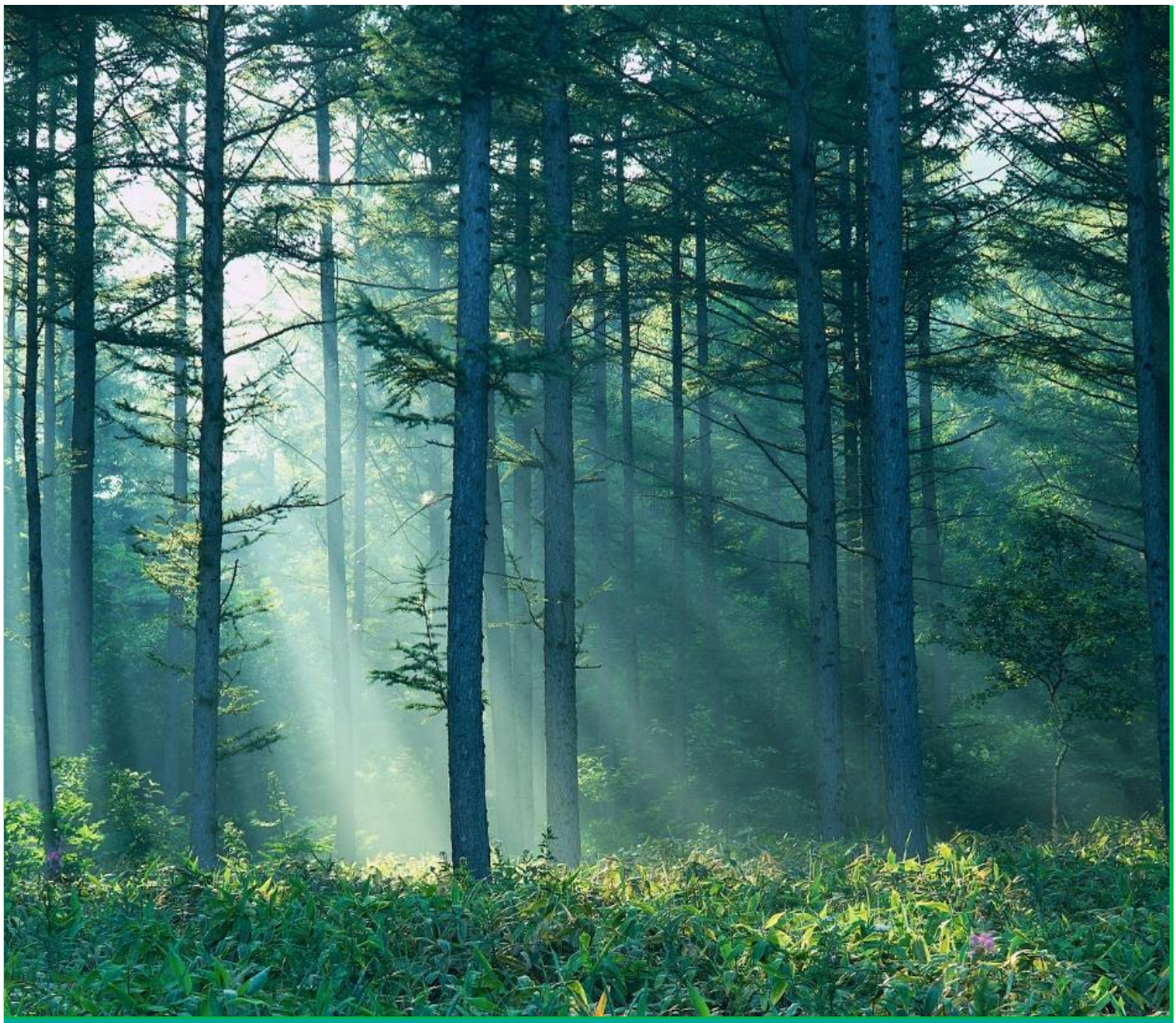

WBA Global Bioenergy Statistics 2014

World Bioenergy Association

www.worldbioenergy.org

WBA GBS report

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Message from President

Dear reader,

It is my pleasure to bring to you the WBA Global Bioenergy Statistics 2014 report.

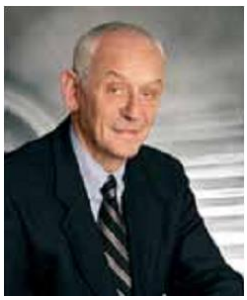
Bioenergy is a very significant contributor in not just mitigation of climate change, but also in ensuring energy independency and economic growth. For such an important energy source, there is a lack of reliable, up to date and consistent statistics. Being a world organization involved in the promotion of bioenergy, it was our responsibility to come up with such a report. It is the first attempt by WBA to provide an overview of the bioenergy sector globally and regionally. Having said that, statistics are a work in progress. Suggestions and comments are most welcome.

For this report, I wish to thank our Project Officer, Mr. Bharadwaj Kummamuru Venkata for his efforts in data collection, compilation and analysis. Also, our sincere thanks to the members of the steering committee and contributors who agreed to oversee the development of this report and provided us with valuable inputs.

Hope you will find these statistics useful!

Happy reading!

Regards



Heinz Kopetz

President, World Bioenergy Association

Table of Contents

Introduction

Bioenergy is energy derived from biomass sources. It is one of the most important renewable energy sources and is also a very complex energy system with a multitude of variations. Biomass can be obtained from a variety of feedstock from forests, agriculture and wastes sectors. Biomass can be converted with variety of conversion techniques like thermal (combustion), thermochemical (torrefaction, gasification etc.), biochemical (anaerobic digestion, fermentation) and chemical conversion (trans esterification). Biomass is principally used in the form of electricity, heating/cooling, and as liquids or solid fuels.

Biomass is by far the most important renewable energy source, in OECD countries as well as outside the OECD countries. In many developing countries biomass provides more than 60% of the energy supply. Biomass for energy has the potential to grow significantly in the next decades and to become one of the pillars of a future sustainable energy system. Yet, in many countries the data about the potential, the production, conversion and utilization of biomass for energy are incomplete, inaccurate or just rough estimations. The relations between bioenergy, agriculture, forestry and waste management are not reported. Hence the issue and potential of a sustainable biomass production often is ignored.

Therefore the World Bioenergy Association (WBA) has attempted to show the global development of biomass to energy –supply, conversion, utilization. The outcome should support political decision makers, the business community, finance institutions and NGOs in their work.

In this report, certain key words are used frequently. Hence, the reader is advised to review the following terminology:

- TPES (Total Primary Energy Supply): It is the energy content of the energy sources and is calculated as production + imports – exports +/- international bunkers +/- stock changes.
- TFEC (Total Final Energy Consumption): It is the final consumption of energy sources in agriculture/forestry, commercial and public services, fishing, industry and others etc. It excludes the use of fossil sources in non-energy use.
- GFEC (Gross Final Energy Consumption): It is the sum of:
    - Total final energy consumption
    - Consumption of electricity and heat by the transformation sector, including the energy industry own use
    - Losses in transmission and distribution of electricity and heat

The majority of the data are used from International Energy Agency (IEA) statistics database available online. Also, data are collected from Food and Agricultural Organization (FAO) statistics database, US Foreign Agricultural Services (FAS), REN21, WBA members and others. To integrate all aspects of bioenergy in one statistical report, it was necessary to use a base period covering all sectors. Hence, for this report we chose 2000 – 2011. Recent data was used wherever it was available.

In this report, Chapter 1 provides an overview of global energy and bioenergy system. Chapter 2 deals with supply side of biomass. Chapters 3, 4 and 5 give more details about the conversion of biomass to electricity, biofuels and heat respectively. Some special sectors like torrefaction, biogas, and pellets are shown in Chapter 6.

World Bioenergy Association

- **The GLOBAL VOICE OF BIOENERGY**

Together with our members

- We work for an increased use of biomass in the global energy system in the markets for heat, electricity and biofuels
- We follow the principles of sustainable, efficient and economic biomass development
- We influence and inform the public opinion in favour of sustainable biomass solutions worldwide and in particular countries
- We cooperate with global institutions such as UNEP, UNFCCC, IEA, IEA Bioenergy, IRENA, REN Alliance, FAO, REN21 etc. towards the target 100% Renewables

How we work?

- **Office** in Stockholm, Sweden
- **Our members:** companies, associations, individuals all over the world
- **Main issues:** biomass potential, sustainability of biomass, small scale heat with biomass, combined heat and power, future of biofuels, carbon neutrality of biomass, bioenergy statistics, biomass trade
- **Main activities:** fact sheets, projects, position papers, presentations in conferences, workshops and supporting biomass trade with the platform: BioenergyConnect.net

What kind of membership is possible?

