ENERGY BALANCE SHEET FOR WALLONIA, 2005
RENEWABLE ENERGY, 2005

October 2006

Produced on behalf of the Directorate-General for Technology, Research and Energy of the Ministry of the Walloon Region

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1. Introduction

This interim report provides a review of the available data on renewable sources of energy in Wallonia in 2005. It has been drawn up in the form of a regional energy balance sheet on behalf of the Directorate-General for Technology, Research and Energy.

This review has been compiled on the basis of statistical data published by the Walloon Energy Commission (CWaPE) and a survey of players in the field of renewable energy, particularly renewables facilitators in the region, and with the aid of estimates. It should also be noted that, in cases where no information was available for 2005, the most recent annual data available were used in respect of installations that were still operational in 2005.

For each renewable source of energy, we have presented our findings in the following manner:

1. The situation in the Walloon region
(a) Presentation of data for 2005
(b) Trends (based on available data from previous years)
(c) Regional projects for the future (where data are available)

2. The situation in Europe (where data are available)
- the place of Belgium and Wallonia
- prospects for 2010 (White Paper)

It is not possible to compare Wallonia with Belgium for all energy sources, since the Belgian energy balance sheet has not yet been published.

The situation in Europe is taken from the European Barometer data which were published by EurObserv'ER in its *Systèmes solaires* magazine and which relate primarily to the situation in 2004. The Barometer for 2005 has not yet appeared.

Depending on the publication source (Eurostat, International Energy Agency (IEA), Plan for Sustainable Energy Management (PMDE), etc.), energy units are expressed in thousands of tonnes of oil equivalent (ktoe), gigajoules (GJ) or gigawatt-hours (GWh). Wherever possible, we have tried to give data in these diverse units at the risk of complicating the presentation of tables. We apologise for this inconvenience, but it serves to facilitate rapid comparisons between data from different publications.

1.1 Projects for 2010 in Wallonia

The Plan for Sustainable Energy Management in Wallonia for 2010, launched by the Minister of Climate and Energy and formally endorsed by the Walloon Government in December 2003, presents a progress report, highlights the challenges and proposes a raft of initiatives.

The plan sets quantified targets for the various categories of energy consumed and the various energy networks and outlines a series of measures to be implemented in pursuit of those targets.

The plan is designed to achieve a decrease in final energy consumption of the order of 6%, while it is estimated that an unchanged policy would result in a 2.4% increase.

In terms of CO_2 emissions from energy consumption alone, a significant contribution to the achievement of the Kyoto target is expected. Two thirds of the reduction would be attributable to rational energy use, and one third would come from the use of energy from renewable sources and cogeneration (20% and 13% respectively).

Lastly, the plan assesses the economic implications, concluding that between 600 and 2 400 jobs are likely to be created.

One of the main measures designed to achieve the target for the use of renewables in electricity production has been the establishment of a ‘green certificates’ scheme, whereby producers of green electricity are awarded certificates on the basis of the reductions in CO_2 emissions they achieve, and network suppliers and operators are required to achieve a minimum ratio of green certificates gained to electricity sold.

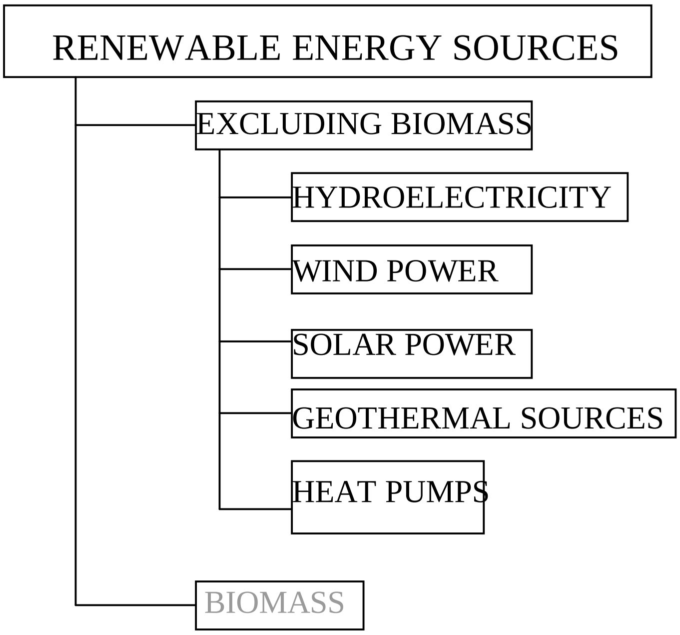
Interested readers can order or download this plan by visiting the following website:
http://energie.wallonie.be.

Details of the arrangements for awarding green certificates can also be consulted in the Plan for Sustainable Energy Management (PMDE) and also on the website of the Walloon Energy Commission at http://www.cwape.be.

In this report we shall reproduce the quantified targets for each type of renewable energy and provide a general summary at the end of the document.

2. Balance sheet excluding biomass

The following paragraphs provide detailed production data for all renewable energy sources except biomass.



Of the renewables other than biomass, some produce only electricity, such as hydroelectric schemes in the form of run-of-the-river plants, wind power (the tall wind turbines that are usually grouped into wind farms) and solar power (solar panels installed in roofs or on walls or at ground level in the form of photovoltaic fields).

The others mainly produce heat, which is used to feed central-heating systems or provide domestic hot water. These are solar heating (solar roof panels connected to a boiler), geothermal power, which involves the collection of heat from deep underground, and heat pumps, which exploit temperature differences between two sources such as soil, air or water.

Since offshore wind power is not yet operational in Belgium, no output has been allocated to the Walloon region.

2.1 Hydroelectricity

2.1.1 Situation in the Walloon region

(a) The situation in 2005

A total of 51 hydroelectric power plants connected to the power grid were registered in Wallonia in 2005. Their gross output for that year amounted to 286 GWh, and their total net output was 280 GWh.

The following table shows electricity output for each class of installed rating.

Power rating	Number of installations	Total installed rating (in MW)	Gross output (in GWh)	Net output (in GWh)
More than 10 MW	3	50.6	116.3	114.0
1 to 10 MW	11	50.7	153.6	150.7
Less than 1 MW	37	7.0	16.0	15.5
Total	***51***	***108.3***	***285.9***	***280.2***

Table 1: Output of hydropower power plants by rating class in Wallonia, 2005

The share of electricity output for each rating class is a fairly accurate reflection of the total rating installed in each class. The three hydroelectric power plants with ratings in excess of 10 MW accounted for a little more than 40% of total output in 2005.

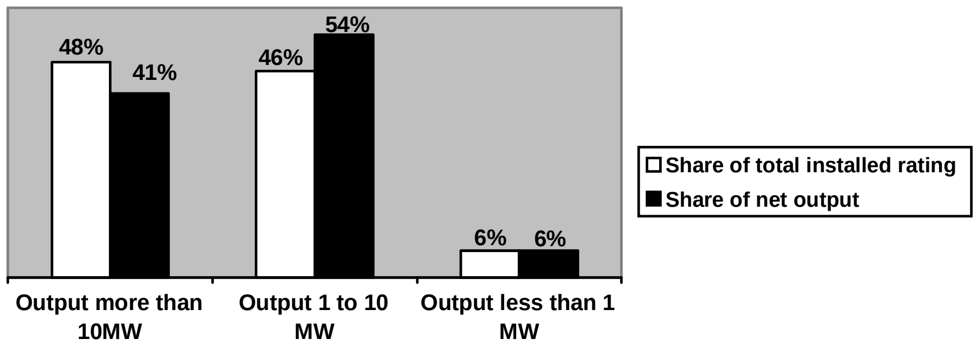


Figure 1 – Rating and output of hydroelectric power plants in Wallonia, 2005

Output data can also be broken down into individual catchment areas and sub-areas.

