

COUNTRY NOTES

The Country Notes on Bioenergy reflect the data and comments provided by WEC Member Committees in 2006/7, supplemented where necessary by information provided for the 2004, 2001 and 1998 editions of the WEC *Survey of Energy Resources*.

Unless otherwise specified, the data relate to the year 2005.

Albania

Municipal solid waste

quantity of raw material available	405	ttoe
------------------------------------	-----	------

Forestry/wood processing

quantity of raw material available	237	ttoe
------------------------------------	-----	------

Data refer to 2002

Algeria

Municipal solid waste

quantity of raw material available	5	million tonnes
------------------------------------	---	----------------

Forestry/wood processing

quantity of raw material available	3.7	million tonnes
------------------------------------	-----	----------------

Urban agricultural wastes

quantity of raw material available	1.33	million tonnes
------------------------------------	------	----------------

Argentina

Municipal solid waste

quantity of raw material available *	48	million tonnes
--------------------------------------	----	----------------

Sugar cane bagasse

quantity of raw material available	4.52	million tonnes
direct use from combustion	864	TJ

Forestry/wood processing

quantity of raw material available	0.54	million tonnes
direct use from combustion	53.89	TJ

Wood

quantity of raw material available	27.01	million tonnes
direct use from combustion	1 998	TJ

Agricultural residues **

quantity of raw material available	34.34	million tonnes
direct use from combustion	6.4	TJ

Industrial agricultural residues

quantity of raw material available	1.32	million tonnes
direct use from combustion	247.78	TJ

Cattle waste

quantity of raw material available	14.2	million tonnes
------------------------------------	------	----------------

* Corresponding to the residues dumped in the Relleno Sanitario de Villa Domínico landfill site. A demonstration project operated between 1978 and January 2004. A total of 48 037 673 tonnes of solid urban residues were accumulated in 25 years from the Ciudad Autónoma de Buenos Aires and the districts of Berazategui, Avellaneda, Quilmes, Almirante Brown, Florencio Varela, Lanús and Lomas de Zamora. The landfill generates some 195 million m³ of biogas (50% methane) which partly generates electricity for on site use; the remainder is flared.

** Including all residues from soybean, maize, wheat, sorghum, rice and cotton.

Australia

Municipal solid waste

quantity of raw material available	~ 6.9	million tonnes
yield of solid fuel	~ 9	GJ/tonne
electricity generating capacity	103 700	kW

Sugar cane bagasse *

quantity of raw material available	11.4	million tonnes
yield of solid fuel	~ 9.3	GJ/tonne
electricity generating capacity	368 600	kW

Forestry/wood processing **

quantity of raw material available	~ 25	million tonnes
yield of solid fuel (operational)	11	GJ/tonne

electricity generating capacity	76 500	kW
direct use from combustion	~ 66 000	TJ

Unless otherwise stated, data refer to 2002.

* 98 700 kW from landfill gas and 5 000 kW from MSW gasification (SWERF plant, Wollongong).

** Data refer to 1997. Sugar industry generation includes the Rocky Point sugar mill cogeneration plant, which uses some wood waste in the non-crushing season.

*** Includes Tumut pulp and paper mill power plants, plus Maryvale pulp and paper and Visy's plant in Brisbane. Direct combustion assumes 6 million tonnes of firewood used mainly for domestic heating.

Approximately 80 megalitres/yr ethanol produced.

Biodiesel production relatively low. Estimated to be below 20 million litres in 2002.

The Bureau of Rural Sciences has developed a bioenergy atlas for Australia.

Austria

Municipal solid waste

quantity of raw material available	1.7	million tonnes
electricity generation	9 675	TJ
direct use from combustion	10 615	TJ
total energy production	20 290	TJ

Wood

quantity of raw material available	4.4	million tonnes
electricity generation	54	TJ
direct use from combustion	64 737	TJ
total energy production	64 790	TJ

Other biomass

quantity of raw material available	8.9	million tonnes
biodiesel capacity *	6 000	TJ/yr
direct use from combustion	42 093	TJ
total energy production	85 147	TJ

* Data refer to 2006

Being well-endowed with forests and therefore wood, Austria opted for energy produced from bioenergy, such as straw, rape and corn, in the early 1980s. This dominance of bioenergy-generated power is the result of a targeted research and development policy. Figures from the energy recycling agency show that for the past two decades, investment in this area has been higher than in other renewable energy sources.

Austria's long years of research and development have led E.V.A. (Austrian Energy Authority) experts to pronounce the country a world leader in biomass firing. Biomass furnaces, particularly when fuelled by new pellets, have successfully shown themselves to be the most environmentally friendly heating system on the market. This technological lead in wood-firing has created a rapidly growing export sector in Austria.

Belgium**Municipal solid waste**

quantity of raw material available	1.1	million tonnes
electricity generating capacity	76 600	kW
electricity generation	1 765	TJ

Black liquor/bark

quantity of raw material available	0.2	million tonnes
electricity generating capacity	31 000	kW
electricity generation	585	TJ

Data refer to 1996

Bolivia**Animal dung**

direct use from combustion	3 270	TJ
----------------------------	-------	----

Sugar cane bagasse

direct use from combustion	10 458	TJ
----------------------------	--------	----

Crop residues

direct use from combustion	307	TJ
----------------------------	-----	----

Data refer to 1996

Botswana**Municipal solid waste**

direct use from combustion	1 420	TJ
----------------------------	-------	----

Estimated

Brazil**Municipal solid waste**

quantity of raw material available	23	million tonnes
electricity generating capacity	20 030	kW
electricity generation	505	TJ
total energy production	1 263	TJ

Sugar cane bagasse

quantity of raw material available	106.47	million tonnes
electricity generating capacity	1 943	MW
electricity generation	27 585	TJ
direct use from combustion	885 491	TJ
total energy production	949 486	TJ

Wood

quantity of raw material available	91.68	million tonnes
solid fuel production capacity	294 331	TJ/yr
yield of solid fuel	6.81	GJ/tonne
solid fuel production	267 574	TJ
electricity generating capacity	100 743	kW
electricity generation	2 224	TJ
direct use from combustion	674 889	TJ
total energy production	1 190	PJ

Forestry/wood processing

quantity of raw material available	2.56	million tonnes
electricity generating capacity	102 569	kW
electricity generation	2 265	TJ
direct use from combustion	24 121	TJ

total energy production	28 945	TJ
-------------------------	--------	----

Rice hulls

quantity of raw material available	0.05	million tonnes
direct use from combustion	532	TJ

Black liquor

quantity of raw material available	14.85	million tonnes
electricity generating capacity	730 918	kW
electricity generation	16 138	TJ
direct use from combustion	139 750	TJ
total energy production	177 808	TJ

Cane juice

quantity of raw material available	106.47	million tonnes
ethanol production capacity	284 616	TJ/yr
yield of ethanol	2.55	GJ/tonne
ethanol production	271 063	TJ
total energy production	277 713	TJ

Molasses

quantity of raw material available	12.52	million tonnes
ethanol production capacity	89 092	TJ/yr
yield of ethanol	6.78	GJ/tonne
ethanol production	84 849	TJ
total energy production	96 982	TJ

Bulgaria**Wood**

solid fuel production	30 019.4	TJ
-----------------------	----------	----

The theoretical potential of biomass and waste amounts to 30 645 GWh/yr. The technical potential of biomass that can be utilised is about 10-25% of physical potential and varies between 3 064 and 7 660 GWh/yr.