Full members

Bioenergy associations on regional, national or international level

Associate members

Companies, energy agencies, research institutes, consultants working in the field of bioenergy

Individual members

Individuals interested in global development of bioenergy as sustainable and renewable energy source

WBA: benefits of membership

- Strengthen the lobbying in favour of biomass in global scale
- Exchange of information and experience between the bioenergy sector world wide
- Possible cooperation in working groups and projects
- Access to new global studies and information about bioenergy

We invite you: Join WBA!

Chapter 1: Global energy system

Quick Facts!

In 2011, the share of renewables in gross final energy consumption was 18.3%, bioenergy was 14.3%

Biomass was predominantly used for heating

1 Global overview

This chapter provides an overview of the energy system. The first part deals with the primary energy sources and the net imports/exports of energy. It is followed by an explanation of calculation of gross final energy consumption from primary energy supply. Finally, the end use of biomass is reported.

1.1 Primary energy supply

From 2000 till 2011, global primary energy supply has increased by 30% (Table 1). The highest absolute increase among renewables was reached by bio – energy. Yet overall, the supply of coal grew faster than the supply of renewables.

Table 1 Global primary energy supply of energy sources (EJ)

	Total	Fossil			Nuclear	Renewables		
		Coal	Crude Oil	Natural Gas		Hydro	Solar, wind etc.*	Bioenergy
2000	426	98.7	157	86.8	28.3	9.44	2.51	43.2
2005	486	125	172	99.0	30.2	10.5	2.95	47.2
2009	515	140	172	106	29.4	11.7	4.28	52.0
2010	543	151	176	115	30.1	12.4	4.69	54.2
2011	552	158	177	117	28.2	12.6	5.32	54.9

*Source: IEA statistics. *Solar, wind etc. include solar, wind, geothermal, tidal, wave and ocean energy*

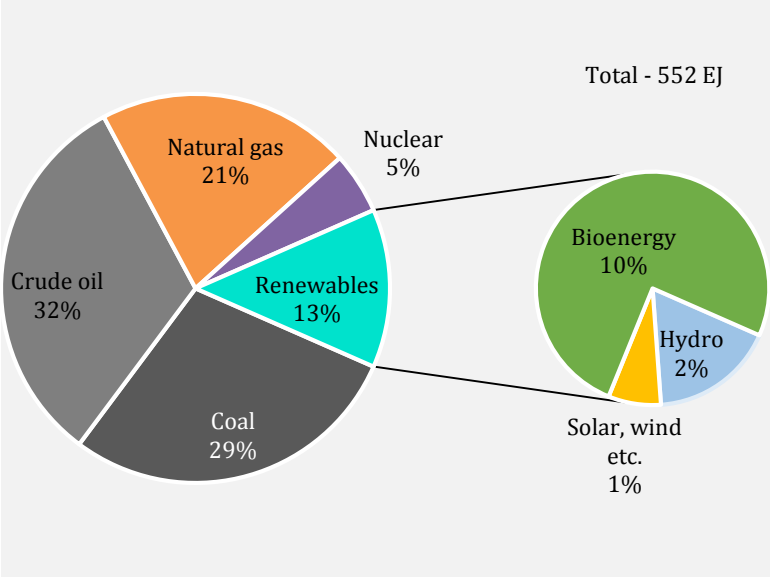


Figure 1 Global primary energy supply of energy sources for year 2011
Source: IEA statistics

1.2 Imports and exports

In 2011, Asia was a dominant importer and exporter of energy. 77.6 EJ was exported while 90.3 EJ was imported by the continent as a whole (Figure 2). Europe is the largest importer of bioenergy with imports totalling 485 PJ in 2011 (Figure 3).

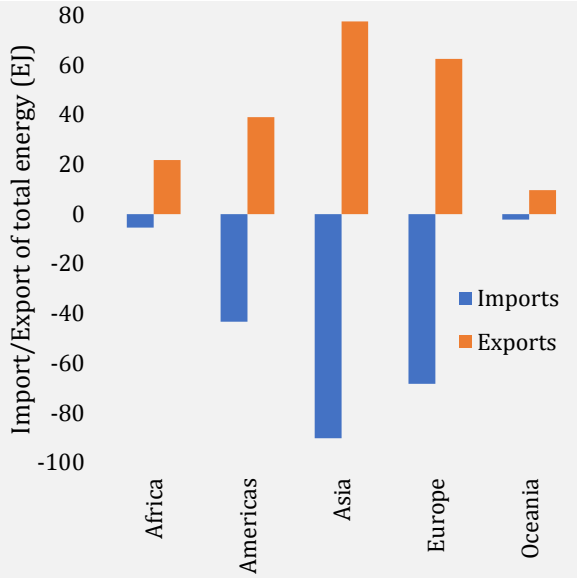


Figure 2 Continental imports and exports of energy in year 2011
Source: IEA statistics

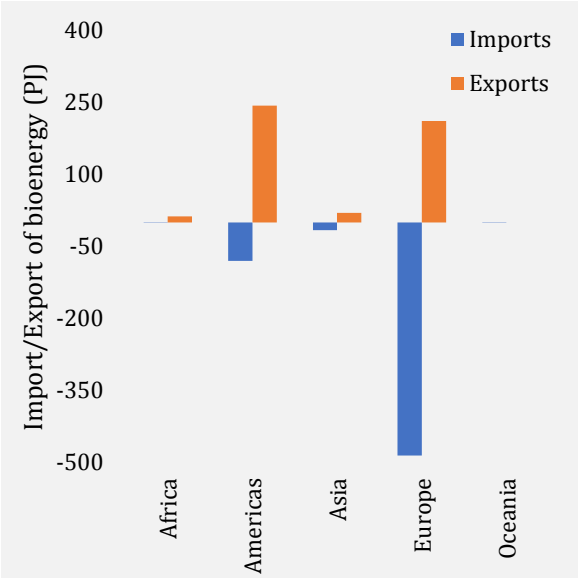


Figure 3 Continental imports and exports of bioenergy in year 2011
Source: IEA statistics

1.3 Primary energy supply to gross final energy consumption

This section provides an overview of the conversion of primary energy supply to gross final energy consumption.

1.3.1 All energy sources

To understand the conversion of energy sources from primary energy supply to gross final energy consumption, the conversion is divided into four parts – primary energy supply, final energy consumption, consumption of heat and electricity, gross final energy consumption. Taking the case of fossil fuels, 451 EJ was the primary energy supply in 2011 (Table 2) out of which 213 EJ was final energy consumption. 45 EJ of electricity and 10.8 EJ of heat was consumed during the same period[1]. The gross final energy consumption of fossil fuels was 269 EJ out of a total of 339 EJ. This gross final energy consumption can be further divided into the use of energy in electricity, heating and transport sectors. For the case of renewables, their contribution was 61.85 EJ (10.6 + 2.75 + 48.5 EJ) which is 18.3% of the GFEC (Figure 4) with bioenergy contributing 14.3%.

[1] The statistics for electricity and heat consumption are derived after including the losses in transmission and distribution & the use of electricity and heat within the energy industry.

Table 2 Primary energy supply to gross final energy consumption for energy sources for year 2011 (EJ)

	TPES	TFEC[2]	Elec. & heat consumption		GFEC Total	Gross final energy consumption		
			Electricity	Heat		Heat	Transport	Electricity
Fossils	451	213	45.0	10.8	269	125	98.9	45.0
Nuclear	28.2	-	7.72	0.02	7.74	0.02	-	7.72
Hydro	12.6	-	10.6	-	10.6	-	-	10.6
Solar, wind etc.	5.32	1.06	1.69	-	2.75	1.06	-	1.69
Bioenergy	54.9	46.5	1.26	0.64	48.5	44.7	2.45	1.26
Total	**552**				**339**	**171**	**101**	**66.3**

Source: IEA statistics and WBA calculations
GFEC = TFEC + Consumption of electricity + Consumption of heat

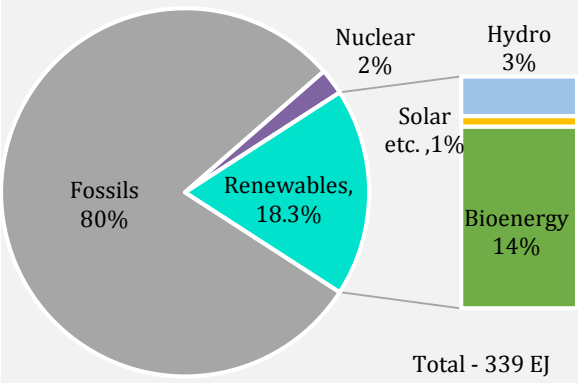


Figure 4 Gross final energy consumption of energy sources in year 2011
Source: IEA statistics

[2] The statistics of IEA available online are for total final consumption which includes the non-energy use of fossil fuels. In 2011, 34.3 EJ of fossil energy was used for non-energy uses. To calculate Total Final Energy Consumption in this report, we eliminate the non-energy uses.