Catchment area	Sub-area	Number	Rating (in MW)	Gross output (in GWh)	Net output (in GWh)
Meuse	Amblève	12	20.7	64.1	62.9
Meuse	Vesdre	9	3.1	11.1	10.7
Meuse	Lesse	8	0.7	2.2	2.2
Meuse	Lower Meuse	7	74.3	194.9	191.1
Meuse	Sambre	4	3.5	1.7	1.7
Meuse	Ourthe	4	1.5	3.6	3.6
Meuse	Semois-Chiers	4	2.1	5.5	5.4
Escaut	Senne	1	2.4	2.2	2.1
Dyle-Jette	Dyle-Jette	1	0.0	0.0	0.0
Rhine	Moselle	1	0.2	0.6	0.5
Total		**51**	**108.3**	**285.9**	**280.2**

Table 2 – Rating and output of hydroelectric power plants by sub-areas, 2005

(b) Trend

The level of output achieved in 2005 is 9% lower than the previous year's figure. This may be explained by the volume of water collected (751 mm, compared with 914 mm in 2004, which represents an 18% decrease) rather than the number of days of precipitation in Belgium, which increased by 1% from 198 days in 2004 to 200 days in 2005.

Year	Net output (in GWh)	Index (1993 =100)	Days of precipitation	Precipitation in mm
1990	263.1	105	178	759.4
1991	226.1	90	165	816.7
1992	337.8	135	181	916.5
1993	**251.0**	**100**	**192**	**856.7**
1994	343.0	137	212	895.1
1995	333.4	133	180	763.4
1996	234.3	93	164	744.6
1997	301.5	120	163	698.4
1998	384.3	153	214	948.0
1999	337.4	134	213	886.0
2000	454.1	181	224	852.2
2001	433.6	173	201	1 088.5
2002	353.1	141	196	1 077.8
2003	240.5	96	157	670.7
2004	308.0	123	198	913.7
2005	280.2	112	200	751.1

Table 3 – Net output of hydroelectric power plants and precipitation levels, 1990 to 2005

Hydropower output has fallen every year since 2000, with the exception of 2004, but it must be recognised that output was exceptionally high in the year 2000, one reason being a concerted effort to maximise production. The average annual output since 1990 has been less than 320 GWh.

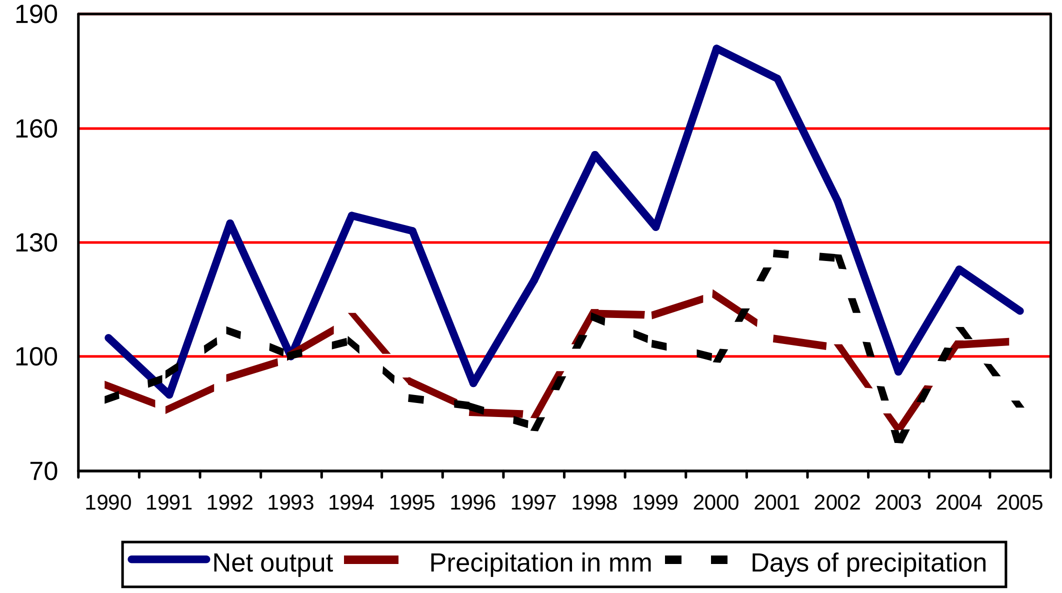


Figure 2 – Trends in net output of hydroelectric schemes and precipitation levels,[1] 1990 to 2005 (1993 = 100)

Sources: FPE, CWaPE and IRM

(c) Projects for the future in the Walloon region

The Plan for Sustainable Energy Management sets the target output from Wallonia's hydroelectric power plants at 395 GWh for 2005 and 440 GWh for 2010.

The graph below reviews hydroelectricity output since 1960 in the light of the targets set in the Plan for Sustainable Energy Management. As the graph shows, the targets for 2005 and 2010 are technically achievable with existing plants (see 2000 and 2001), but in practice they are not being attained.

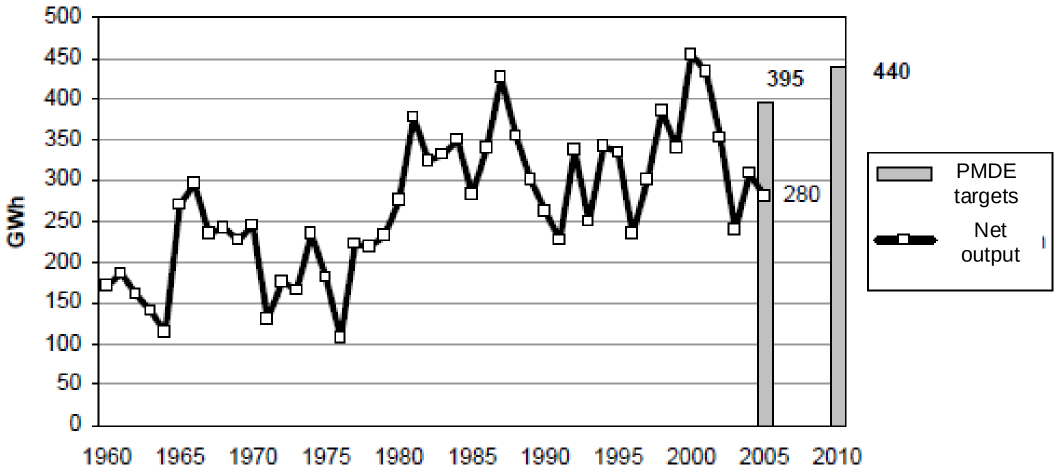


Figure 3 – Hydroelectricity output trends and targets of the Plan for Sustainable Energy Management for 2005 to 2010 (in GWh)

Sources: FPE - CWaPE - Plan for Sustainable Energy Management (December 2003)

[1] Precipitation measurements recorded at Uccle meteorological station.

More information may be obtained from the Hydroenergy Facilitator for the Walloon Region:
E-mail: hydro@apere.org
Website: http://www.apere.org.

(d) The Walloon region in relation to the whole of Belgium

Virtually all of Belgium's hydroelectricity output (99%) is generated in the Walloon region.

Region	Number of installations	Rating installed (in MW)	Gross output (in GWh)	Net output (in GWh)
Wallonia	*51*	*116.1*	285.9	280.2
Brussels	*0*	*0.0*	0.0	0.0
Flanders	*8*	*0.9*	2.3	2.3
Total	***59***	***117***	***288.2***	***282.5***

Table 4 – Output of Belgian hydroelectric installations by region in 2005
Sources: CWaPE - ANRE

2.1.2 Small-scale hydro schemes in Europe

Since the publication with the 2005 data on small hydro schemes is not yet available, we shall focus on the information that was reported for 2004.

According to EurObserv'ER, the total generating capacity of small-scale hydro schemes, i.e. those with a capacity of less than 10 megawatts, installed in the European Union was estimated at 10 828 MW at the end of 2004. In other words, the initial target of 12 500 megawatts set by the European Commission in its White Paper has not been met. If we make a projection based on the average annual growth rate for hydropower in Europe in recent years, we arrive at 13 140 MW by the end of 2010, which falls short of the Commission's expectation of 14 000 MW.