Cameroon**Wood**

consumption for fuel	9 581	thousand tonnes
----------------------	-------	-----------------

Charcoal

consumption for fuel	138 952	tonnes
----------------------	---------	--------

Sawdust and shavings

consumption for fuel	175 383	tonnes
----------------------	---------	--------

Canada**Municipal solid waste**

electricity generating capacity *	116 325	kW
-----------------------------------	---------	----

Forestry/wood processing

quantity of raw material available *	36.9	million tonnes
yield of solid fuel	18.5	GJ/tonne

solid fuel production	17 113	TJ
electricity generating capacity *	1 453	MW
electricity generation **	25 011	TJ

Crop residues - corn

ethanol production capacity	3 658	TJ/yr
yield of ethanol	9.25	GJ/tonne
ethanol production	3 658	TJ

Crop residues – wheat

ethanol production capacity	1 250.8	TJ/yr
yield of ethanol	8.85	GJ/tonne
ethanol production	1 250.8	TJ

Crop residues – wheat straw

ethanol production capacity	23.6	TJ/yr
yield of ethanol	7.79	GJ/tonne
ethanol production	23.6	TJ

Canola

biodiesel production capacity	147.6	TJ/yr
yield of biodiesel	16.79	GJ/tonne
biodiesel production	147.6	TJ

Fish oil

biodiesel production capacity	258.3	TJ/yr
yield of biodiesel	41.7	GJ/tonne
biodiesel production	258.3	TJ

* Data refer to 2004

** Data refer to 2003

Canada has significant advantage in bioenergy, based on the extent of arable land and forested areas. Currently, biofuels, in the form of ethanol and biodiesel, are the most advanced source of bioenergy and the Federal Government has committed to ensuring that fuels sold in Canada have an average 5% renewable fuel content by 2010.

Installed ethanol capacity is 4 932 TJ/yr, of which corn-based ethanol accounts for approximately 74%, wheat-based ethanol contributes 25% and ethanol extracted from wheat straw less than 1%. Installed biodiesel capacity is 406 TJ/yr, of which canola-based biodiesel accounts for about 36% of Canadian production and fish oil for 64%.

Government support for alternative fuels includes exemption from the excise tax on gasoline, which equates to CDN\$ 0.04/litre for biodiesel and CDN\$ 0.10/litre for ethanol. The Ethanol Expansion Program provided support (CDN\$ 100 million) to ethanol plants. Various research and development programs and public information programs are also supported, including the Canadian Biomass Innovation Network (CBIN) which coordinates R&D activities at the federal level in bioenergy, biofuels, and industrial biotechnology.

The following equipment qualifies for tax incentives with accelerated depreciation treatment: equipment powered by wood waste, municipal waste, biogas from a sewage treatment facility; equipment that recovers biogas from landfill sites; equipment used to

convert biomass into bio-oil and biogas production equipment.

In 2005 around 35 million litres of ethanol were exported and 125 million imported. Of the 925 000 tonnes of wood pellets produced in 2005, 825 000 tonnes were exported (approximately 60% to Europe and 30% to the USA).

Cote d'Ivoire

As reported for SER 2004:

Data concerning the use of biomass energy (apart from wood and charcoal) are unavailable. To resolve this problem, a strategy is being devised to collect data on production and consumption of all forms of biomass.

There is a programme for restructuring the institutional framework of renewable energies and a project concerning the inventory and the evaluation of agricultural and industrial waste.

Natural biomass, agricultural waste and industrial waste constitute the potential renewable energies for direct use.

78% of the population consumes biomass energy in different forms (firewood, charcoal by city dwellers, agricultural and industrial waste).

The agricultural and industrial energy resources are estimated at more than 4 mtoe/yr. They constitute an important source of energy and essentially come from palm oil, manufactured wood, coffee, rice and sugar cane.

The principal technologies used for the conversion of biomass into energy are carbonisation, gasification and fermentation.

Firewood and charcoal constitute 60% of the national energy consumption. As well as household consumption, wood fuels are also used in restaurants, ironwork, bakeries, potteries, curing and drying feed.

Croatia

Wood

solid fuel production capacity	112	TJ/yr
yield of solid fuel	28	GJ/tonne
solid fuel production	81.2	TJ

Forestry/wood processing

solid fuel production capacity	60.5	TJ/yr
yield of solid fuel	17.2	GJ/tonne
solid fuel production	40.4	TJ

Czech Republic

Municipal solid waste

quantity of raw material available	0.3	million tonnes
biogas production	532	TJ
electricity generation	320	TJ
direct use from combustion	1 386	TJ

total energy production	2 346	TJ
-------------------------	-------	----

Forestry/wood processing

quantity of raw material available	4.2	million tonnes
electricity generation	1 811	TJ
direct use from combustion	40 741	TJ
total energy production	46 174	TJ

Agricultural residues

quantity of raw material available	1.4	million tonnes
biogas production capacity	8 190	TJ/yr
biogas production	5 300	TJ
biogas production	153	TJ
electricity generation	223	TJ
direct use from combustion	9 031	TJ
total energy production	15 000	TJ

Sewage sludge

biogas production	1 650	TJ
electricity generation	266	TJ
direct use from combustion	851	TJ

In 2005 Czech Republic imported 8 000 tonnes of biodiesel and exported 132 000 tonnes.