The trend from the year 2000 shows the dominance of fossil fuels (Figure 5).

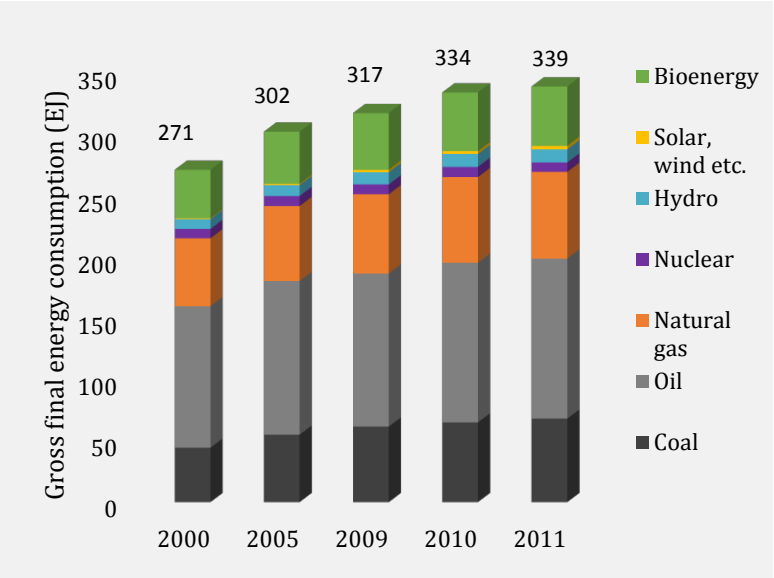


Figure 5 Trend of gross final energy consumption of energy sources since 2000
Source: IEA statistics

50% of the global energy was used in the heating sector in 2011 (Figure 6) while 92% of bioenergy was used in heating (Figure 7).

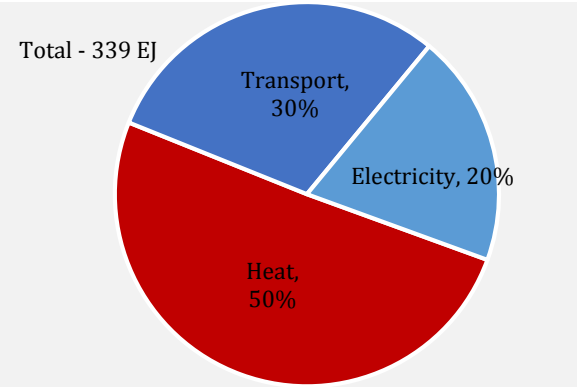


Figure 6 Gross final energy consumption of energy as end use in year 2011
Source: IEA statistics

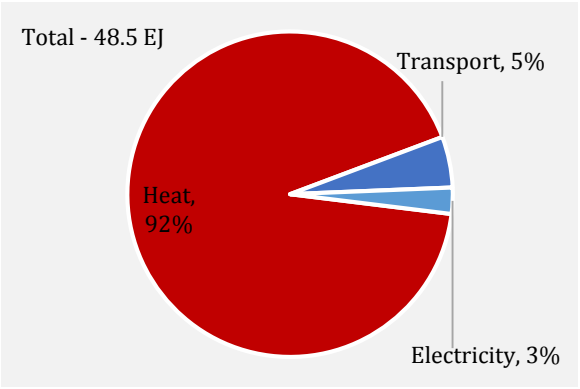


Figure 7 Gross final energy consumption of bioenergy as end use in year 2011
Source: IEA statistics

1.3.2 Bioenergy use in continents

Asia uses almost 50% of the global bioenergy (Table 3) – most of it as heat.

Table 3 Primary energy supply to gross final energy consumption for bioenergy for year 2011 (EJ)

	TPES	TFEC	Consumption of el. & heat		GFEC total	Gross Final Energy Consumption		
			Electricity	Heat		Heat	Transport	Electricity
World	54.9	46.5	1.26	0.64	48.5	44.7	2.45	1.26
Africa	14.1	12.5	-	-	12.5	12.5	-	-
Americas	9.63	7.49	0.41	0.04	7.94	5.79	1.73	0.41
Asia	24.9	22.6	0.36	0.05	23.1	22.6	0.12	0.36
Europe	6.11	3.73	0.47	0.55	4.76	3.70	0.59	0.47
Oceania	0.22	0.19	0.01	-	0.20	0.17	0.01	0.01

Source: IEA statistics and WBA calculations

Asia is the largest user of bioenergy followed by Africa and Americas.

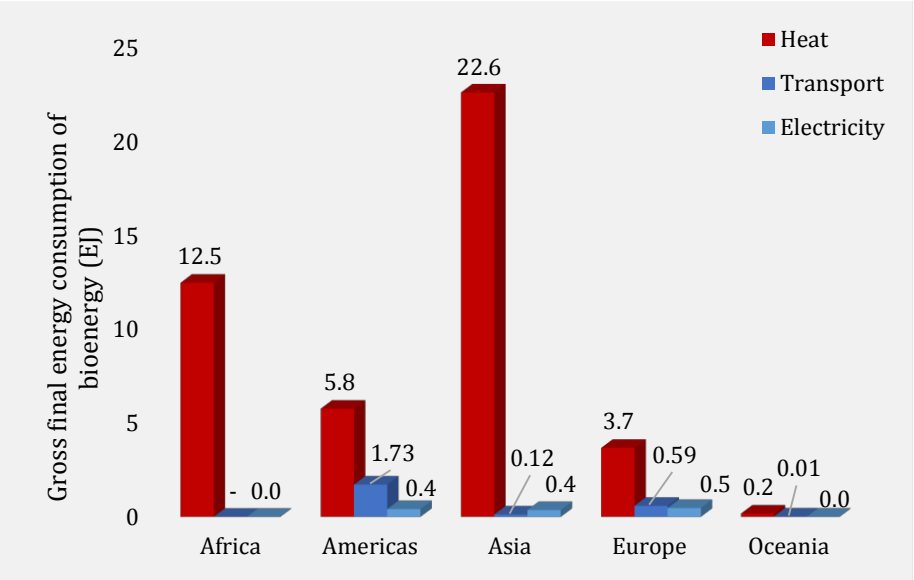


Figure 8 Continental distribution of gross final energy consumption of bioenergy per end use for year 2011
Source: IEA statistics and WBA calculations

1.3.3 Primary energy supply of bioenergy

Biomass can be obtained from wastes, solid biomass, biogas and liquid biofuels.

Table 4 Primary energy supply to gross final energy consumption for biomass sources for year 2011 (EJ)[3]

	PES	FEC	Consumption of el. & heat		GFEC total	Gross Final Energy Consumption		
			Electricity	Heat		Heat	Transport	Electricity
Wastes	2.12	0.50	0.27	0.29	1.07	0.79	-	0.27
Solid Biomass	49.2	41.9	0.82	0.32	43.0	42.2	-	0.82
Biogas	1.10	0.55	0.15	0.02	0.73	0.57	-	0.15
Liquid Biofuels	3.00	2.95	0.01	-	2.97	0.05	2.91	0.01
Total	**55.4**	**45.9**		**0.64**	**47.8**	**43.6**	**2.91**	**1.26**

Source: IEA statistics and WBA calculations

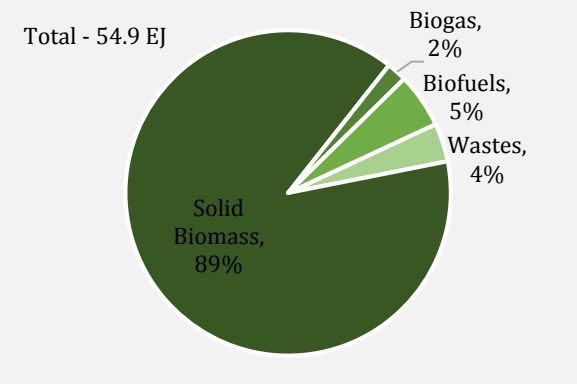


Figure 9 Total primary energy supply of biomass in year 2011
Source: IEA statistics

1.4 Biomass to electricity

The global electricity production from biomass has more than doubled during 2000 - 2011 (Table 5). As an estimation, WBA uses 26% as an average efficiency of electricity plants for converting biomass. Hence, 5.84 EJ of biomass was used for electricity generation in 2011.