Country	2000	2001	2002	2003	2004
Italy	2 229	2 270	2 233	2 330	2360
France	2 018	2 020	2 020	2 020	2021
Spain	1 573	1 607	1 655	1 722	1750
Germany	1 514	1 515	1 610	1 630	1565
Sweden	1 062	1 050	1 050	1 050	1105
Austria	866	870	980	1 001	950
Finland	320	320	320	327	370
Portugal	286	308	289	301	320
United Kingdom	162	160	160	160	162.3
Belgium	60	61	61	61	64
of which Wallonia	*59*	*59*	*58*	*58*	*55*
Greece	50	52	61	65	70
Luxembourg	39	39	39	21	40
Ireland	33	34	34	34	38.1
Denmark	11	11	11	11	11
Netherlands	2	2	2	2	2
Total EU 15	**10 225**	**10 319**	**10 458**	**10 734**	**10 828.4**
10 new Member States			694		769
Total EU 25			**11 358**		**11 698**

Table 5 – Capacity of small-scale hydro plants (less than 10 megawatts of generating capacity) in the European Union (in MW, 2000 to 2004)
Source: EurObserv'ER, European Barometer, 2005 (data for Wallonia from the ICEDD).

2.2 Wind power

2.2.1 Situation in the Walloon region

(a) The situation in 2005

The total rating of the large wind turbines that were feeding the power grid by the end of 2005 amounted to 49 megawatts, with 18 new turbines having been commissioned since the previous year. In terms of gross output, the turbines generated 72.2 GWh – a net output of 71.1 GWh – in 2005.

In addition, 24 small turbines – an increase of one – that are not connected to the power grid have been recorded by bodies such as the Compagnons d'Eole in Wallonia. Their power ratings range from 2.5 to 40 kW, and their total rating amounts to about 260 kW. Their aggregate annual electricity output is estimated at 0.15 GWh.

(b) Trend

The total net output of wind turbines in Wallonia amounted to 71.2 GWh in 2005, which represents an increase of 64% on the previous year. Gross output amounted to 72.3 GWh.

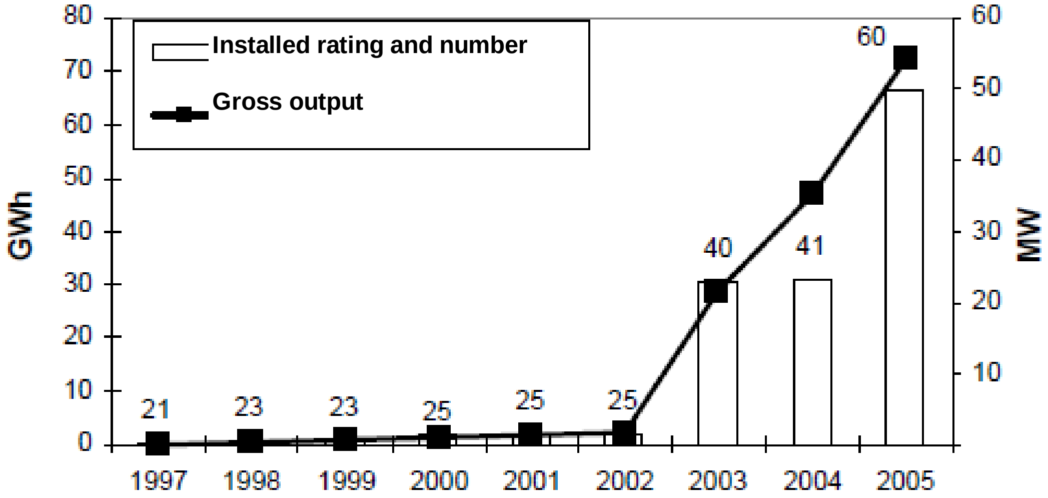


Figure 4 – Trends in gross output, installed rating and number of wind turbines in Wallonia from 1997 to 2005.

Sources: SPF – CWaPE - Compagnons d'Eole

(c) Projects for the future in the Walloon region

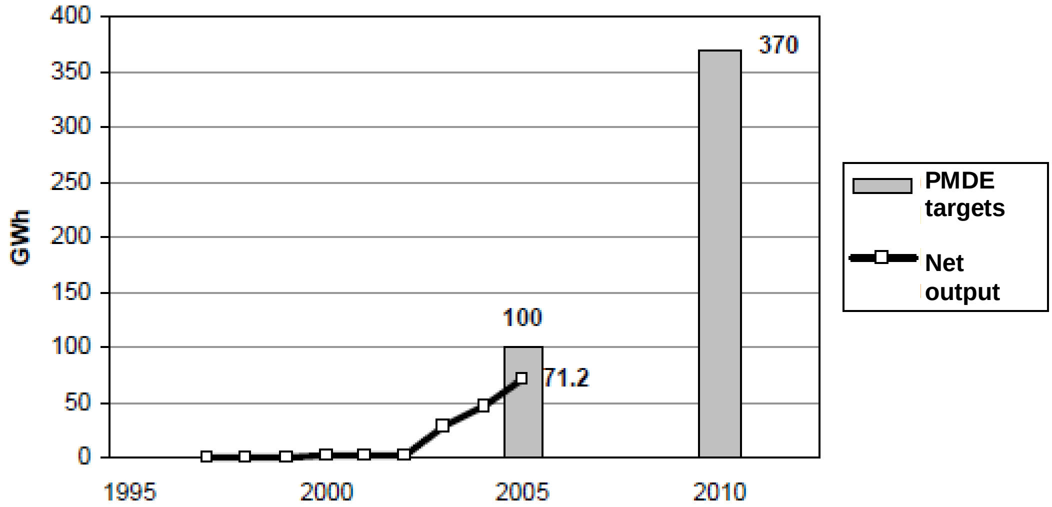


Figure 5 – Trends in the use of wind power for electricity generation and targets of the Plan for Sustainable Energy Management (PMDE) for 2005 and 2010 (in GWh)

Sources: SPF, Compagnons d'Eole – Plan for Sustainable Energy Management (December 2003)

The target set in the Plan for Sustainable Energy Management is the generation by wind turbines installed in Wallonia of 370 GWh of electricity, which is equivalent to the annual output of about 150 turbines. Since there is limited space for wind farms, the emphasis will be on high-powered turbines, i.e. those with ratings in excess of 500 kW.

There are numerous projects for the installation of large wind turbines. At the end of September 2006, turbines with a total rating of 5.3 MW were added to the installations commissioned in 2005, an 800-kW turbine being added to the Allons-en-vent wind farm in Beauraing and three 1 500-kW turbines to the Perwez site. Licences have been granted in Wallonia for 89 new turbines with a total rating of 223 MW and a theoretical output capacity estimated at 490 GWh. The output targets for 2010 appear to be well within reach.

If you wish more information, the wind-power facilitator for the Walloon Region has a list of the schemes that are now operational and those for which licences have been granted. These are accessible on the facilitator's website at:
http://www.apere.org
E-mail: eole@apere.org.

(d) The Walloon region in relation to the whole of Belgium

The region is playing an increasingly important role in the generation of electricity from wind power in Belgium. Whereas it contributed a mere 3% of the Kingdom's total output in 2002, Wallonia was generating almost 33% of Belgian wind-powered electricity by 2005.

	Net output (in GWh)	Installed rating (in MW)
Large wind turbines	225.1	167.8
Small wind turbines	0.5	0.8
Total Belgium	**225.6**	**168.7**
Total Wallonia	*71.2*	*49.8*
Total Brussels	*0*	*0*
Total Flanders	*154.4*	*118.9*

Table 6 – Electricity output and power rating of wind turbines in Belgium by region, 2005

Sources: CWaPE - ANRE.

2.2.2 Wind power in Europe

Since the publication with the data for 2005 is not yet available, we shall focus on the information that was reported for 2004.

According to EurObserv'ER, new installation records in Spain, Italy, Britain, Portugal and Ireland have enabled the European market to keep growing. The European Union was thus able to install an additional 5 856 megawatts in the course of 2004, bringing the cumulative rating of its wind farms to 34 367 MW, an increase of 20.3% in relation to 2003.