Denmark

Municipal solid waste

quantity of raw material available *	36 951	TJ
--------------------------------------	--------	----

Wood

quantity of raw material available	17 667	TJ
------------------------------------	--------	----

Forestry/wood processing			total energy production 479.08 TJ		
quantity of raw material available	16 775	TJ	Forestry/wood processing		
Agricultural residues - straw			quantity of raw material available	1.2	million tonnes
quantity of raw material available	1.275	million tonnes	Cotton stalks		
Biodiesel			quantity of raw material available	1.2	million tonnes
production	2 670	TJ	Rice straw		
Biogas			quantity of raw material available	3.4	million tonnes
production	3 830	TJ	Animal dung		
Fish oil			quantity of raw material available	6	million tonnes
quantity of raw material available	0.02	million tonnes	biogas production capacity	40	TJ/yr
* Comprising 28 695 TJ renewable waste and 8 256 TJ non-renewable waste.			yield of biogas	4.1	GJ/tonne
In 2005 imports of wood and products from the forestry and wood-processing industry totalled 1 963 TJ and 1 199 TJ respectively; 2 670 TJ of biodiesel was exported.			biogas production	15	TJ
Egypt (Arab Republic)			direct use from combustion	15	TJ
Municipal solid waste			Sewage sludge		
quantity of raw material available	2.4	million tonnes	quantity of raw material available	2.4	million tonnes
Sugar cane bagasse			electricity generating capacity	18 000	kW
quantity of raw material available	1.4	million tonnes	Industrial waste		
ethanol production capacity	456.25	TJ/yr	quantity of raw material available	3	million tonnes
biodiesel production capacity	22.83	TJ/yr	Food processing waste		
			quantity of raw material available	2	million tonnes
			Data refer to 2002		

Estonia**Municipal solid waste**

quantity of raw material available	0.569	million tonnes
biogas production (landfill gas)	107	TJ

Forestry/wood processing

quantity of raw material available	0.567	million tonnes
solid fuel production	8 692	TJ

Data refer to 1999

Ethiopia**Sugar cane bagasse**

quantity of raw material available	0.75	million tonnes
ethanol production capacity	169	TJ/yr
ethanol production	148	TJ
direct use from combustion	7 568	TJ
total energy production	7 716	TJ

Wood

quantity of raw material available	56	million tonnes
solid fuel production capacity	1 857	TJ/yr
yield of solid fuel	3.6	GJ/tonne
solid fuel production	464	TJ
direct use from combustion	783 000	TJ
total energy production	783 464	TJ

Agricultural residues –**crop residue**

quantity of raw material available	6.3	million tonnes
direct use from combustion	97 000	TJ

Agricultural residues – animal dung

quantity of raw material available	9.8	million tonnes
biogas production capacity	3.7	TJ/yr
biogas production	1.5	TJ
direct use from combustion	136 000	TJ
total energy production	136 002	TJ

Finland**Municipal solid waste**

quantity of raw material available	1.2	million tonnes
electricity generation	2 160	TJ
direct use from combustion	2 380	TJ
total energy production	4 540	TJ

Wood

direct use from combustion	48 280	TJ
----------------------------	--------	----

Forestry/wood processing

quantity of raw material available	17	million tonnes
solid fuel production capacity*	5 150	TJ/yr
yield of solid fuel*	17	TJ/tonne
solid fuel production*	3 210	TJ

electricity generating capacity	2 000	MW
electricity generation	31 900	TJ
direct use from combustion	238 200	TJ
total energy production	273 310	TJ

Agricultural residues – reed canary grass

quantity of raw material available**	0.05	million tonnes
direct use from combustion	750	TJ

Biogas from farm and co-digestion plants

quantity of raw material available**	0.004	million tonnes
electricity generation	18	TJ
direct use from combustion	32	TJ
total energy production	50	TJ

Biogas from landfills

quantity of raw material available**	0.2	million tonnes
electricity generation	34	TJ
direct use from combustion	1 046	TJ
total energy production	1 080	TJ

Biogas from wastewater treatment plants

quantity of raw material available**	0.03	million tonnes
electricity generation	100	TJ
direct use from combustion	300	TJ
total energy production	400	TJ

* Data refer to 2004

** Data refer to 2002

The present use of bio-energy is dominated by residues and by-products from the forest industry. In 2005 the share of black liquor (and other similar liquors) was 39% of the total use of renewable energy (excluding peat). Wood fuels in industry and energy production also have a significant share (about 28%). The main part of forestry/wood processing residues is exploited by co-generation plants producing electricity and heat.

A substantial share, 83% (2 650 TJ), of Finnish wood pellets were exported.

The acreage of reed canary grass (grown as an energy crop) is increasing rapidly in Finland: in 2005 there were 10 400 ha under cultivation, rising to 16 000 ha in 2006. The crop can be harvested two years after seeding.

Biogas produced from 6 farm and 4 co-digestion plants totalled 2.702 million m³, of which 90% was utilised as electricity (4.9 GWh), heat (8.4 GWh) and mechanical energy (0.02 GWh).

At the end of 2005 landfill gas was collected from 33 landfills and totalled 118.404 million m³, of which 59% was utilised as electricity (9.5 GWh) and heat (289.0 GWh).

Biogas produced in 16 municipal and 4 industrial wastewater treatment facilities totalled 23.754 million m³, of which 87% was utilised as electricity (27.7 GWh), heat (83.1 GWh) and mechanical energy (2.0 GWh).

France			
Municipal solid waste			
quantity of raw material available	1 891	thousand toe	
electricity generation	11 736	TJ	
direct use from combustion	29 394	TJ	
total energy production	41 130	TJ	
Wood			
quantity of raw material available	7 419	thousand toe	
direct use from combustion	310 559	TJ	
Forestry/wood processing			
quantity of raw material available	1 935	thousand toe	
electricity generation	4 888	TJ	
direct use from combustion	4 748	TJ	
total energy production	9 636	TJ	
Agricultural residues – straw etc.			
quantity of raw material available	78	thousand toe	
direct use from combustion	3 265	TJ	
Biogas from landfills			
quantity of raw material available	127	thousand toe	
electricity generation	1 422	TJ	

direct use from combustion	251	TJ	
total energy production	1 673	TJ	
Biogas – other			
quantity of raw material available	82	thousand toe	
electricity generation	234	TJ	
direct use from combustion	2 093	TJ	
total energy production	2 327	TJ	
Biofuels			
quantity of raw material available	476	thousand toe	
ethanol production	3 140	TJ	
biodiesel production	16 785	TJ	
total energy production	19 925	TJ	

The above data relate only to metropolitan France and exclude overseas departments (DOM).

Sugar cane bagasse: in the DOM, the quantity of bagasse available in 2005 was 150 thousand toe; 1 494 TJ electricity was generated, 5 407 TJ was used directly from combustion and total energy production totalled 6 901 TJ.

Gabon

Sugar cane bagasse

quantity of raw material available	113 490	tonnes	
------------------------------------	---------	--------	--

direct use from combustion	209 956.5	million kcal
----------------------------	-----------	--------------

Société Sucrière du Gabon, owner of the plantations, utilises the bagasse as a source of fuel for generating electricity and heat used in the transformation of the sugar cane.