Table 5 Electricity production and biomass used for electricity generation globally

	Electricity production (TWh)	Primary biomass for electricity (EJ)
2000	170	2.35
2005	233	3.22
2009	324	4.49
2010	387	5.37
2011	422	5.84

Source: IEA statistics

[3] WBA uses the primary energy of liquid biofuels and biogas instead of considering the primary energy of crops for this report. IEA and other statistics treat energy commodities in their statistics which is in line with International Recommendations on Energy Statistics.

1.5 Biomass to liquid biofuels

In year 2012, 106 billion litres of liquid biofuels were produced (Table 6).

Table 6 Global production of liquid biofuels

	Bioethanol production		Biodiesel production		Biofuel production	
	Billion litres	PJ	Billion litres	PJ	Billion litres	EJ
2000	17.0	398	0.80	28.2	17.8	0.43
2005	31.1	728	3.80	134	34.9	0.86
2009	73.2	1 713	17.8	627	91.0	2.34
2010	85.0	1 989	18.5	651	104	2.64
2011	84.2	1 970	22.4	788	107	2.76
2012	83.1	1 945	22.5	792	106	2.74

Source: REN21 GSR 2013. Energy content of bioethanol – 23.4 MJ/l. Energy content of biodiesel – 35.2 MJ/l

1.6 Biomass to heat

The most significant use of biomass is for production of heat with the use of biomass for electricity and transportation secondary. WBA suggests the calculation of the use of biomass for heat as follows:

$$Biomass\ for\ heating = Total\ primary\ energy\ supply\ of\ biomass - Biomass\ use\ for\ electricity - Biomass\ use\ for\ biofuels$$

Hence, in the year 2011, 46.3 EJ of biomass was used for heating.

Table 7 Biomass used for heating globally (EJ)

	TPES	Biomass for electricity	Biomass for liquid biofuels	Biomass for heat
2000	43.2	2.35	0.43	40.5
2005	47.2	3.22	0.86	43.1
2009	52.0	4.49	2.34	45.2
2010	54.2	5.37	2.64	46.2
2011	54.9	5.84	2.76	46.3

Source: WBA calculations

Chapter 2: Supply of biomass

Quick facts!

- Forestry supply 87% of the total primary energy supply of biomass
- The yield of crops is one of the lowest in African continent
- The energy from waste is highest in Americas and Europe

2 Supply of biomass

This chapter deals with supply of biomass from forestry, agriculture and wastes.

2.1 Total primary energy supply of biomass

The continental and regional distribution of primary energy supply shows the dominance of Asia (Table 8 & Table 9). Europe has shown the fastest relative growth since 2000.

Table 8 Total primary energy supply of biomass globally and continentally (EJ)

	World	Africa	Americas	Asia	Europe	Oceania
2000	43.2	10.7	7.31	21.6	3.35	0.26
2005	47.2	12.2	8.06	22.5	4.15	0.27
2009	52.0	13.4	9.02	23.9	5.49	0.22
2010	54.2	13.7	9.57	24.6	6.14	0.22
2011	54.9	14.1	9.63	24.9	6.11	0.22

Source: IEA statistics

Table 9 Total primary energy supply of biomass for regions (EJ)

	China	India	EU	Nigeria	USA	Brazil	Canada	Japan	Russia	Australia
2000	8.53	6.23	2.76	3.10	3.07	1.95	0.49	0.25	0.29	0.21
2005	8.53	6.66	3.54	3.50	3.17	2.65	0.51	0.30	0.29	0.21
2009	8.79	7.38	4.82	3.87	3.51	3.19	0.50	0.28	0.27	0.17
2010	8.94	7.54	5.42	3.97	3.74	3.42	0.50	0.41	0.29	0.17
2011	9.06	7.74	5.38	4.07	3.83	3.26	0.51	0.44	0.30	0.17

Source: IEA statistics

2.2 Biomass origins

The origin of biomass is an important criteria for the understanding of the bioenergy sector (Table 10).

Table 10 Origin of biomass

Origin	Type	Share in TPES	TPES (EJ)
Forestry	Fuel wood	67%	36.3
	Charcoal	7%	3.80
	Forest residues	1%	0.54
	Black liquor	1%	0.54
	Wood industry residues	5%	2.71
	Recovered wood	6%	3.25
Agriculture	Animal by products	3%	1.63
	Agricultural by products	4%	2.17
	Energy crops	3%	1.63
Waste	MSW and landfill gas	3%	1.63
Total primary energy supply for year 2010			**54.2**

Source: IPCC

Further investigation is required to adapt such technique to continental and regional levels.

2.3 Forestry

This section provides data on area of forests and the production of forest products.

2.3.1 Forest area

The total forest area in various geographical locations shows a decrease in area for Africa, Americas and Oceania while an increase is observed in Europe and Asian continent (Table 11 & Table 12).

Table 11 Global and continental forest area (million ha)

	World	Africa	Americas	Asia	Europe	Oceania
2000	4 085	709	1 610	570	998	198
2005	4 061	691	1 588	584	1 001	197
2009	4 039	678	1 573	591	1 004	192
2010	4 033	674	1 570	593	1 005	191
2011	4 027	671	1 566	594	1 006	190

Source: FAO statistics

Table 12 Forest area of regions (million ha)

	Australia	Brazil	Canada	China	India	Japan	Nigeria	Russia	USA	EU
2000	155	546	310	177	65.4	24.9	13.1	809	300	154
2005	154	530	310	193	67.7	24.9	11.1	809	302	156
2009	150	522	310	204	68.3	25.0	9.45	809	304	158
2010	149	520	310	207	68.4	25.0	9.04	809	304	159
2011	148	517	310	210	68.6	25.0	8.63	809	304	159

Source: FAO statistics

2.3.2 Roundwood production

The production of roundwood has increased since 2000 except in Americas (Table 13 & Table 14).

Table 13 Global and continental roundwood production (million m³)

	World	Africa	Americas	Asia	Europe	Oceania
2000	3 348	621	1 047	1 035	585	61
2005	3 570	676	1 107	1 063	662	62
2009	3 463	701	956	1 082	659	65
2010	3 496	707	995	1 083	642	69
2011	3 526	714	1 030	1 080	635	67

Source: FAO statistics

Table 14 Roundwood production of regions (million m³)

	Australia	Brazil	Canada	China	India	Japan	Nigeria	Russia	USA	EU
2000	31.1	223	186	317	297	15.9	69.1	165	449	381
2005	31.8	258	184	318	329	16.7	71.0	191	457	422
2009	30.4	272	142	332	332	17.3	72.6	175	324	428
2010	31.4	284	148	329	332	18.4	73.0	150	338	434
2011	28.5	292	153	326	331	18.6	73.4	151	361	427

Source: FAO statistics

2.4 Agriculture

Agriculture has a significant contribution to production of biomass after forestry in terms of energy crops, by products and residues.

2.4.1 Agricultural area

Since 2000, statistics show an increase in total agricultural area for all continents except Asia and Oceania (Table 15). India and China are few countries which have shown a reduction in total agricultural area (Table 16).

Table 15 Global and continental agricultural area (million ha)

	World	Africa	Americas	Asia	Europe	Oceania
2000	4 934	1 124	1 194	1 658	485	473
2005	4 921	1 153	1 206	1 631	472	459
2009	4 898	1 163	1 210	1 629	473	423
2010	4 894	1 168	1 212	1 633	469	412
2011	4 912	1 170	1 215	1 634	470	423

Source: FAO statistics

Table 16 Agricultural area of select regions (million ha)

	Australia	Brazil	Canada	China	India	Japan	Nigeria	Russia	USA	EU
2000	456	261	67.6	525	183	5.26	71.9	217	414	200
2005	445	271	67.6	524	180	4.69	76.5	216	412	189
2009	409	274	63.9	517	180	4.61	74.2	216	412	190
2010	399	273	63.3	519	180	4.59	76.2	214	411	189
2011	410	275	62.6	519	180	4.56	76.2	215	411	188

Source: FAO statistics

The area harvested for select crops is dominated by maize which is predominantly cultivated in USA and Asia[4] (Table 17). This total area is used not only for food and feed, but also for production of biofuels.