COUNTRY	2000	2001	2002	2003	2004
Germany	6 091	8 750	11 994	14 609	16 629
Spain	2 443	3 660	5 042	6 202	8 263
Denmark	2 297	2 417	2 889	3 110	3 117
Netherlands	448	483	685	912	1 078
Italy	389	697	788	904	1 262
United Kingdom	409	474	552	648	889
Austria	78	97	139	415	606
Sweden	231	264	328	399	442
Greece	189	273	302	375	465
Portugal	100	127	194	299	520
France	79	94	153	253	406
Ireland	118	132	138	186	342
Belgium	13	31	35	67	93
of which Wallonia	*1.35*	*1.35*	*1.35*	*22.9*	*23.5*
Finland	38	39	43	51	82
Luxembourg	10	15	16	22	35
Total EU 15	**12 933**	**17 548**	**22 331**	**28 452**	**34 229**
10 new Member States	62			104	138
Total EU 25	**11 992**			**28 569**	**34 367**

Table 7 – Total rating of wind turbines installed in the EU in megawatts, 2000 to 2004
Source: EurObserv'ER, European Barometer (data for Wallonia from the ICEDD).

Unlike the Union's small-scale hydro capacity, the installed rating of its wind turbines exceeds the European Commission's expectations for 2003 (10 000 MW) by more than 18 000 megawatts. On the basis of these new data, the installed rating for 2010 is now estimated at 72 000 MW, compared with the target of 40 000 MW that was set by the White Paper.

2.3 Electricity from solar power

2.3.1 Situation in the Walloon region

(a) The situation in 2005

The cumulative potential power of the photovoltaic panels installed in Wallonia was 43.5 kilowatts peak (kWp) in 2005, and the corresponding output is estimated at 33 MWh or 117 gigajoules. We are looking at an annual output of 750 kilowatt-hours for each installed kilowatt peak.

Potential power in kWp [2]	Output in MWh	Output in GJ
43.5	32.6	117

Table 8 – Potential and output of photovoltaic solar panels in the Walloon region in 2005

The existing small installations are too widely scattered and too insignificant (parking meters, etc.) to be the subject of an exhaustive inventory, nor are they covered by European statistics.

(b) Trend

In 2005, according to the Belsolar trade association, the potential power of Wallonia's solar collectors amounted to 5.2 kWp. In 2004, there was a total of 11.55 kWp at 53 sites, in 2003 the 44 installations had a total capacity of 3.02 kWp, and in 2002 the installed capacity came to 6.2 kWp.

(c) Projects for the future in the Walloon region

The Plan for Sustainable Energy Management does not set a regional target, but the system of green certificates may encourage the installation of solar collectors, as may the national tax concessions for environmental investments.

2.3.2 Solar power generation in Europe

Since the publication with the data for 2005 is not yet available, we shall focus on the information that was reported for 2004.

According to EurObserv'ER, the European Union, driven by the German market, which accounts for 88.4% of EU trade in solar technology, had an estimated potential of 410.5 MWp installed in 2004, which took the cumulative potential power of Europe's solar collectors to more than 1 000 MWp by the end of 2004. Another indicator of this spectacular growth is the *per capita* peak power potential, which now amounts to 2.2 Wp, as against 1.3 Wp in 2003. Another enduring phenomenon is the predominance of grid-tied applications (solar roofs and walls and solar power plants), which had a 98.1% share of the market in 2004. On-grid collectors now account for 91.6% of the solar installations in Europe.

[2] One kilowatt peak (kWp) is the full charge that can be achieved at an insulation intensity of 1 000 watts per square metre.

The White Paper expresses the hope that the total installed potential power in the EU will reach 3 000 MWp in 2010. Estimates based on the trend in 2003 suggested a figure of some 1 400 MWp, but the trend in 2004 and the laws enacted in some countries to encourage the use of solar power have led to a revision of this estimate to 4 500 MWp in 2010.

2.4 Solar-powered heating

2.4.1 Situation in the Walloon region

(a) The situation in 2005

Our assessment of the output of solar-powered heating in the course of year *n* is based on the hypothesis that such output is derived exclusively from the surface area that was already fitted with solar heating panels in year *n-1*. On the basis of the area previously fitted with solar heating panels, we therefore put the total functional area of heating panels in the Walloon region in 2005 at 35 198 m^2. Accepting the most plausible hypothesis, we estimated that 90% of the total area of solar heating panels was to be found on housing, the remainder being on public buildings.

Applications for grants under the Soltherm programme were made in respect of 6 382 m^2 in 2004, while Belsolar, the Belgian Solar Industry Association, reports 1 120 installation projects with a total surface area of 7 744 m^2 of new heating panels in 2004.

Estimated functional surface	35 198 m²
Equivalent power[3]	24.6 MWth
Specific output	406 kWh/m²
Estimated output	14 291 MWh 51 450 GJ 1 229 TOE

Table 9 – Output of solar heating panels in Wallonia in 2005

(b) Trend

The development of heat output from solar panels is essentially influenced by panel type and climatic conditions. Their output is estimated on the basis of hours of sunshine, the assumption being that a normal annual total of 1 555 hours of sunshine will yield an average output of 390 kWh per square metre, and insulation, the normal level of which is assumed to be 980 kW per square metre.

[3] See comments in point 2.4.2 below.

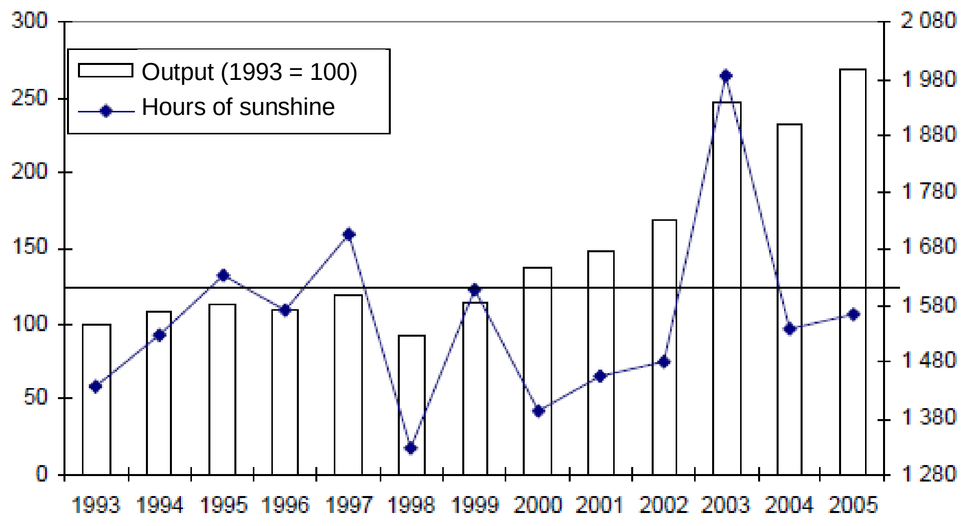


Figure 6 – Development of total hours of sunshine at Uccle meteorological station and of heat output (1993=100)

Source: IRM

(c) Projects for the future in the Walloon region

The Walloon Region has launched an action plan, known as Soltherm, to promote solar-powered heating. The aim is to achieve a total of 200 000 square metres of installed solar panels by 2010. The introduction of regional grants and of area, provincial and even municipal incentives and the campaign to promote solar boilers has boosted growth in the installation of solar-powered heating. In 2005, the surface area installed with the aid of regional grants amounted to 9 080 m². Belsolar has put forward a figure of almost 13 000 m² of panelling installed in 2005.