Germany

Municipal solid waste *

biodiesel production capacity	940 000	tonnes/yr
biogas production capacity	160	MW
biogas production	9 600	TJ
electricity generating capacity	852 000	kW
electricity generation	11 200	TJ

Forestry/wood processing**

direct use from combustion	182 442	TJ
----------------------------	---------	----

Wood waste etc. **

electricity generation	639	GWh
------------------------	-----	-----

Landfill gas **

electricity generating capacity	142	MW
electricity generation	88	GWh

Sewage sludge gas **

electricity generating capacity	75	MW
electricity generation	732	GWh

Liquid biofuels **

plant capacity	500 000	tonnes/yr
----------------	---------	-----------

Other biogas **

electricity generating capacity	200	MW
electricity generation	74	GWh

* Data refer to 2002

** Data refer to 2001

Ghana

Agricultural residues

quantity of raw material available		
coconut shell and husk	0.135	million tonnes
groundnut shells	0.0475	million tonnes
rice straw and husk	0.120	million tonnes

Data refer to 1990

Greenland

Municipal solid waste

solid fuel production capacity	214	TJ/yr
yield of solid fuel	10.5	GJ/tonne

solid fuel production	281	TJ
direct use from combustion	83	TJ
Waste from fishing industry		
yield of biodiesel	38.62	GJ/tonne
biodiesel production	12.33	TJ

Data refer to 2002

Hong Kong, China

Municipal solid waste		
quantity of raw material available	7.7	million tonnes
Sewage gas		
direct use from combustion	116.2	TJ
Landfill gas		
quantity of raw material available	240	million m ³
biogas production capacity	350	TJ/yr
yield of biogas	0.005	GJ/tonne
biogas production	72	TJ
electricity generation	14	TJ
direct use from combustion	2 000	TJ
total energy production	2 086	TJ

In May 2005, the Hong Kong Government established a renewable energy strategy in its First Sustainable Development Strategy for Hong Kong. The strategy aims for 1-2% of total power generation to come from renewables by the year 2012. This would be met through a

combination of wind power, solar energy and waste-to-energy. Municipal solid waste could make a significant contribution to this goal.

Hong Kong's comprehensive Policy Framework for the Management of Municipal Solid Waste (2005-2014) outlines a plan for reducing waste, increasing recycling and recovery, and treating about half of the remaining waste by incineration and/or other methods. These could include waste-to-energy.

A demonstration waste-to-energy facility was operated by Green Island Cement in 2005. This facility combined waste and fuel oil to produce electricity for on-site use.

Of approximately 240 million cubic metres of landfill gas available in Hong Kong in 2005, about 130 million cubic metres were utilised as energy. The unused gas was flared.

In 2005, the major uses of landfill gas in Hong Kong were heating up leachate in the ammonia removal process for the treatment of landfill waste water on-site, and generating electricity for the landfill site infrastructures, such as offices, maintenance workshop and pumping stations.

However, landfill gas was also used in a variety of other ways: as fuel in the production of town gas, and for power generation supplied to the grid; gas from a closed landfill (containing 14.3 million tonnes of waste, including construction and demolition waste) was treated and piped to

the gas company where it was used as fuel to provide 72 TJ of energy in the town gas production process. Landfill gas was also used to generate 14 TJ (4 Gigawatt hours) of electricity for the Hong Kong power grid.

Hungary

Municipal solid waste

quantity of raw material available	0.258	million tonnes
yield of solid fuel	12.5	GJ/tonne
solid fuel production	19 908	TJ
biodiesel production capacity	114	TJ/yr
yield of biodiesel	38	GJ/tonne
biogas production capacity	133	TJ/yr
yield of biogas	23	GJ/tonne
biogas production	100	TJ
electricity generating capacity	26 064	kW
electricity generation	290	TJ
direct use from combustion	32 141	TJ

Forestry/wood processing

quantity of raw material available	1.167	million tonnes
------------------------------------	-------	----------------

Agricultural residues

quantity of raw material available	0.175	million tonnes
------------------------------------	-------	----------------

Iceland

Municipal solid waste

electricity generating capacity	831	kW
electricity generation	15	TJ
direct use from combustion	56	TJ
total energy production	71	TJ

The total quantity of municipal waste is in the region of 0.5 million tonnes.

Electricity generation from landfill gas began in 2004.

Indonesia

Sugar cane bagasse

quantity of raw material available	6.5	million tonnes
------------------------------------	-----	----------------

Agricultural residues - rice husk

quantity of raw material available	14.3	million tonnes
------------------------------------	------	----------------

Agricultural residues - coconut shells

quantity of raw material available	1.1	million tonnes
------------------------------------	-----	----------------

Agricultural residues - coconut fibre

quantity of raw material available	2.0	million tonnes
------------------------------------	-----	----------------

Agricultural residues - palm oil residues		
quantity of raw material available	8.5	million tonnes

Data refer to 1999

Iran (Islamic Republic)**Municipal solid waste**

quantity of raw material available	15.33	million tonnes
------------------------------------	-------	----------------

Forestry/wood processing

quantity of raw material available	0.2	million tonnes
------------------------------------	-----	----------------

Data refer to 1999

Ireland**Municipal solid waste**

electricity generating capacity	14 732	kW
electricity generation	324	TJ

Data refer to 1999

Israel**Municipal sewage**

electricity generating capacity	2 000	kW
electricity generation	5 000	MWh

Industrial waste water

electricity generating capacity	300	kW
electricity generation	1 000	MWh

Italy**Municipal solid waste**

electricity generating capacity	526 500	kW
electricity generation	9 431	TJ
direct use from combustion	11 957	TJ
total energy production	21 388	TJ

Wood

electricity generating capacity *	389 400	kW
electricity generation	42 070	TJ
direct use from combustion	106 925	TJ
total energy production	148 995	TJ

Agricultural residues – wine, beet molasses, corn and fruits

ethanol production capacity **	281 000	tonnes/yr
ethanol production	127 200	tonnes/yr

Agricultural residues – oil seeds, fatty acid

biodiesel production capacity	857 000	tonnes/yr
biodiesel production	396 000	tonnes
direct use from combustion	15 000	tonnes

Agricultural residues – oil seeds

quantity of raw material available	0.79	million tonnes
------------------------------------	------	----------------

Other – animal, human and industrial organic waste

biogas production ***	14 382	TJ
electricity generating capacity	283 873	kW

* Installed capacity is powered by solids and other agro-industrial waste

** Production of ETBE

*** Used to make electricity

Japan

Municipal solid waste

quantity of raw material available *	601	thousand toe
electricity generating capacity **	1 553 000	kW

Sugar cane bagasse

quantity of raw material available *	80	thousand toe
electricity generating capacity ***	27 000	kW

Wood

quantity of raw material available *	438	thousand toe
electricity generating capacity ***	50 000	kW

Agricultural residues – rice husk

quantity of raw material available *	6	thousand toe
--------------------------------------	---	--------------

Black liquor

quantity of raw material available *	4 032	thousand toe
--------------------------------------	-------	--------------

* Data relate to FY 1999

** Data relate to 2004.3

*** Data relate to 2000.3

Jordan

Municipal solid waste

quantity of raw material available	2	million tonnes
biogas production	3.6	million m ³
electricity generating capacity	1 000	kW
electricity generation	5 142	MWh
direct use from combustion	5 142	MWh

Jordan has executed a pilot project for the utilisation of municipal solid waste for electricity generation through landfill and biogas technology systems. The project is funded by GEF and is considered to be the first of its kind in the region, with a capacity of 1 MW. A biogas company was established to run this plant. During 2006 the capacity of the plant was increased to 3.5 MW and is expected to generate 28 GWh/yr.