Table 17 Area harvested for select crops for year 2011 (million ha)

	Africa	Americas	Asia	Europe	Oceania	World
Cassava	13.9	2.66	4.08	-	0.02	20.6
Maize	34.7	64.1	56.5	16.6	0.09	172
Rapeseed	0.11	8.05	14.7	8.81	2.08	33.8
Sorghum	26.6	5.90	8.91	0.26	0.63	42.3
Soybeans	1.57	79.1	20.0	2.97	0.02	104
Sugar beet	0.20	0.53	0.76	3.58	-	5.06
Sugar cane	1.43	13.2	10.6	0.00	0.36	25.6

Source: FAO statistics

2.4.2 Crop production and yield

In terms of production quantity, sugarcane is produced the most in Americas and Asia (Table 18).

Table 18 Production quantity of crops for year 2011 (million tons)[5]

	World	Africa	Americas	Asia	Europe	Oceania
Cassava	263	148	34.4	80.5	-	0.25
Maize	888	66.7	438	272	111	0.58
Oil, palm	47.7	2.30	2.62	42.2	-	0.60
Rapeseed	62.7	0.18	15.1	22.7	22.3	2.36
Sorghum	58.4	25.3	19.9	10.3	0.93	1.94
Soybeans	262	2.0	225	29.6	5.80	0.03
Sugar beet	278	10.5	29.0	37.3	201	-
Sugar cane	1 819	91.6	993	707.6	0.01	27.6

Source: FAO statistics

Africa has the lowest average yields for almost all crops (Table 19).

Table 19 Average yields of crops for year 2011 (tons/ha)

	World	Africa	Americas	Asia	Europe	Oceania
Cassava	12.7	10.7	13.0	19.7	-	10.9
Maize	5.16	1.92	6.84	4.81	6.66	6.81
Rapeseed	1.86	1.64	1.88	1.54	2.53	1.14
Sorghum	1.38	0.95	3.38	1.16	3.63	3.06
Soybeans	2.53	1.25	2.85	1.48	1.95	1.71
Sugar beet	54.9	52.8	55.1	49.2	56.2	-
Sugar cane	71.1	64.2	75.1	66.9	85.5	76.2

Source: FAO statistics

[4] This is the total area used for both energy and food production.
[5] This crop production statistics are for both food and fuel production

2.5 Waste

Another origin of biomass is from wastes sector.

2.5.1 Municipal waste[6]

Americas and Europe dominate the statistics for the use of municipal waste for energy production (Table 20 & Table 21).

Table 20 Total primary energy supply of municipal waste globally and continentally (PJ)

	World	Africa	Americas	Asia	Europe	Oceania
2000	776	-	348	74.3	354	-
2005	920	-	302	135	483	-
2009	1 111	-	305	145	662	-
2010	1 139	-	298	143	698	-
2011	1 210	-	301	166	743	-

Source: IEA statistics

Table 21 Total primary energy supply of municipal waste of select regions (PJ)

	USA	EU	Republic of Korea	Japan	Canada
2000	343	313	7.63	40.9	4.97
2005	297	434	21.2	58.6	4.97
2009	299	608	30.1	57.5	5.23
2010	293	641	34.0	47.4	5.23
2011	296	683	39.3	52.2	5.23

Source: IEA statistics

[6] Share of biomass in municipal solid waste is not available in current statistics.

Chapter 3: Biomass to electricity

Quick facts!

- Europe produces the most electricity from biomass in year 2011
- Electricity generation from biomass increased by more than 15 times for China and India since 2000

3 Biomass to electricity

Europe leads the way in using biomass for electricity generation with a 37% share in global biomass electricity generation, but Asia has shown the fastest growth since 2000 (Table 22). Developed regions like EU, USA have significant bioelectricity production while India, China, Brazil have made major progress in the last decade (Table 23).

Table 22 Electricity generation from biomass globally and continentally (TWh)

	World	Africa	Americas	Asia	Europe	Oceania
2000	170	0.68	93.9	22.0	51.2	1.72
2005	233	0.75	104	35.5	88.4	4.33
2009	324	0.88	117	72.6	130	3.41
2010	387	0.86	130	105	148	3.38
2011	422	0.87	138	121	159	2.71

Source: IEA statistics

Table 23 Electricity generation for regions (TWh)

	EU	USA	China	Japan	Brazil	India	Canada	Russia	Australia	Kenya
2000	46.6	71.7	2.42	15.2	7.84	1.35	8.23	2.54	1.13	0.32
2005	83.3	71.2	5.20	22.1	13.6	1.93	9.18	2.64	3.83	0.32
2009	125	72.3	20.7	21.4	22.6	19.6	7.74	2.64	2.82	0.32
2010	142	75.4	33.8	35.8	31.5	23.3	9.08	2.77	2.78	0.32
2011	153	77.5	42.3	37.0	32.2	28.7	10.8	2.78	2.10	0.32

Source: IEA statistics

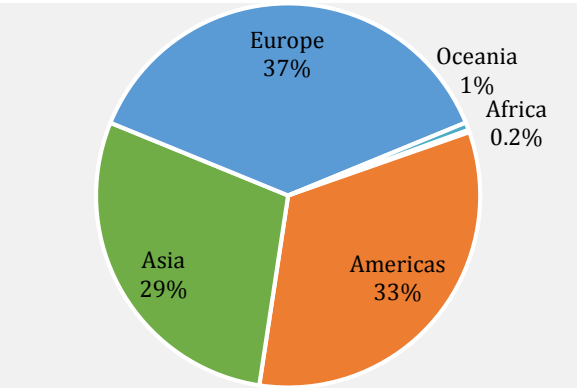


Figure 10 Share of electricity generation for each continent for year 2011
Source: IEA statistics

3.1 Electricity only plants

Asia leads the production of electricity from biomass in electricity only plants (Table 24 & Table 25).

Table 24 Electricity generation from biomass in electricity only plants globally and continentally (TWh)

	World	Africa	Americas	Asia	Europe	Oceania
2000	102	1.04	52.4	22.6	26.2	0.08
2005	143	1.11	65.8	38.2	36.4	1.74
2009	247	1.61	68.6	94.7	80.8	1.35
2010	298	1.55	73.7	131	90.0	1.33
2011	311	1.54	77.6	154	76.3	1.30

Source: IEA statistics. An electrical conversion efficiency of 33% is used for electricity only plants

Table 25 Electricity generation from biomass in electricity only plants for regions (TWh)

	USA	EU	Japan	China	India	Canada	Australia
2000	36.0	25.4	11.6	3.20	2.96	7.30	-
2005	44.0	36.0	16.5	6.86	4.24	8.14	1.60
2009	45.3	80.4	15.7	27.3	33.4	6.66	1.20
2010	48.3	89.6	26.8	44.6	39.5	7.83	1.17
2011	49.1	75.9	27.9	55.8	48.6	9.31	1.16

Source: IEA statistics. An electrical conversion efficiency of 33% is used for electricity only plants.

3.2 Combined heat and power plants

Europe produces the most electricity from biomass in cogeneration plants (Table 26 & Table 27).

Table 26 Electricity generation from biomass in CHP plants globally and continentally (TWh)

	World	Africa	Americas	Asia	Europe	Oceania
2000	67.6	-	37.1	0.07	28.2	2.21
2005	93.6	-	36.5	0.30	52.4	4.42
2009	93.5	-	33.4	0.65	57.9	1.61
2010	107	-	37.4	0.69	67.0	1.45
2011	114	-	38.5	1.11	73.7	1.10

Source: IEA statistics. An electrical conversion efficiency of 23% is used for CHP plants.

Table 27 Electricity generation from biomass in CHP plants for regions (TWh)

	USA	EU	Brazil	Russia
2000	31.9	22.0	4.18	4.36
2005	27.6	45.2	7.34	4.63
2009	19.7	49.5	11.3	4.49
2010	20.6	41.1	15.5	5.15
2011	21.1	63.7	15.5	5.17

Source: IEA statistics. An electrical conversion efficiency of 23% is used for CHP plants.

Chapter 4: Biomass to biofuels

Quick facts!

- USA and Brazil produced around 60% of the total biofuel production in 2011.
- Europe is produces 3.9 TWh of upgraded biogas or bio methane

4 Biomass to biofuels

This chapter deals with biofuels. Americas are the dominant biofuel producers (Table 28 & Table 29).