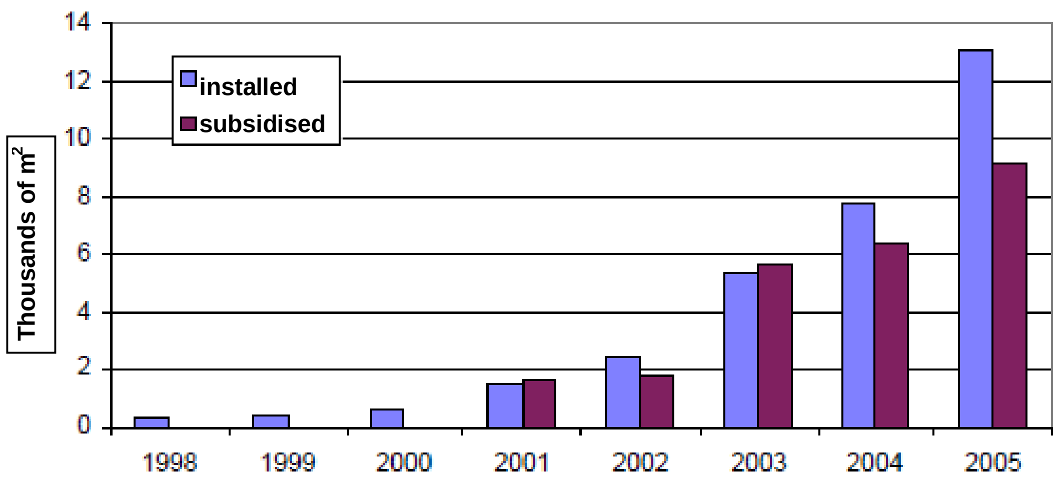


Figure 7 – Growth in panel areas subsidised by the Walloon Region and installed (according to Belsolar data) since 1998

The graph below shows the surface areas installed each year, which means that the area shown for 2005 is the area that had been installed by the end of 2005, not the area taken into account in the calculation of output for 2005.

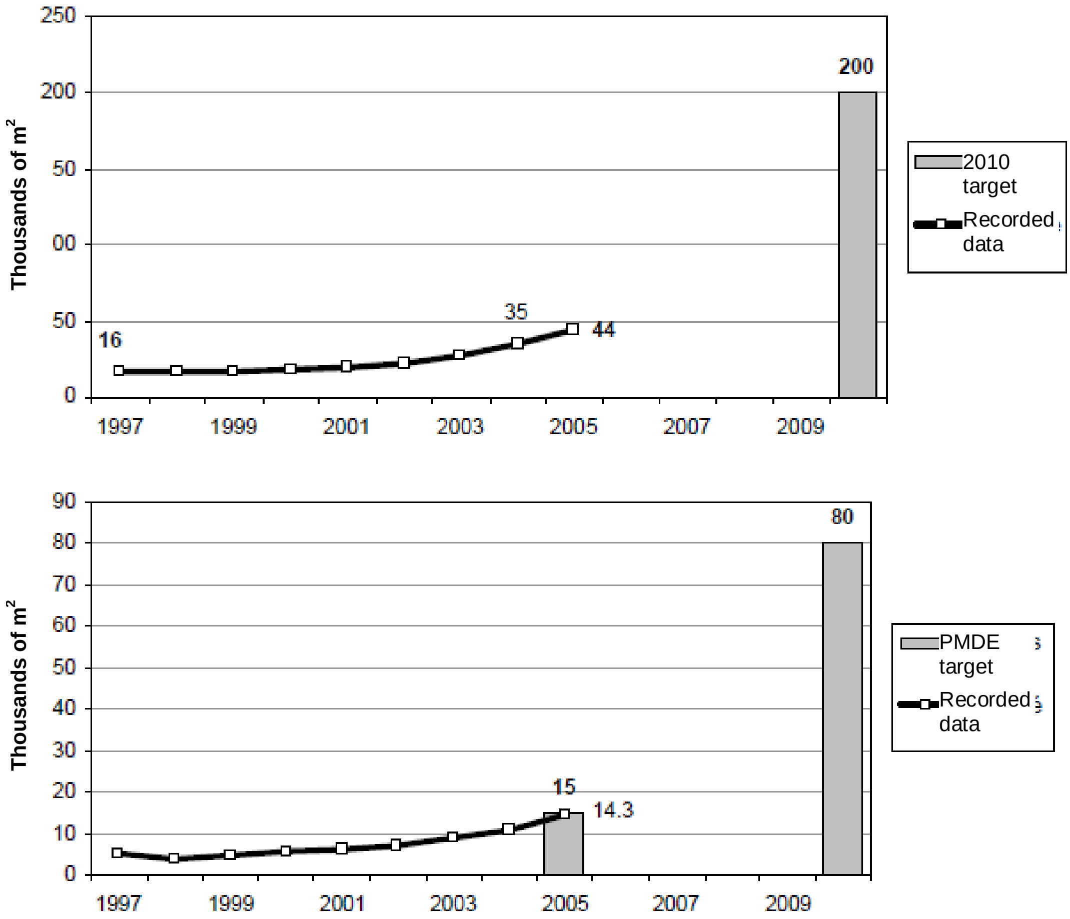


Figure 8 – Growth in the surface area and output of installed solar heating panels and targets set in the Plan for Sustainable Energy Management (PMDE) for 2005 and 2010

Sources: ICEDD - Plan for Sustainable Energy Management, December 2003

2.4.2 Solar-powered heating in Europe

Since the publication with the data for 2005 is not yet available, we shall focus on the information that was reported for 2004.

According to EurObserv'ER, growth in the market for solar-powered heating continued in 2004, with a 10.1% increase in relation to 2003. The annual growth in installations (1 693 004 m², corresponding to 1 185 MWth), however, is still far short of the European Commission's target of 100 million square metres (70 000 megawatts thermal) by the end of 2010.

In order to make these figures more easily comprehensible and comparable with those for other energy sources, it is possible to express the installed surface area of solar-heating panels in terms of thermal power. To this end we use the conversion factor approved by the IAE-SHC (International Energy Agency – Solar Heating and Cooling Programme) and by the associations for the promotion of the use of solar energy; this factor is 0.7 kilowatts thermal per square metre of installed collectors, regardless of which of the three forms of solar technology currently on the market is being used – flat-plate panels, unglazed panels or evacuated-tube collectors.

Country	**1999**	**2000**	**2001**	**2002**	**2003**	**2004 (m²)**	**2004 (MWth)**
Germany	2 750 200	3 336 700	4 119 050	4 715 110	5 478 000	6 199 000	4339.3
Greece	1 975 000	1 945 000	2 807 200	2 850 200	2 779 200	2 826 700	1978.7
Austria	2 020 000	2 150 900	2 370 960	2 541 960	2 267 557	2 399 791	1679.9
France	536 700	542 500	660 000	670 000	716 380	792 500	554.8
Italy	255 000	271 000	363 050	408 450	415 211	457 711	320.4
Netherlands	214 200	237 300	330 800	395 190	457 740	503 829	352.7
Denmark	219 000	242 800	287 780	290 320	314 410	328 380	229.9
Spain	364 000	369 000	252 240	282 380	361 351	440 151	308.1
UK	140 000	130 000	175 920	203 420	163 160	176 160	123.3
Portugal	160 200	145 400	210 900	199 900	124 890	109 200	76.4
Sweden	149 000	161 900	186 130	199 250	205 989	224 774	157.3
Finland	9 000	9 700	47 550	43 250	10 800	12 250	8.6
Belgium*	38 000	39 500	36 455	41 320	38 315	52 015	36.4
of which Wallonia	*16720*	*17 125*	*17 768*	*19 418*	*21 172*	*27 440*	*19*
Ireland	1 500	1 500	3 300	4 170	5 602	7 596	5.3
Luxembourg	1 000	1 000	?	?	9 800	11 500	8.1
EU	**8 832 800**	**9 584 200**	**11 851 330**	**12 844 900**	**13 348 405**	**14 541 557**	**10 179**

Table 10 – Cumulative surface area of solar-heating collectors in the European Union (in square metres)
Source: EurObserv'ER, European Barometer, 2004 (data for Wallonia from the ICEDD).

It should be noted that our own estimates indicate an installed area of more than 80 000 m^2 in Belgium at the end of 2004.

2.5 Geothermal energy

2.5.1 Situation in the Walloon region

(a) The situation in 2005

Compared with other renewable energy sources, geothermal energy has the advantage of being independent of atmospheric conditions – sunshine, rain and wind – and of the availability of a particular substrate, as is the case with biomass. It is therefore a reliable and steady source of energy. It is not, however, an entirely inexhaustible source, for if a well is exploited at a faster rate than its geothermal resources can be regenerated, its heat reservoir will one day be depleted.