Korea (Republic)

Municipal solid waste

direct use from combustion	21 153	TJ
----------------------------	--------	----

Sugar cane bagasse		
biodiesel production	561	TJ
Wood		
solid fuel production	250	TJ
direct use from combustion	11 970	TJ
total energy production	12 220	TJ
Landfill gas		
electricity generating capacity	30 293	kW
electricity generation	1 356	TJ
direct use from combustion	428	TJ
total energy production	1 784	TJ
Sludge gas		
direct use from combustion	1 161	TJ
Other gas		
direct use from combustion	672	TJ

Latvia

Municipal solid waste		
quantity of raw material available	0.3	million tonnes
yield of biogas	7.3	GJ/tonne
biogas production	127	TJ
electricity generating capacity	7 300	kW
electricity generation	120	TJ
Wood		
yield of solid fuel	12.6	GJ/tonne

solid fuel production	59 500	TJ
Agricultural residues – corn		
ethanol production capacity	260	TJ/yr
yield of ethanol	26	GJ/tonne
ethanol production	260	TJ
Agricultural residues – canola		
biodiesel production capacity	93.5	TJ/yr
yield of biodiesel	37.4	GJ/tonne
biodiesel production	93.5	TJ

Wood occupies a central place in Latvia's energy resources as 45% of the territory is covered by forests.

In 2005 11.29 million m³ of trees were felled, of which 3.89 million m³ (34.5%) were from government forests and 7.4 million m³ (65.5%) from forests belonging to private owners, municipalities and others. In contrast to the year 2001, the total felled wood has increased by 0.78 million m³. This rise can be attributed to an increase of 0.69 million m³ trees cut in privately-owned forests. The comparable rise in timber harvested from government-owned forests was only 0.09 million m³.

The quantity of felling allowed from sustainable forest supplies has been increased to 10 million m³/yr, a level exceeded in each year between 1999 and 2006.

A thriving industry utilising waste wood exists in Latvia: more than 30 companies are engaged in

the production of woodchip briquettes, which are mainly exported to the Nordic countries; a great number of small companies are using wood waste for the production of charcoal and, being in high demand within Europe, it is both exported and sold locally; wood pellets produced are mostly exported. In 2005 20.3 PJ of wood pellets, charcoal and woodchips were exported to the UK and Scandinavian countries.

Lebanon

Municipal solid waste

quantity of raw material available	1.44	million tonnes
------------------------------------	------	----------------

Data refer to 2001

In 2004, it was reported that biogas projects were installed on a small, trial scale. None were designed to generate electricity but rather provide heating fuel. Plant residues are generally burnt in rural homes for space heating.

Lithuania

Wood

quantity of raw material available	2.05	million tonnes
electricity generating capacity	1 500	kW
electricity generation	9.4	TJ
direct use from combustion	29 641	TJ
total energy production	29 650	TJ

Agricultural residues – straw

quantity of raw material available	0.02	million tonnes
direct use from combustion	112	TJ

Agricultural residues – rape-grain

quantity of raw material available	0.02	million tonnes
biodiesel production capacity	370	TJ/yr
yield of biodiesel	12.4	GJ/tonne
biodiesel production	260	TJ

Agricultural residues – rye-wheat corn

quantity of raw material available	0.02	million tonnes
ethanol production capacity	590	TJ/yr
yield of ethanol	12.4	GJ/tonne
ethanol production	270	TJ

According to recent data from the Forest Inventory and Management Institute, Lithuania's forested land area is about 32% of the territory or about 20.9 thousand km². In 2005 the total consumption of firewood and wood waste was assessed as 3 616 thousand m³ or 708.7 thousand toe, the major share of which was firewood (569.3 thousand toe) used directly by final consumers and 144.2 thousand toe for production of heat in heating plants.

On 5 December 2001 the Government of Lithuania approved a regulation No 1474 *Procedure for the Promotion of Purchasing of Electricity Generated from Renewable and*

Waste Energy Sources. The regulation promotes the use of biofuels for power generation and feed-in tariffs (€ 0.0579/kWh) are applied for the purchase of electricity generated by such power plants.

Production of biofuels (used as motor fuels) is increasing in Lithuania. In 2006, capacities of AB 'Biofuture' will increase from 16 000 to 21 000 tonnes of dehydrated ethyl alcohol (ethanol). A new company is being formed which will significantly increase capacity for the production of biodiesel (methyl ester from rape-seed oil) and vegetable oils. There are plans to process 300 000 tonnes of rape-seed and to produce about 115 000 tonnes of methyl ester.

Luxembourg

Wood

solid fuel production	700	TJ
-----------------------	-----	----

Agricultural residues

biogas production	226	TJ
-------------------	-----	----

Municipal waste residue

solid fuel production	1 730	TJ
-----------------------	-------	----

Data refer to 2004

Mexico

Municipal solid waste

quantity of raw material available	160	million tonnes
electricity generating capacity	7 400	kW

electricity generation	186.7	TJ
------------------------	-------	----

Sugar cane bagasse

quantity of raw material available	13	million tonnes
total energy production	92 063	TJ

Wood

quantity of raw material available	17.8	million tonnes
total energy production	258 411	TJ

Forestry/wood processing

quantity of raw material available	1.32	million tonnes
total energy production	23 760	TJ

Agricultural residues – pig farms *

quantity of raw material available	15.6	million tonnes
biogas production capacity	26 408	TJ/yr
yield of biogas	1.69	GJ/tonne

Agricultural residues – milk dairies *

quantity of raw material available	36.6	million tonnes
biogas production capacity	30 281	TJ/yr
yield of biogas	0.84	GJ/tonne

Agricultural residues – slaughter houses *

quantity of raw material available	84.1	million tonnes
------------------------------------	------	----------------

biogas production capacity	530	TJ/yr
yield of biogas	0.006	GJ/tonne

Recycled waste water

quantity of raw material available	1.6	million tonnes
biogas production capacity	38.5	TJ/yr
yield of biogas	0.024	TJ/yr
biogas production	33.7	TJ
electricity generating capacity	971	kW
electricity generation	14.5	TJ
total energy production	48.2	TJ

Animal fat (biodiesel)

quantity of raw material available	0.006	million tonnes
Biodiesel production capacity	252	TJ/yr
yield of biodiesel	46.7	GJ/tonne
biodiesel production	95	TJ

* Data refer to potential identified resources: no installations have yet been built.

