	4.5
Montana	7.1	0.0			7.3	
Nebraska	6.5	0.0	5.5	0.0	6.5	6.5
Nevada	6.6	0.0			7.3	5.8
New Hampshire	5.2	0.0			5.2	4.8
New Jersey	2.8	0.0			3.6	1.4
New Mexico	4.9	0.0	5.0	5.0	5.2	1.6
New York	6.2	0.0	4.0	0.0	5.6	2.1
North Carolina	6.4	0.0			6.4	6.4
North Dakota	5.5	0.0	5.0	0.0	5.5	5.5
Ohio	6.9	0.0	5.0	0.0	6.9	6.9
Oklahoma	4.5	0.0	4.5	0.0	3.7	4.5
Oregon	6.3	0.0			6.3	4.9
Pennsylvania	6.8	0.0	6.0	0.0	8.1	5.1
Rhode Island	7.9	0.0			7.9	7.9
South Carolina	4.2	0.0	5.0	0.0	4.2	4.2
South Dakota	5.8	0.5	4.0	0.0	5.8	5.3
Tennessee	5.7	0.4	7.0	0.0	4.9	3.7
Texas	5.3	0.0	6.3	0.0	5.3	4.0
Utah	6.5	0.0	4.8	0.0	6.5	6.5
Vermont	5.3	0.0			6.9	
Virginia	4.6	0.0			4.2	4.2
Washington	7.4	0.0	6.5	0.0	7.4	
West Virginia	6.7	0.0			6.7	6.7
Wisconsin	7.5	0.0	5.0	0.0	7.5	7.5
Wyoming	3.7	0.0	4.0	0.0	3.7	

Table 21-2 - EISA fuel production mandates
(million L/year)

Year	Conventional Biofuels	Advanced Biofuels
2006	15.1	0
2007	17.8	0
2008	34.1	0
2009	39.7	2.3
2010	45.4	3.6
2011	47.7	5.1
2012	50.0	7.5
2013	52.2	10.4
2014	54.5	14.2
2015	56.8	20.8
2016	56.8	27.4
2017	56.8	34
2018	56.8	41.6
2019	56.8	49.2
2020	56.8	56.8
2021	56.8	68.1
2022	56.8	79.5

21.2.4 Fiscal incentives and investment subsidies

The Bush Administration proposed a Farm Bill in 2007 that includes US $1.6 billion in new renewable energy and energy efficiency-related spending at the U.S. Department of Agriculture (USDA), including US $210 million to support loan guarantees for cellulosic ethanol projects. In May 2008, Congress passed this bill (now titled the Food, Conservation, and Energy Act of 2008) with just over US $1 billion in mandatory funding for such energy activities.

21.2.5 Other measures stimulating the implementation of biofuels

The total financial commitment that the US has made to biofuels dwarfs the investment that other countries have made. By 2006, total cumulative US funding through national or state programs applicable to bioethanol has exceeded US $2.5 billion. Funding since has included US $1.05 billion for three Bioenergy Research Centres, continued funding for loan guarantees (see above), funding of US $385 million for four commercial-scale biorefinery projects, a further US $114 million for nine small-scale biorefinery projects, as well as solicitations for improved enzymes and fermentation organisms.

Support for RD&D:
Funding provided to the US Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) has risen sharply in recent years, from approximately $1 billion (US) in 2000 to $1.7 billion (US) in 2008; it has been boosted by a factor of 8+ to $16.8 billion (US) in 2009. Within this budget, the Office of Biomass Programs will receive $800 million (US) in 2009, up from $198 million (US) in 2008.

21.2.6 Promotion of second generation biofuels

The US Congress passed a Renewable Fuel Standard (RFS) as part of the Energy Independence and Security Act (EISA) of 2007. The RFS requires 136.3 billion litres of biofuel in the transportation fuel mix by 2022, and includes specific provisions for advanced biofuels, including cellulosic ethanol and biomass based diesel contributions that pave the way for advanced technologies. The structure of the RFS is shown in

Table 21-2. Classifications for biofuels include conventional (1st-generation) biofuels, as well as advanced biofuels (including cellulosic ethanol and 'green gasoline, green diesel, and other synthetic fuels all of which can be classified as 2nd-generation biofuels). However, to date, the ability of the industry to meet the RFS for advanced biofuels is limited, with only one or two projects under construction for biofuel production.

21.3 Market development and policy effectiveness

In the United States, most bioethanol production capacity is concentrated in the Midwest, where corn is found in abundance, and where state and federal government incentives have combined to make an attractive environment for investment in the infrastructure required for bioethanol production. Over half of US production capacity is found in just three states. The US states with the highest bioethanol capacities include Iowa (annual bioethanol production capacity, 10.5 billion L), Nebraska (4.1 billion L), and South Dakota (3.4 billion L). Today, there are 192 ethanol plants in the United States, producing about 36 billion litres per year, with an additional 19 plants and 5 billion litres of capacity under construction (see Table 21-3). Overall, ethanol capacity has risen 585% since 2000 (see Table 21-4).

Table 21-3 - Existing and future U.S. ethanol capacity (2009)

State	Existing plants (2009)	Under construction (2009)	Existing capacity (million litres/a)	New capacity (million litres/a)
Arizona	1		210	
California	5	2	140	400
Colorado	4		470	
Georgia	2	1	380	75
Iowa	40	2	10,500	815
Idaho	2		15	
Illinois	10	4	2,190	775
Indiana	11	1	2,670	335
Kansas	12	1	1,650	75
Kentucky	2		145	
Louisiana	1		6	
Missouri	5	1	815	20
Minnesota	21	1	3,040	190
Montana	6	1	990	20
Mississippi	1		205	
North Carolina		1		230
North Dakota	6		820	
Nebraska	24	1	4,130	330
New Mexico	1		115	
New York	2		190	
Ohio	5	1	930	250
Oregon	1	1	150	
Pennsylvania		1		415
South Dakota	15	1	3,430	125
Tennessee	2	1	670	145
Texas	2	1	530	435
Virginia		1		245
Washington		1		210
Wisconsin	9		1,885	
Wyoming	2		25	
Total	**192**	**19**	**36,300**	**5,090**

Over the past few years, biodiesel production in the US has risen at an exponential rate, from 8 million litres in 2000 to 2.7 billion litres in 2008 (see Table 21-4). Biodiesel capacity is primarily found along the Northeastern seaboard, in the Mideast and Southern states, and on the West Coast.

Table 21-4 - Biofuel development and market share, USA

Year	Biodiesel (million L/a)	Bioethanol (million L/a)	PPO (n/a)	Biogas (n/a)	2nd-Gen (n/a)	Market share (%)
2000	8	6,169				
2001	19	6,699				
2002	57	8,062				
2003	76	10,598				
2004	95	12,869				
2005	285	14,777				
2006	945	18,376				
2007	1,700	24,602				
2008	2,650	36,300				
2009						

Source: NBB (2009), RFA (2009)

21.4 Sources

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