In 2005, the district-heating network in the town of Saint-Ghislain supplied 80% of its energy to public buildings and 20% to housing.

The Douvrain well, for its part, helps to heat the Louis Caty Hospital in Baudour.

Geothermal energy: two sites	Primary energy	Useful energy recovered
In gigajoules	78 888	51 067
In gigawatt-hours	21.9	14.2
In tonnes of oil equivalent	1 885	1 220

Table 11 – Geothermal energy in Wallonia, 2005

(b) Trend

The decline of geothermal energy that had been observable since 2001 seems to have been halted.

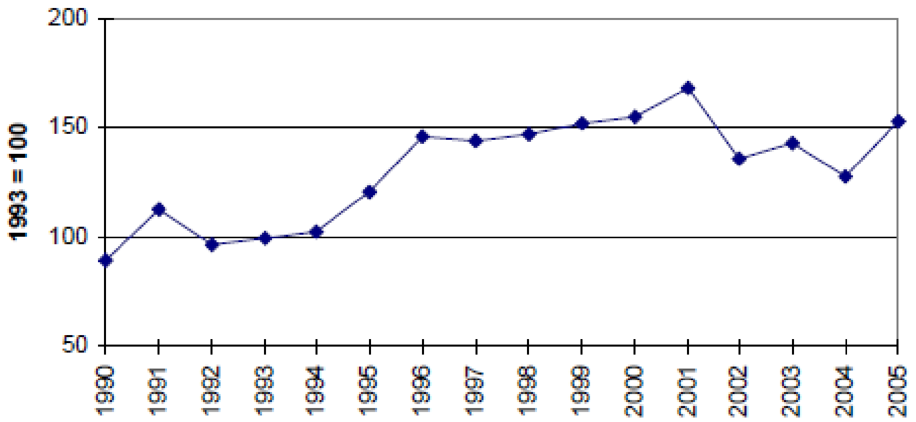


Figure 9 – Development of geothermal energy production in Wallonia (1993 = 100)

Source: IDEA

(c) Projects for the future in the Walloon region

A socio-economic study, cofinanced by the Walloon Region and European funds, was conducted with a view to assessing the demand for heating and hence the viability of exploiting a third well, which is located at Bouvrain. As there are no dwellings near the site, the capital cost of establishing a district-heating network would be high. The water temperature is 71°C, the pressure 5 bar and the hourly flow rate 130 cubic metres.

The graph below shows the output of geothermal energy since 1990 and compares it with the targets of the Plan for Sustainable Energy Management for 2005 and 2010. In order to meet these targets, efforts will be made to step up the recovery of heat from the various wells.

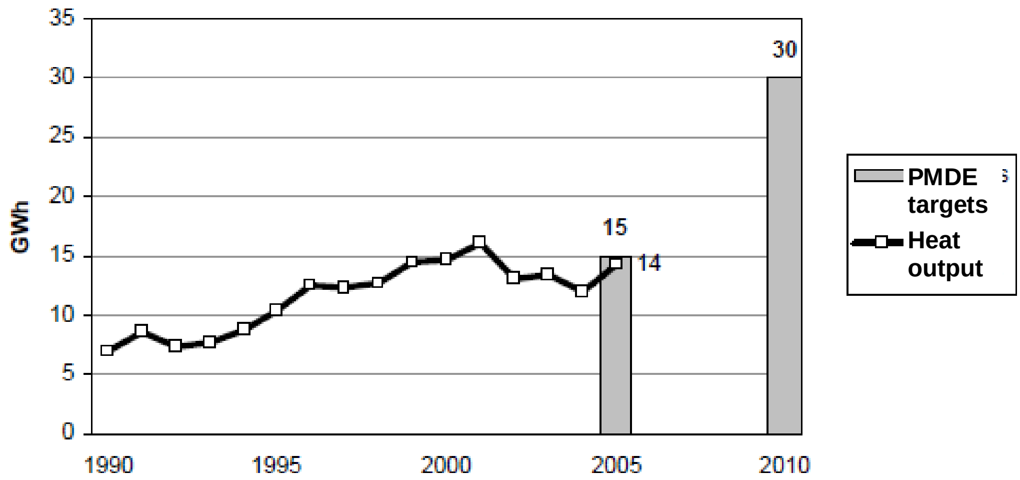


Figure 10 – Development of geothermal heat output and targets of the Plan for Sustainable Energy Management for 2005 and 2010 (in GWh)

Sources: ICEDD – Plan for Sustainable Energy Management, December 2003

(d) The Walloon region in relation to the whole of Belgium

The Walloon region currently accounts for all of Belgium's geothermal-energy output.

2.5.2 Geothermal energy in Europe

Since the publication with the data for 2005 is not yet available, we shall focus on the information that was reported for 2004.

According to EurObserv'ER, installations for the production of low-temperature heat seem to be difficult to quantify but were estimated at about 2 059 MWth in 2004 in the 25 Member States of the EU, chiefly in Hungary, France and Italy. Total European output in 2004 was estimated at 637 ktoe (7 400 GWh).

The White Paper envisages that geothermal sources will be contributing 5 000 MWth to heat production by the end of 2010. Current data indicate that this target is already being exceeded, and EurObserv'ER estimates that more than 10 300 MWth will be achieved in 2010.

The EurObserv'ER data for Belgium contain an estimate of 30 GWh for 2004, which does not correspond in any way to the data in our possession, which put primary energy production at 18 GWh.

	2000		**2002**		**2003**		**2004**	
Country	Power (MWth)	Energy produced (GWh)	Power (MWth)	Energy produced (GWh)	Power (MWth)	Energy produced (GWh)	Power (MWth)	Energy produced (GWh)
Italy	324.6	1046.2	426	1337	486.5	1953	487	1959
France	326.0	1360.0	330	1488	330.0	1512	292	1313
Austria	27.3	143.1	92	144	100.0	116	52	216
Greece	56.7	106.1	69	135	75.0	no data	71	147
Germany	53.2	116.8	70	113	70.5	no data	105	198
Sweden	47.0	141.0	47	267	47.0	no data		
Belgium	3.9	15.3	6.8	13	9.0	21	4	30
of which Wallonia		*14.7*	*6.8*	*13*	*9.0*	*21*	*9*	*18*
Portugal	5.5	10.0	5.5	10	5.5	no data	30	107
Denmark	4.0	15.2	4.0	15	4.0	23		0
UK	2.3	5.2	2.3	5.2	2.3	14	3	22
Ireland	0.7	2.1	0.7	2.1	0.7	5	0	6
EU 15	**851.2**	**2960.5**	**1 053.3**	**3529.3**	**1 130.6**	**3645.0**	**1066**	**4094**
10 new Member States							993	3309
Total EU 25							**2059**	**7403**

Table 12 – Low-temperature geothermal energy situation (excluding heat pumps) in the European Union
Source: EurObserv'ER, European Barometer, 2005 (data for Wallonia from the ICEDD).

2.6 Heat pumps

The heat pump is regarded as a renewable source of energy in so far as it collects atmospheric heat energy from the sun. It does, however, require a steady supply of electricity to operate. It is a hybrid system that only becomes viable as an energy source when its coefficient of performance (COP) exceeds three.

2.6.1 Situation in the Walloon region

(a) The situation in 2005

A socio-economic survey conducted by the Belgian National Statistical Institute in 2001 examined the main energy sources that people used to heat their homes and found that heat pumps were used in 941 dwellings. Since the use of heat pumps is being encouraged at the present time, we have assumed a flat-rate annual increase of 1% in the number of these installations. Assessing heat requirements on the basis of the average specific consumption of the dwelling and assuming a coefficient of performance of 2.5 (based on a field study conducted by the University of Mons) we obtained the estimates set out in table 13 below.