Table 28 Liquid biofuels production, globally and continentally (billion litres)[7]

	World	Africa	Americas	Asia	Europe	Oceania
2000	19.1	-	18.0	0.13	0.97	-
2005	35.6	-	29.8	0.27	5.47	0.03
2009	92.2	-	66.9	4.20	20.7	0.41
2010	102	-	73.7	4.38	23.6	0.52
2011	102	-	74.8	4.86	22.2	0.62

Source: IEA statistics.

Table 29 Liquid biofuels production for regions (billion litres)

	USA	Brazil	Argentina	China	Canada	Thailand	Indonesia	India	EU
2000	5.52	10.7	-	-	0.25	-	-	0.13	0.97
2005	15.6	12.7	0.02	-	0.32	0.06	-	0.19	5.46
2009	40.9	23.7	0.06	2.20	1.46	0.98	0.13	0.27	20.5
2010	45.1	24.9	0.75	2.10	2.16	1.01	0.24	0.30	23.4
2011	47.3	22.7	1.14	2.15	2.90	1.08	0.38	0.34	22.0

Source: IEA statistics

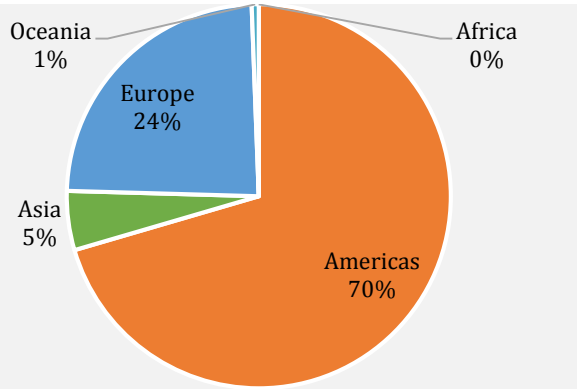


Figure 11 Continental use of biomass for transport in year 2011

[7] The IEA statistics are in 1000 tonnes. To convert to billion litres, average density of 0.84 kg/l is used.

4.1 Bioethanol

Bioethanol is produced predominantly in USA and Brazil (Table 30).

Table 30 Production of bioethanol globally and for regions (billion litres)

	World	USA	Brazil	China	Canada	Thailand	Colombia	India	EU
2000	17.0								
2005	31.1	15.0	15.0	1.0	0.2	-	0.2	0.3	0.9
2009	73.2	41.0	26.0	2.1	1.1	0.4	0.3	0.2	3.6
2010	85.0	49.0	28.0	2.1	1.4	0.4	0.4	-	4.5
2011	84.2	54.2	21.0	2.1	1.8	0.5	0.3	-	4.3
2012	83.1	50.4	21.6	2.1	1.8	0.7	0.4	0.5	4.2

Source: REN21 global status reports

4.2 Biodiesel

By 2012, global biodiesel production reached 22.5 billion litres (Table 31).

Table 31 Production of biodiesel globally (billion litres)

	World	USA	Brazil	Argentina	Thailand	Indonesia	EU
2000	0.8						
2005	3.8	0.3	-	1.0	1.0	-	3.6
2009	17.8	2.1	1.6	1.4	0.6	1.0	8.9
2010	18.5	1.2	2.3	2.1	0.6	0.7	10.0
2011	22.4	3.2	2.7	2.8	0.6	1.4	9.2
2012	22.5	3.4	2.7	2.8	0.9	1.5	9.1

Source: REN21 global status reports

4.3 Vegetable oils[8]

Vegetable oils are a source of biofuels. Their total production has increased in the last decade (Table 32).

Table 32 Production of vegetable oils globally (million tons)

	World
2000	90.0
2005	119
2009	141
2010	149
2011	157
2012	161
2013	169

Source: US FAS.

[8] These statistics include the use of vegetable oils for biodiesel production as well

The industrial consumption of vegetable oils is highest in Asian countries (Table 33 & Table 34).

Table 33 Industrial consumption of vegetable oil globally and continentally (million tons)

	World	Africa	Americas	Asia	Europe	Oceania
2000	9.06	0.53	1.18	4.68	2.66	0.01
2005	18.6	0.57	2.38	8.22	7.39	0.01
2009	29.7	0.72	6.42	10.7	11.9	0.01
2010	32.6	0.72	7.77	12.2	11.9	0.01
2011	35.2	0.73	9.57	13.1	11.8	0.02
2012	36.0	0.74	8.93	14.4	11.9	0.02
2013	38.8	0.79	9.61	16.2	12.2	0.02

Source: US FAS

Table 34 Industrial consumption of vegetable oil for regions (million tons)

	EU	Indonesia	Malaysia	Brazil	China	USA	Argentina	Thailand
2000	2.05	0.86	1.78	0.32	0.44	0.42	-	0.24
2005	6.71	1.19	2.72	0.54	2.15	1.18	0.02	0.31
2009	11.2	2.12	3.16	2.48	2.49	1.35	1.55	0.90
2010	11.2	3.02	2.88	2.67	2.50	1.84	2.15	1.15
2011	11.0	3.61	2.89	2.87	2.63	2.80	2.65	1.19
2012	11.0	4.38	3.15	2.92	2.82	2.80	1.90	1.23
2013	11.3	5.85	3.23	3.05	2.85	2.94	2.21	1.26

Source: US FAS

4.4 Advanced biofuels

The past few years has seen an increased focus on advanced biofuels production (Table 35). Since the actual production volumes were not available, the installed production capacity values are presented.

Table 35 Advanced biofuels production capacity globally (billion litres)

	World
2010	1.58
2011	3.19
2012	4.13
2013	4.21

Source: IEA statistics

4.5 Biomethane

Europe is the only region with production of biomethane or upgraded biogas (Table 36).

Table 36 Production of upgraded biogas or biomethane for year 2011 (GWh)

	EU	Germany	Netherlands	Sweden	Luxembourg	Austria	Finland
2011	3 857	3 400	208	170	26.4	50	2.0

Source: AEBIOM statistical report

Chapter 5: Biomass to heat

Quick facts!

- Europe is dominant in using biomass for heating in energy transformation sector
- Asia (22 EJ) and Africa (12 EJ) are leading continents in direct use of biomass in 2011

5 Biomass to heat

This chapter deals the use of biomass for heat generation in energy transformation sector and direct use.

5.1 Biomass to heat in energy transformation

In terms of heat generation in energy generation sector, Europe is dominant (Table 37 & Table 38).

Table 37 Heat generation from biomass in energy transformation sector globally and continentally (PJ)

	World	Africa	Americas	Asia	Europe	Oceania
2000	421	-	29.1	21.0	371	-
2005	539	-	18.7	25.9	494	-
2009	665	-	49.6	32.4	583	-
2010	776	-	46.2	59.3	671	-
2011	786	-	44.6	65.3	676	-

Source: IEA statistics

Table 38 Heat generation from biomass in energy transformation sector for regions (PJ)

	USA	China	EU	Russia	Canada
2000	27.1	12.2	241	111	2.01
2005	16.7	12.1	348	118	2.01
2009	47.4	11.9	420	118	2.16
2010	44.0	33.9	498	120	2.15
2011	42.5	37.6	499	119	2.15

Source: IEA statistics

5.2 Use of biomass as direct heat

The use of biomass for direct heat is calculated as mentioned in section 1.6 (Table 39 & Table 40). In contrast to converting biomass in heating plants, the use of biomass directly in end sectors shows the dependence of Africa and Asia on biomass.