Monaco**Municipal solid waste**

quantity of raw material available	0.07	million tonnes
electricity generating capacity	2 600	kW
electricity generation	26	TJ
direct use from combustion	72	TJ
total energy production	98	TJ

Data refer to 1996

Morocco**Animal dung**

biogas production capacity	4.00	TJ/yr
yield of biogas	0.56	GJ/tonne
biogas production	4.00	TJ

Data refer to 1996

Namibia

At the present time there is no legislation in place to regulate the use of bio-energy resources.

Nepal**Wood**

direct use from combustion	293.17	TJ
----------------------------	--------	----

Agricultural residues

direct use from combustion	14.3	TJ
----------------------------	------	----

Animal dung

direct use from combustion	21.63	TJ
----------------------------	-------	----

Netherlands**Municipal solid waste**

electricity generation	10 296	TJ
direct use from combustion	1 085	TJ
total energy production	11 381	TJ

Forestry/wood processing

direct use from combustion		
households	5 400	TJ

industry	1 750	TJ
Landfill gas		
biogas production	2 763	TJ
Sludge		
biogas production	2 041	TJ
Fermentation		
biogas production	5 632	TJ

Data refer to 1999

New Zealand

Forestry/wood processing		
quantity of raw material available	43 540	TJ
electricity generating capacity	78 573	kW
electricity generation	1 900	TJ
direct use from combustion	35 419	TJ
total energy production	37 319	TJ
Sewage		
quantity of raw material available	470	TJ
electricity generating capacity	5 950	kW
electricity generation	99	TJ
direct use from combustion	115	TJ
total energy production	214	TJ
Landfill		
quantity of raw material available	1 049	TJ
electricity generating capacity	16 000	kW

electricity generation	294	TJ
------------------------	-----	----

Paraguay**Sugar cane bagasse**

quantity of raw material available	0.536	million tonnes
ethanol production capacity *	861.6	TJ/yr
yield of ethanol *	1.303	GJ/tonne
ethanol production **	704.231	TJ

Wood

quantity of raw material available	4.417	million tonnes
yield of solid fuel	10.501	GJ/tonne
solid fuel production	6 746.3	TJ
direct use from combustion	56 854.52	TJ
total energy production	63 600.82	TJ

Forestry/wood processing

quantity of raw material available	1.319	million tonnes
direct use from combustion	24 066.79	TJ

Agricultural residues – cotton

quantity of raw material available	0.263	million tonnes
direct use from combustion	3 844.1	TJ

Agricultural residues - other

quantity of raw material available	0.062	million tonnes
direct use from combustion	940.9	TJ

* Data refer to total (i.e. including non-energy use)

** Data refer to energy use

Peru**Sugar cane bagasse**

quantity of raw material available	1.9	million tonnes
electricity generating capacity	43 400	kW
electricity generation	5 003.6	TJ
direct use from combustion	2 475.2	TJ
total energy production	7 478.8	TJ

Wood

quantity of raw material available	5.13	million tonnes
yield of solid fuel	15.1	GJ/tonne
solid fuel production	5 697.6	TJ
direct use from combustion	71 335.4	TJ
total energy production	77 033.0	TJ

Agricultural residues

biogas production capacity	15.07	TJ/yr
yield of biogas	13.5	GJ/tonne
biogas production	10.55	TJ

Philippines**Municipal solid waste**

electricity generation	6	TJ
------------------------	---	----

Sugar cane bagasse

electricity generation	6 518	TJ
------------------------	-------	----

Forestry/wood processing

electricity generation	22 981	TJ
------------------------	--------	----

Crop residues - coconut

electricity generation	7 046	GWh
------------------------	-------	-----

Crop residues – rice

electricity generation	2 934	GWh
------------------------	-------	-----

Animal

electricity generation	146	GWh
------------------------	-----	-----

Data refer to 2002

Poland**Municipal solid waste**

direct use from combustion	675	TJ
----------------------------	-----	----

Wood / Forestry/wood processing

quantity of raw material available	13 839	thousand m ³
direct use from combustion	127	TJ
	914	
total energy production	131	TJ
	474	

Agricultural residues		
direct use from combustion	21 337	TJ
total energy production	31 741	TJ
Industrial waste		
direct use from combustion	16 529	TJ
total energy production	22 282	TJ

The Polish Statistical Office does not currently publish data on itemised bioenergy by type. The following total bioenergy production data are available for 2005:

Solid fuels (biomass and industrial wastes)	49.3	PJ
Liquid biofuels	0.6	PJ
Biogas	2.0	PJ
Electricity	1 506	MWh

Up to the present time renewable energy has not been intensively utilised. However, this situation is likely to change considerably in the short term, owing to European law and Poland's renewable energy obligations. By 2010, it is expected that electricity generation from renewables (geothermal, biomass, wind and hydro) will contribute 9% of the total. Moreover, the share of biofuels in the transport sector will rise to 5.75%.

Portugal

Municipal solid waste

quantity of raw material available	1.1	million tonnes
electricity generating capacity	90 000	kW
electricity generation	7 919	TJ

Forestry/wood processing

quantity of raw material available	6.2	million tonnes
biogas production	424	TJ
electricity generating capacity	369 000	kW
electricity generation	8 757	TJ
direct use from combustion	104 906	TJ
total energy production	113 663	TJ

Romania

Municipal solid waste

quantity of raw material available	545	thousand toe
------------------------------------	-----	--------------

Wood

quantity of raw material available	487	thousand toe
------------------------------------	-----	--------------

Forestry/wood processing

quantity of raw material available	1 175	thousand toe
------------------------------------	-------	--------------

Agricultural residues

quantity of raw material available	4 799	thousand toe
------------------------------------	-------	--------------

Biogas		
quantity of raw material available	588 thousand	tonnes

Russian Federation

Forestry/wood processing

quantity of raw material available	73.7	million GJ
electricity generating capacity	560.4	MW
electricity generation	2.2	TWh
direct use from combustion	40.7	million GJ

Data refer to 2001

Senegal

Municipal solid waste

electricity generating capacity	20 000	kW
---------------------------------	--------	----

Agricultural residues – peanut shells

electricity generating capacity	22 000	kW
---------------------------------	--------	----

Biomass potential (per annum)

Peanut shells	197 500	tonnes (221 MW)
Palmetto shells	1 740	tonnes

Sugar cane bagasse	250 000	tonnes (20 MW)
Rice husks	217 212	tonnes
Sawdust	3 000	cubic metres
Millet/Sorghum/Maize stalks	4 052 900	tonnes
Typha reed	1 000 000	tonnes
Cotton stalks	23 991	tonnes
Peanut haulm	790 617	tonnes

Data refer to 1999

Serbia

Municipal solid waste

quantity of raw material available	31 200	TJ
------------------------------------	--------	----

Forestry/wood processing

quantity of raw material available	2 300	TJ
direct use from combustion	3 300	TJ

Agricultural residues

quantity of raw material available	56 200	TJ
------------------------------------	--------	----