Walloon region	Number of dwellings	Installed power (kW)	Heat output (GJ)	Energy gain[4] (in GJ)	Energy gain (in toe)	Energy gain (in GWh)
Residential	988	no data	54 380	32 628	779.5	9.1
Public buildings	N/A	3 142	21 846	13 108	313.1	3.6
Total	---	---	**76 226**	**45 736**	**1092.6**	**12.7**

Table 13 – Energy produced by heat pumps in Wallonia, 2005

Heat pumps	**Heat output**	**Electricity consumption**	**Useful energy recovered**
in toe	1 821.0	728.4	1 092.6
in GWh	21.2	8.5	12.7
in TJ	76.2	30.5	45.7

Table 14 – Energy produced by heat pumps in Wallonia, 2005

Electrical energy is needed to operate a heat pump. In order to produce 21.2 GWh of heat, the pumps themselves consumed 8.5 GWh of electricity, which means that they produced a net output of 12.7 GWh of useful recovered energy.

This electricity consumption is imputed in the section headed ‘consumption of own output’ in the final balance sheets set out in Tables 38 and 39 at the end of this report.

[4] To be more precise, the ‘energy gain’ referred to here is the difference between the net heat requirement and the quantity of electricity that has had to be consumed in order to recover that heat from the soil, air or water.

(b) Trend

In 1989, a total of 89 sites with a total power of 2 400 kWth were recorded in the Walloon region, their aggregate output amounting to 55 terajoules. It was assumed that, in spite of year-on-year fluctuations, their output had remained constant in the longer term.

New information from the Belgian National Statistical Institute INS and the energy survey has made it possible to refine this calculation but has not fundamentally altered the aggregate figures. It is, however, observable that the total volume of energy produced by heat pumps has fallen by 17%.

(c) Projects for the future in the Walloon region

The Plan for Sustainable Energy Management of December 2003 sets targets of 20 GWh for 2005 and 50 GWh for 2010, compared with the current recovery of 13 GWh.

2.6.2 Situation in Europe

Since the publication with the data for 2005 is not yet available, we shall focus on the information that was reported for 2004.

According to EurObserv'ER, the total cumulative power of geothermal heat pumps in 2004 amounted to 4 531 MWth, a sharp increase on the 2003 figure, thanks to Sweden and other countries. The main countries of the Union that are involved in very low-temperature geothermal technology (heat pumps) are Sweden, with 1 700 MWth, Germany, with 632 MWth, and France, with 549 MWth.

2.7 Total excluding biomass

The following table summarises the data for the primary output of renewable energy sources other than biomass in Wallonia in 2005 in absolute figures and in percentages and indicates the rate of change from 2004 to 2005.

Type of renewable energy	Primary energy		Trend 2004 to 2005	Share in %	Net electricity (GWh)	Heat (GWh)	Total net output (GWh)
	(toe)	(GWh)					
Hydroelectricity	***24 590***	***285.9***	-9.1%	68.8%	280.2	---	280.2
Wind power	***6 220***	***72.3***	+53.6%	17.4%	71.2	---	71.2
Solar electricity	***3***	***0.03***	+13.6%	0.0%	0.03	---	0.03
Solar heat	***1 229***	***14.3***	+30.7%	3.4%	---	14.3	14.3
Geothermal energy	***1 885***	***21.9***	+20.1%	5.3%	---	14.2	14.2
Heat pumps	***1 821***	***21.2***	-1.3%	5.1%	---	12.7	12.7
Total	***35 747***	***415.7***	***+0.8%***	***100%***	***351.4***	***41.2***	***392.6***

Table 15 – Production of primary energy and net energy output from renewables other than biomass in Wallonia, 2005

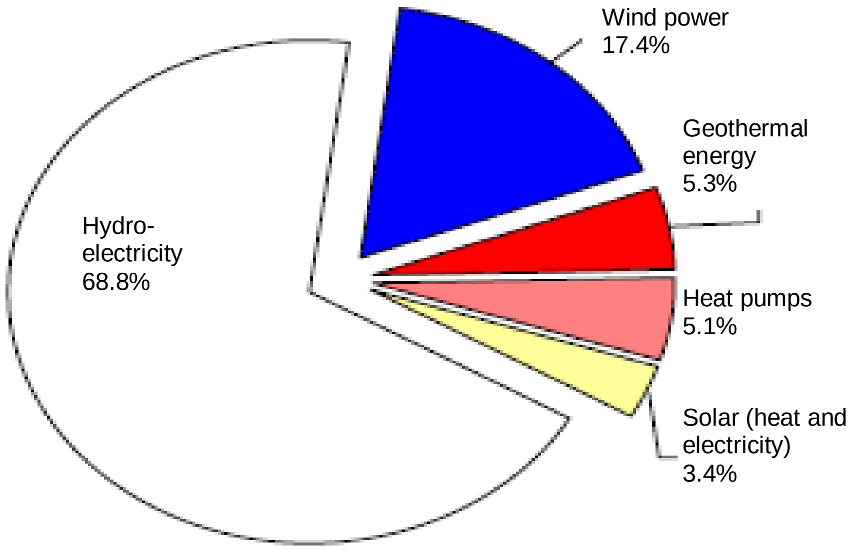


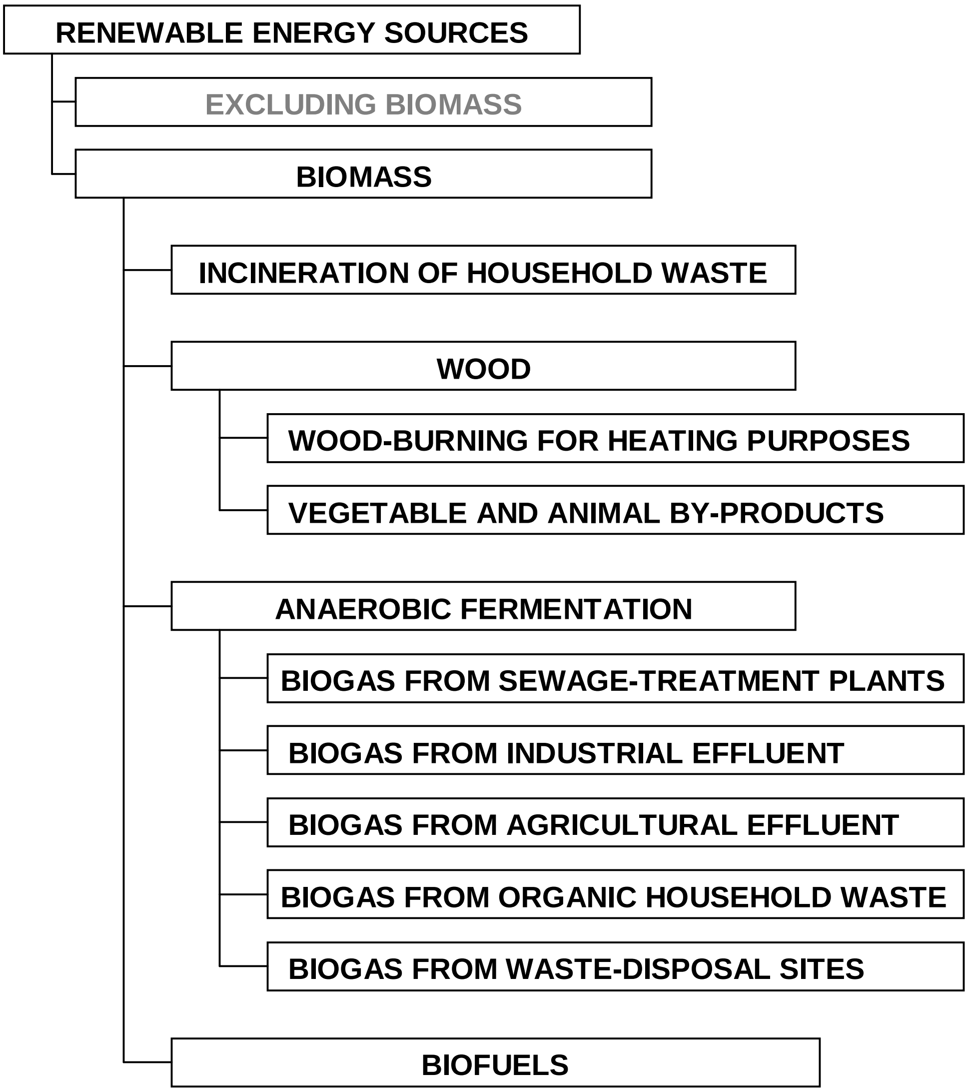
Figure 11 – Distribution of primary energy from renewable sources other than biomass in Wallonia, 2005