Table 39 Use of biomass for direct heat globally and continentally (EJ)

	World	Africa	Americas	Asia	Europe	Oceania
2000	38.3	9.50	5.31	20.9	2.37	0.22
2005	40.6	10.8	5.50	21.6	2.51	0.18
2009	42.7	11.9	5.49	22.3	2.85	0.17
2010	43.7	12.2	5.73	22.5	3.15	0.17
2011	44.1	12.5	5.76	22.5	3.14	0.17

Source: WBA calculations

Table 40 Use of biomass for direct use in select countries (EJ)

	USA	Brazil	EU	China	Nigeria	Australia
2000	2.05	1.22	1.99	8.47	3.02	0.18
2005	1.92	1.66	2.15	8.43	3.41	0.13
2009	1.78	1.77	2.45	8.42	3.77	0.13
2010	1.88	1.88	2.74	8.36	3.87	0.13
2011	1.89	1.84	2.73	8.35	3.96	0.13

Source: WBA calculations

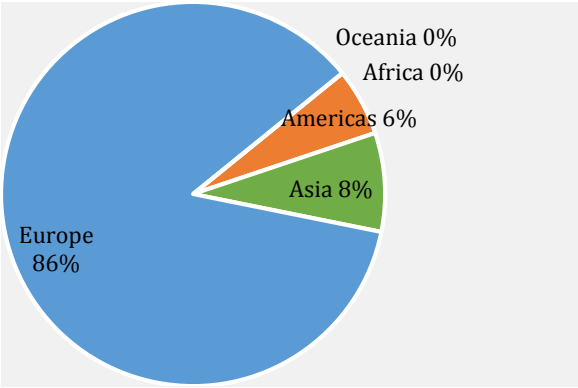


Figure 12 Consumption of derived heat from energy transformation sector for year 2011
Source: IEA statistics

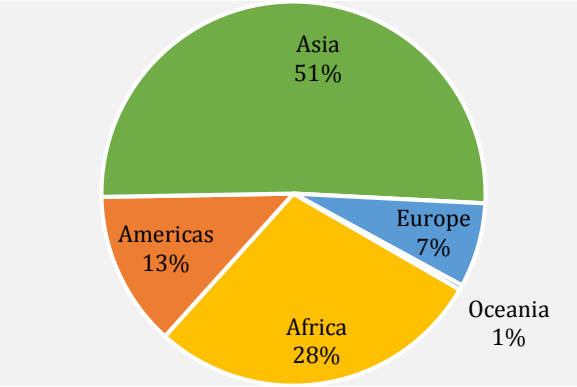


Figure 13 Consumption of direct heat for year 2011
Source: IEA statistics

Chapter 6: Special sectors

Quick facts!

- Global pellet production in 2012 was 18.5 million tons, dominated by USA and EU
- Pyrolysis oil and torrefaction technologies are some of the fast growing technologies

6 Special sectors

This section outlines special sectors contributing to bioenergy.

6.1 Biogas

Recent years have witnessed an increased use of biogas (Table 41 & Table 42).

Table 41 Global and continental production of biogas (PJ)

	World	Africa	Americas	Asia	Europe	Oceania
2000	292	-	132	56.6	95.1	7.11
2005	520	-	169	157	185	9.94
2009	944	0.07	224	361	344	15.6
2010	1 050	0.08	237	334	464	15.7
2011	1 103	0.08	248	405	434	16.3

Source: IEA statistics

Table 42 Biogas production in regions (PJ)

	USA	EU	Australia	China	Singapore	Thailand
2000	124	91.5	5.78	47.6	-	-
2005	160	181	7.50	144	-	0.04
2009	213	340	12.9	322	19.0	1.52
2010	223	459	12.9	293	18.3	2.62
2011	230	428	13.5	339	21.7	24.5

Source: IEA statistics

6.2 Pellets

Wood pellets are a crucial sector in bioenergy with significant increase in production and trade of the commodity all over the world. Due to unavailability of statistics, only data for 2012 are shown (Table 43).[9]

Table 43 Production of pellets (million tons)

	World	Africa	Americas	Asia	Europe	Oceania
2012	18.5	0.13	5.91	0.30	12.2	0.04

Source: FAO statistics

USA and EU are the major producers of pellets (Figure 14).

[9] WBA follows FAO statistics. Other statistical reports suggest higher pellet production.

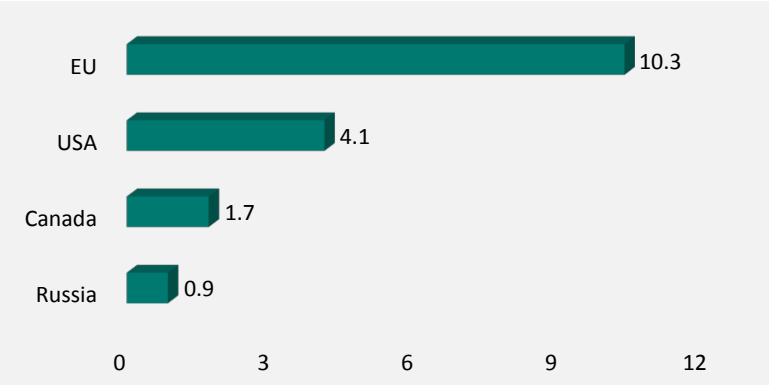


Figure 14 Pellet production (million tons) for top regions for year 2012
Source: FAO statistics

6.3 Charcoal[10]

The global charcoal production was 51.3 million tons in year 2012 with Africa being the dominant producer of charcoal (Table 44 & Table 45).

Table 44 Global and continental distribution of charcoal production (million tons)

	World	Africa	Americas	Asia	Europe	Oceania
2000	37.0	20.4	9.67	6.58	0.30	0.04
2005	46.2	24.5	13.2	8.01	0.52	0.03
2009	46.2	27.9	9.19	8.48	0.60	0.04
2010	48.2	28.9	10.4	8.40	0.53	0.04
2011	49.9	29.9	10.8	8.61	0.51	0.04
2012	51.3	30.6	11.5	8.56	0.51	0.04

Source: FAO statistics

Table 45 Regional distribution of charcoal production (million tons)

	Brazil	China	Colombia	DR Congo	Ethiopia	India	Nigeria	Tanzania
2000	6.35	1.80	0.33	1.43	2.91	1.66	3.09	1.16
2005	9.53	1.76	0.50	1.70	3.30	2.88	3.51	1.37
2009	5.06	1.73	1.04	1.96	3.64	2.88	3.85	1.56
2010	6.33	1.73	1.04	2.03	3.73	2.88	3.94	1.61
2011	6.84	1.72	1.04	2.10	3.83	2.88	4.02	1.66
2012	7.60	1.71	1.04	2.17	3.92	2.88	4.11	1.66

Source: FAO statistics

6.4 Traditional biomass

The data on traditional biomass shows the dependence of Africa (Table 46).

Table 46 Global and continental use of traditional biomass for year 2010 (EJ)

	World	Africa	Americas	Asia	Europe	Oceania
Traditional biomass use	31.7	10.8	1.12	1.90	0.41	0.17
Share in GFEC (%)	10%	53%	1.3%	14%	0.6%	4.3%

Source: IEA statistics

[10] It is difficult to estimate the actual production of charcoal as significant quantities are locally traded which do not get reflected in official statistics.

African countries like Ethiopia depend almost completely on traditional biomass for energy consumption (Table 47).

Table 47 Regional distribution of traditional biomass use (EJ)

	China	Congo, DR	Ethiopia	India	Indonesia	Nigeria
Traditional biomass use	8.06	0.70	1.21	5.57	1.95	3.48
Share in GFEC (%)	14%	74%	93%	32%	32%	80%

Source: IEA statistics

6.5 Pyrolysis oil

In 2012, Canada was the world leader in production of pyrolysis oil. The past year has shown a tremendous increase in the installation of commercial plants. Due to lack of production quantities, the recent developments in this sector are shown (Table 48).

Table 48 Pyrolysis oil developments globally

Year	Company	Location	Capacity (tpd)	Capacity (tpa)	Feedstock
2005	Ensyn	Renfrew, Ontario, Canada	100		-
2014				46,000	-
2007	Dynamotive*	West Lorne, Ontario, Canada	100		-
2009			130	31,000	-
2009-10	Dynamotive*	Guelph, Ontario, Canada	200	-	-
2013	Metso	Joensuu, Finland	-	50,000	225000 m^3 of solid forest residue
2014	Empryo BV	Hengelo, Netherlands	-	22,500	-
	Domtar & Battelle	Dryden, Ontario, Canada	100	-	Wood waste
	Ensyn	Malaysia and Indonesia	400	-	Oil palm residues
	Ensyn	Colle di Val d'Elsa, Italy	150	-	-

Source: WBA calculations

**The plants are currently non-operational*

6.6 Torrefaction

Torrefaction technology has seen a rapid development from R&D phase to commercial plants. Since statistics are not available for production quantities, recent developments are shown (Table 49).