Orchard

quantity of raw material available	14 100	TJ
------------------------------------	--------	----

Vineyard

quantity of raw material available	6 100	TJ
------------------------------------	-------	----

Singapore**Municipal solid waste**

electricity generating capacity	135 000	kW
electricity generation	3 994.68	TJ

Data refer to 2002

Slovakia**Wood**

quantity of raw material available	0.4	million tonnes
------------------------------------	-----	----------------

Forestry/wood processing

quantity of raw material available	1.4	million tonnes
------------------------------------	-----	----------------

Agricultural residues - straw

quantity of raw material available	0.73	million tonnes
------------------------------------	------	----------------

Agricultural residues – corn

quantity of raw material available	0.67	million tonnes
------------------------------------	------	----------------

Agricultural residues – other

quantity of raw material available	0.63	million tonnes
------------------------------------	------	----------------

Dung

quantity of raw material available	13.7	million tonnes
------------------------------------	------	----------------

Slovenia**Landfill**

electricity generating capacity	253	kW
electricity generation	29.936	TJ

Urban sewage sludge

electricity generating capacity	31	kW
electricity generation	2.232	TJ

Solid biomass

electricity generation	81.555	TJ
direct use from combustion	19.560	TJ

In 2005 cumulative biodiesel capacity totalled 24 000 tonnes/yr and production 8 700 tonnes.

South Africa**Sugar cane bagasse**

quantity of raw material available	3.6	million tonnes
------------------------------------	-----	----------------

Wood

quantity of raw material available	11.2	million tonnes
------------------------------------	------	----------------

Forestry/wood processing

quantity of raw material available	8.1	million tonnes
------------------------------------	-----	----------------

* Calculated from a TJ value, using conversion factors of 14 MJ/kg for bagasse and 17 MJ/kg for fuel wood and forestry wastes.

Data generally refer to 2003

A data collection system for biofuels has not yet been formalised in South Africa.

Spain

Agricultural residues

quantity of raw material available	5 768 563 *	toe
ethanol production capacity	415 000	tonnes/yr
ethanol production	257 000	tonnes
biodiesel production capacity	322 000	tonnes/yr
biodiesel production	150 000	tonnes

* Potential = 12 802 208 toe

The breakdown of bioenergy electricity generation capacity is not available. Total installed electricity generating capacity stood at 3 440 kW at end-2004 and provisionally at 3 660 kW at end-2005.

In 2004 the total direct and indirect energy produced from all bioenergy sources was 4 167 035 toe.

The estimated potential of forestry/wood processing residues is of 11 819 000 toe, but at end-2004 only 7 576 040 toe were being exploited.

Sri Lanka

As preliminary steps towards eventual large-scale use of wood for electricity generation, two facilities have been installed in Sri Lanka:

- in the village of Endagalayaya, a 3.5 kW_e electrical generator coupled with a gasifier

system processing chips of *Gliricidia Sepium*; this provides lighting for 31 houses, with each having 2 light bulbs indoors and one externally to deter elephants and other wild animals;

- at Walapane, a 1 MW_e dendro-thermal power plant fuelled by *Gliricidia* wood, and capable of generating 6 447 MWh/yr.

Gliricidia Sepium is a fast-growing tropical tree cultivated by local farmers.

A biomass gasifier at Madampe, in the Coconut Triangle, also uses wood as feedstock. The gas is used to dry coconut fibre prior to its conversion into briquettes, which are then exported for use as a growing medium

Swaziland

Sugar cane bagasse

quantity of raw material available	1.32	million tonnes
------------------------------------	------	----------------

Forestry/wood processing

quantity of raw material available	0.63	million tonnes
------------------------------------	------	----------------

Data refer to 2002

Sweden

Municipal solid waste

solid fuel production	12 300	TJ
biogas production	1 250	TJ

electricity generating capacity	290	kW
electricity generation	9 400	TJ

Wood

solid fuel production	330 000	TJ
electricity generating capacity	2 500	kW
electricity generation	53 000	TJ

Switzerland**Municipal solid waste**

quantity of raw material available	3.25	million tonnes
electricity generating capacity	301 600	kW
electricity generation	3 079.8	TJ
direct use from combustion	8 386.0	TJ
total energy production	11 465.8	TJ

Sewage

electricity generation	406.5	TJ
direct use from combustion	1 001.0	TJ
total energy production	1 407.5	TJ

Wood (incl. forestry/wood residues)

electricity generation	118.8	TJ
direct use from combustion	19 610.0	TJ
total energy production	19 728.8	TJ

Manure and vegetal residues

electricity generation	33.9	TJ
direct use from combustion	17.1	TJ

total energy production	51.0	TJ
-------------------------	------	----

Syria (Arab Republic)**Municipal solid waste**

quantity of raw material available	4	million tonnes
------------------------------------	---	----------------

Wood

quantity of raw material available	0.5	million tonnes
------------------------------------	-----	----------------

Forestry/wood processing

quantity of raw material available	0.2	million tonnes
------------------------------------	-----	----------------

Taiwan, China**Municipal solid waste**

electricity generating capacity	583.8	kW
electricity generation	27 128.9	TJ

Waste cooking oil

quantity of raw material available	0.15 – 0.2	million tonnes
biodiesel production capacity	275.97	TJ/yr
yield of biodiesel	34.5	GJ/tonne
biodiesel production	5.2 – 6.9	GJ

Tanzania**Sugar cane bagasse**

quantity of raw material available	229 617	tonnes
------------------------------------	---------	--------

Wood

quantity of raw material available	140	million m ³
------------------------------------	-----	------------------------

The country has a considerable biomass resource in the form of agricultural and forest residues and animal wastes which together account for about 90% of the nation's energy requirements. There is no immediate renewable energy substitute for wood fuel used for cooking apart from biogas, the technology of which has not yet reached a high enough level of dissemination.

According to data for 2003, there was a growing stock of 4.39 billion m³ woody biomass with a mean annual increment of 140 million m³. Annual wood fuel consumption is approximately 34 million m³, contributing to deforestation at an estimated rate of 91 276 ha/yr.

Generally, biomass is not internationally traded.

The Government has formed a National Taskforce to work on liquid fuels promotions. The Taskforce/Special Committee is working in close collaboration with various stakeholders to formulate practical recommendations. The production of ethanol and biodiesel is being developed by small-scale private companies.