Table 49 Torrefaction developments globally

Developer	Location	Production capacity	Status and scale
Airless systems	Latvia	40000	Out of business
Atmosclear SA (CH)	Latvia, New Zealand, USA	50000	Out of business
Bio Energy Development North AB (SWE)	Ö-vik (SWE)	25000	-
BioLake B.V. (NL)	Eastern Europe	5,000 – 10,000	Pilot stage
Earth Care Products	Kansas (USA)	20000	Demonstration / commercial
EBES AG (AT)	Frohnleiten (AU)	10000	1 mt/hr pilot plant in commissioning
ECN (NL)	Stenderup (DK)	10000	ECN combines technology with Andritz
Integro Earth Fuels, LLC (US/NC)	Roxboro, NC	80000	Pilot stage
New Biomass Energy	Quitman, Mississippi, USA	40000	Existing
Renergy/4Energy Invest (BE)	Amel (BE) , Ham (Be)	38000	Project terminated
Renergy/4Energy Invest (BE)	Ham (Be)	38000	Project terminated
River Basin Energy	Laramie, Wyoming, USA	48000	Pilot stage
Rotawave, Ltd. (UK)	Terrace, British Columbia (CA)	110000	Stopped in BC, announced partnership with Cate Street capital (Maine)
Horizon Bioenergy. (NL)	Steenwijk (NL),	45000	Operational again after plant fire in Feb 2012
Thermya (FR) / Grupo Lantec (SP)	Urnieta (SP)	20000	Early stage commissioning
Thermya (FR) / LMK Energy (Fr)	Mazingarbe (Fr)	20000	Early stage commissioning
Topell Energy B.V. (NL)	Duiven (NL)	60000	Final stage of commissioning
Torr-Coal B.V. (NL)	Dilsen-Stokkem (BE)	35000	-
WPAC (CA)	-	35000	

Data from IEA Bioenergy Task 32 - Torrefaction review. Only data which includes production capacity is used here.

Appendix

General global and continental information

Table 50 General global and continental information for year 2011 [11]

	World	Africa	Americas	Asia	Europe	Oceania
Population (millions)	6 958	1 045	933	4 132	821	27
GDP (billion 2005 GDP)	52 485	1 267	17 872	15 548	16 776	1 019
Emissions ($MtCO_2$)	31 342	967	7 412	15 217	6 204	427
Land area (1000 km^2)	130 034	29 648	38 892	30 935	22 133	8 487

Source: IEA statistics and FAO statistics

Geographical classification

The classification provided by IEA Key World Energy Statistics is followed.

Africa: Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Cote d'Ivoire, Democratic Republic of the Congo, Djibouti, Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Guinea – Bissau, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Sao Tome and Principe, Senegal , Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Togo, Tunisia, Uganda, United Republic of Tanzania, Western Sahara, Zambia, Zimbabwe.

Americas (*OECD Americas* + *Non OECD Americas*): Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, Bermuda, Bolivia, Brazil, British Virgin Islands, Canada, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falklands Islands , French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, Suriname, Turks and Caicos Islands, United States of America, Uruguay, Venezuela.

Asia (*Asia (excl. China)* + *China* + *Turkey* + *Israel* + *Japan* + *Republic of Korea* + *Middle east*): Afghanistan, Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, China, Hong Kong SAR, China, Macao SAR, Democratic People's Republic of Korea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Korea Democratic Republic, Kuwait, Lao People's Democratic Republic, Lebanon, Malaysia, Maldives, Mongolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Syrian Arab Republic, Thailand, Turkey, United Arab Emirates, Viet Nam, Yemen.

Europe (*OECD Europe* + *Non OECD Europe and Eurasia - Turkey)*: Albania, Austria , Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Gibraltar, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Montenegro, Netherlands, Norway, Poland, Portugal, Republic of Moldova, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, The Former Yugoslav Republic of Macedonia, Ukraine, United Kingdom.

[11] *Data may not add up due to statistical difference*

Oceania (*OECD Asia Oceania – Israel – Japan – Republic of Korea):* Australia, New Zealand

Israel, Japan and Turkey are shifted from Oceania to Asia while Turkey is represented in Asia instead of Europe. FAO and other sources have slight variations in geography which will be addressed from the next statistical report.

Unit conversion

Table 51 Basic unit conversion

To:	TJ	Gcal	Mtoe	Mbtu	GWh
From:	(Multiply by)				
TJ	1	238.8	2.39E-05	947.8	0.2778
Gcal	4.19E-03	1	1.00E-06	3.968	1.16E-03
Mtoe	4.19E+04	1.00E+08	1	3.97E+07	11 630
Mbtu	1.06E-03	0.252	2.52E-08	1	2.93E-04
GWh	3.60	860	8.60E-05	3,412	1

Source: IEA statistics

Physical properties

Table 52 Energy content and density of liquid fuels

Fuel	Energy content (MJ/l)	Density (kg/l)
Gasoline	35.2	0.75
Ethanol	23.4	0.79
Diesel	37.3	0.83
Biodiesel	35.2	0.88
Biofuels average	29.3	0.84

Source: REN21global status report and WBA calculations

Table 53 Electrical and heat conversion efficiencies

	Electricity conversion
Electricity only plants	33%
CHP plants	23%

Source: WBA assumption

Glossary

Agricultural area

Agricultural area is the sum of areas under a) arable land - land under temporary agricultural crops (multiple-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years); (b) permanent crops - land cultivated with long-term crops which do not have to be replanted for several years (such as cocoa and coffee); land under trees and shrubs producing flowers, such as roses and jasmine; and nurseries (except those for forest trees, which should be classified under "forest"); and (c) permanent meadows and pastures - land used permanently (five years or more) to grow herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land).

Advanced biofuels

Advanced biofuels or second generation biofuels are liquid fuels with the conversion technology still in R&D, pilot or demonstration phase. However, in the past few years, commercial plants have started production. They include hydro treated vegetable oil, biofuels from lignocellulosic biomass and algae based biofuels.

Area harvested

Data refer to the area from which a crop is gathered. Area harvested, therefore, excludes the area from which, although sown or planted, there was no harvest due to damage, failure, etc.

Bioenergy

Bioenergy is energy produced from biomass (including biological origin fraction of municipal and industrial wastes) and used directly as fuel or processed into liquids or gases.

Biogas

Biogas is the gas obtained from anaerobic fermentation of biomass in landfills, sewage etc. – comprising primarily of methane and carbon dioxide.

Biomass

Biomass is any organic matter derived from plants, animals or algae.

Combined Heat and Power (CHP)

CHP plants are designed to cogenerate heat and electricity from a variety of plants, sizes and technologies.

Crop production

Crop production data refer to the actual harvested production from the field or orchard and gardens, excluding harvesting and threshing losses and that part of crop not harvested for any reason.

Crop yield

Harvested production per unit of harvested area for crop products.

Electricity only

Electricity plants refers to plants which are designed to produce electricity only.

Forest area

Forest area is the land spanning more than 0.5 hectares with trees higher than 5 metres and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use.

Heat only

Heat plants, refers to plants (including heat pumps and electric boilers) designed to produce heat only.

Industrial wastes

IEA considers industrial waste of non-renewable origin which consists of solid and liquid products combusted directly, usually in specialised plants, to produce heat and/or power. Renewable industrial waste is not included here.

Liquid biofuels

Liquid biofuels includes bioethanol, biodiesel and other liquid biofuels.

Municipal wastes

Municipal waste consists of products that are combusted directly to produce heat and/or power and comprises of wastes from household, industry, hospitals and other sources which are collected by local authorities for incineration.

Pellets

Wood pellets are mostly produced from sawdust and wood shavings compressed under high pressure. They are cylindrical in shape and usually 6-10 mm in diameter.

Pyrolysis oil

Pyrolysis Oil is a dark-brown, free-flowing liquid made from plant material by a process called fast pyrolysis, whereby biomass particles are rapidly heated to ~500 °C in the absence of oxygen, vapourized, and the vapours then quenched into the Pyrolysis Oil liquid, also known as bio-oil.

Roundwood

Roundwood comprises all wood obtained from removals, i.e. the quantities removed from forests and from trees outside the forest, including wood recovered from natural, felling and logging losses during the period, calendar year or forest year.

Traditional biomass

Traditional biomass refers to the use of fuel wood, charcoal, animal dung and agricultural residues in stoves with low efficiencies.

Vegetable oils

It includes the production and consumption of coconut oil, cottonseed oil, olive oil, palm oil, palm kernel oil, peanut oil, rapeseed oil, soybean oil and sunflower seed oil.

Wood charcoal

Wood charcoal is wood carbonised by partial combustion or the application of heat from external sources.

Metadata

This report includes data for few years and for certain countries to see the trends of bioenergy. Data files for all years, countries and for general queries about this report, kindly contact info@worldbioenergy.org.

Reference

IEA statistics

http://www.iea.org/statistics/

FAO statistics

http://faostat3.fao.org/faostat-gateway/go/to/home/E

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KWB
The biomass heating system