Thailand**Municipal solid waste**

electricity generating capacity	3 125	kW
electricity generation	43	TJ

Agricultural residues – molasses

quantity of raw material available	1.16	million tonnes
ethanol production capacity	2 597	TJ/yr
yield of ethanol	5.24	GJ/tonne
ethanol production	1 146	TJ

Agricultural residues – waste water

biogas production capacity	26.98	million m ³ /yr
yield of biogas	0.497	ttoe/m ³
biogas production	8.691	ttoe

Agricultural residues – waste from farm

biogas production capacity	16.41	million m ³ /yr
yield of biogas	1.2	kWh/m ³
biogas production	33.174	GWh

Agricultural residues – used cooking oil

quantity of raw material available	0.08	million tonnes
biodiesel production capacity	65.3	TJ/yr
yield of biodiesel	33	GJ/tonne
biodiesel production	42	TJ

In 2005 there was a total molasses production of 2.26 million tonnes. The domestic consumption (excluding the ethanol industry) was about 1.1 million tonnes. There was thus 1.16 million tonnes available for export or ethanol production. Thailand imported about 20.9 million litres (438 TJ) of ethanol.

Turkey

Municipal solid waste

quantity of raw material available	~ 25	million tonnes
biogas production	~ 575	TJ

Sugar cane bagasse

quantity of raw material available	N	million tonnes
------------------------------------	---	----------------

Wood

quantity of raw material available	3.52	million tonnes
------------------------------------	------	----------------

Forestry/wood processing

quantity of raw material available	3.56	million tonnes
------------------------------------	------	----------------

Agricultural residues – straw + stalks

quantity of raw material available	13.2	million tonnes
------------------------------------	------	----------------

Agricultural residues – kernels, shells, tree prunings

quantity of raw material available	4	million tonnes
------------------------------------	---	----------------

Dung

quantity of raw material available	13.8	million tonnes
------------------------------------	------	----------------

Biodiesel can be produced under the biodiesel processing licence, given by the Energy Market Regulatory Body (EMRA). Currently, 52 biodiesel production companies have applied to the EMRA.

There is only one bioethanol production plant in Turkey, mostly processing wheat. The total production capacity of the plant is 30 000 m³/yr.

The Turkish bioenergy resource is in the form of agricultural crops and residues, including dry manure, but have yet to be properly determined. The results above are taken from the final report of a project funded by European Commission (EC Contract Number: LIFE 03 TCY/TR/000061), *Exploitation of Agricultural Residues in Turkey*.

Ukraine

Agricultural residues – wheat, corn, barley etc.

quantity of raw material available	4.27	million tonnes
direct use from combustion	64	TJ

Agricultural residues – sunflower

quantity of raw material available	1.21	million tonnes
------------------------------------	------	----------------

direct use from combustion	38.3	TJ
Wood		
quantity of raw material available	0.33	million tonnes
direct use from combustion	23	TJ
Dung		
quantity of raw material available	0.74	million tonnes
biogas production	10.9	TJ
Sewage sludge		
biogas production	105.5	TJ

In 2005 the use of biogas at the Bortnychy cleaning facility (Kiev) saved over 2.3 million m³ of natural gas (equal to about 3.6 thousand tce).

United Kingdom

Municipal solid waste *		
quantity of raw material available	3.7	million tonnes
electricity generating capacity	321 400	kW
electricity generation	5 551	TJ
direct use from combustion	6 255	TJ
total energy production	11 806	TJ
Wood & forestry/wood processing		

quantity of raw material available	1.1	million tonnes
direct use from combustion	11 937	TJ
Agricultural residues **		
quantity of raw material available	1.1	million tonnes
electricity generating capacity	186 100	kW
electricity generation	3 078	TJ
direct use from combustion	3 094	TJ
total energy production	6 172	TJ

Biomass co-fired with fossil fuels

quantity of raw material available ***	2	million tonnes
electricity generating capacity	308 800	kW
electricity generation	9 112	TJ

Landfill gas

electricity generating capacity	817 800	kW
electricity generation	15 444	TJ

Sewage sludge digestion

electricity generating capacity	127 900	kW
electricity generation	1 440	TJ

* Including non-biodegradable wastes, which account for about 40% of the total.

** Includes farm waste, poultry litter, meat and bone, straw and energy crops.

*** In 2005, of the 2 million tonnes of biomass used for co-firing, 1.8 million was imported and 0.2 was home produced.

In 2005 consumption of biodiesel and bioethanol was almost all from imported sources, but amounts were comparatively small.

The UK also used landfill gas and sewage gas for the production of heat and electricity and classifies these as biofuels.

The White Paper *Meeting the Energy Challenge* (May 2007) announced the Government's intention to strengthen the Renewables Obligation (RO), increasing the RO to 'up to 20% as and when increasing amounts of renewables are deployed' and introducing banding of the RO in order to provide differentiated support to the various renewable technologies. In this latter connection, particular mention was made of the need to bring forward offshore wind and biomass.

United States of America

Municipal solid waste

quantity of raw material available	146.2	million tonnes
electricity generating capacity*	2 647	MW
electricity generation*	53 580	TJ
direct use from combustion	23 940	TJ
total energy production	77 520	TJ

Forestry/wood processing

quantity of raw material available	153	million tonnes
electricity generating capacity	6 970	MW
electricity generation	139 252	TJ
direct use from combustion	975 817	TJ

total energy production	1 115	PJ
-------------------------	-------	----

Agricultural residues – corn

ethanol production	313 051	TJ
--------------------	---------	----

Agricultural residues – soybean

biodiesel production	11 331	TJ
----------------------	--------	----

Agricultural residues – other

electricity generating capacity	282 700	kW
electricity generation	2 430	TJ
direct use from combustion	37 631	TJ
total energy production	40 061	TJ

Landfill gas

electricity generating capacity	963 000	kW
electricity generation	18 487	TJ
direct use from combustion	67 005	TJ
total energy production	85 492	TJ

Other

electricity generating capacity	359 300	kW
electricity generation	4 803	TJ
direct use from combustion	9 958	TJ
total energy production	14 760	TJ

In 2005, 8 847 TJ of ethanol was imported.

Uruguay

Municipal solid waste

biogas production capacity	31.5	TJ/yr
----------------------------	------	-------

electricity generating capacity	1 000	kW
---------------------------------	-------	----

Sugar cane bagasse

quantity of raw material available	0.05	million tonnes
electricity generating capacity	3 000	kW
electricity generation	20.9	TJ
direct use from combustion	502.1	TJ

Wood

quantity of raw material available	1.5	million tonnes
electricity generating capacity	2 800	kW
electricity generation	33.5	TJ
direct use from combustion	16 769.5	TJ

Agricultural residues – sunflower husks

quantity of raw material available	0.03	million tonnes
direct use from combustion	37.7	TJ

Agricultural residues – rice husks

quantity of raw material available	0.24	million tonnes
electricity generation	4.2	TJ
direct use from combustion	748.9	TJ

Black liquor

quantity of raw material available	0.04	million tonnes
electricity generation	58.6	TJ
direct use from combustion	447.7	TJ

installation of up to 20 MW of electricity generation based on biomass (<10 MW) provided by IPPs.

In March 2006 the Government passed a decree which is the first stage in encouraging the