Year	Hydro.	Wind	Solar (elec. and heating)	Geotherm.	Heat pumps	**Total**	1993 = 100
1993	**254.5**	**0.0**	**4.3**	**14.3**	**27.8**	**300.8**	**100**
1994	346.5	0.0	4.6	14.6	24.4	390.1	130
1995	337.1	0.0	4.8	17.3	23.3	382.5	127
1996	238.1	0.0	4.7	20.9	23.3	286.9	95
1997	304.5	0.1	5.1	20.6	23.3	353.5	118
1998	388.5	0.6	3.9	21.1	23.3	437.4	145
1999	340.5	1.0	4.9	21.8	23.3	391.5	130
2000	458.2	1.3	5.8	22.2	23.3	511.1	170
2001	442.0	2.0	6.4	24.1	23.3	497.8	165
2002	357.3	2.1	7.2	19.5	27.7	413.8	138
2003	244.7	28.7	10.6	20.6	21.3	325.8	108
2004	314.5	47.1	11.0	18.2	21.5	412.2	137
2005	285.9	72.3	14.3	21.9	21.2	415.7	138

Table 16 – Production trends for primary energy from renewable sources other than biomass in the Walloon region, 1993-2005 (in GWh)

3. Balance sheet for biomass

The following paragraphs provide details of energy output from the various renewable sources that fall under the heading of biomass.



In 2005, two new renewable energy sources began to feature in the region’s energy mix, namely vegetable oils and animal fats.

Vegetable oils, which are produced either from crops or from the recycling of used oils, are regarded as a biofuel and are used in this case to generate electricity. They should not be confused with the biofuels that are used as motor fuels or motor-fuel additives, which should make their appearance in the balance sheet for 2006.

Animal fats, which are often recovered from the food industry or from abattoir waste, are classed with the other forms of solid waste.

3.1 Incineration of household waste

3.1.1 Situation in the Walloon region

(a) The situation in 2005

In accordance with the practice of the International Energy Agency (IEA) and Eurostat, not all energy obtained from incinerated household waste is regarded as renewable energy from biomass. Only the organic components of waste are regarded as renewable sources. The statistics collected for the IEA distinguish between the renewable and the non-renewable elements of waste.

An incinerator is a plant in which waste is burned. The heat that is generated there can be recovered in the form of steam which drives an alternator. The net output of electricity is generally small.

The four Wallonian incinerators involved in the recovery of energy from household waste burned a combined total of 518 300 tonnes. The table below shows the primary energy and the gross and net outputs of electricity in 2005. The data were communicated to us directly by the intermunicipal companies that operate these incinerators.

Total	**Primary energy recovered**	**Element recovered from renewables**	**Gross electricity output**	**Net electricity output**	**Gross electricity output from renewables**
in ktoe	119.2	19.0	22.5	19.9	3.2
in GWh	1 385.5	221.4	261.3	231.9	37.1
in TJ	4 987.7	797.1	940.6	834.8	133.5

Table 17 – Production of energy from the incineration of household waste in Wallonia, 2005

The volume of primary energy regarded as renewable is 22.5 kilotonnes of oil equivalent, and the *pro rata* share of gross electricity output is 37.1 gigawatt-hours. The renewable percentage is applied to the mass of incinerated waste, regardless of differences in calorific values.

This compares with a gross volume of electricity generated by incinerators in 2005 amounting to 261.3 GWh, the net output being 231.9 GWh.

(b) Trend

Incineration data go back to 1991 and are based on the total volume of incinerated waste and the total output of electricity (the organic and the inorganic elements of each). Accordingly, we have taken a default value of 30% as the proportion of incinerated waste that is organic. Specific information on the organic percentage of incinerated waste is available for 2000 and subsequent years.

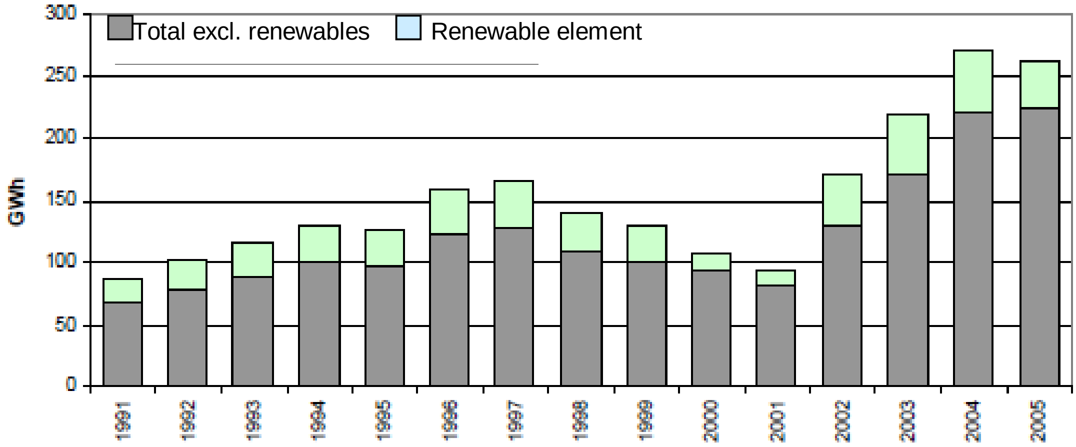


Figure 12 – Trends in gross electricity output of incinerators in the Walloon region (in GWh)

(c) Projects for the future in the Walloon region

Basically, the only way to increase the capacity for the recovery of energy from incinerated waste is to make improvements to the existing incinerators. Intradel is planning to replace its incinerator in 2008 with a new plant, where the organic element of household waste will no longer be separated from the rest. The Plan for Sustainable Energy Management does not number waste incineration among the renewable energy sources and therefore sets no regional incineration targets.

3.2 Wood-burning for heating purposes

Household consumption of fuel wood in forms such as logs, pellets and woodchips is calculated on the basis of the socio-economic survey conducted by the National Statistical Institute INS in 2001, which found that 27 500 Walloon households used wood as their main heating fuel. Their fuel wood needs have been calculated on the basis of an average consumption of 2.6 ktoe per dwelling. The data from Table 19 have been added to take account of market developments.

Variations in annual consumption have been estimated partly by means of trends in degree days, a measure of the severity and duration of cold weather based on an indoor-temperature target and heating cut-off point of 15°C, as recorded by the Royal Meteorological Society of Belgium (IRM), and partly on trends in the sale of boilers and wood-burning stoves, analysed from data collected by the facilitator for domestic wood-fired heating. On the basis of these two trends, the consumption of fuel wood in 2005 has been estimated at 4 130 terajoules, corresponding to 98.7 kilotonnes of oil equivalent or 1 147 gigawatt-hours.

	Consumption in ktoe	**Consumption in TWh**	**Consumption in TJ**	**Change from 2004 to 2005**
Fuel wood	98.7	1.1	4 130	+6%

Table 18 – Household fuel wood consumption in Wallonia, 2005

	Number sold before 2005	**Number installed by the end of 2005**	**Total output capacity before 2005 (kW)**	**Total output capacity at the end of 2005 (kW)**
Boilers	62	272	1 570	7 717
Stoves	321	1 648	2 722	12 535
Stoves fitted with boilers	30	79	454	1 188
Total	**413**	**1 999**	**4 746**	**21 440**

Table 19 – Statistics for sales of wood-pellet boilers and stoves in Wallonia, 2005
Source: The Facilitator for Domestic Wood-fired Heating for Wallonia

On the basis of the average output capacity shown in Table 19, the aggregate capacity of all wood-fired boilers installed in residential premises may be estimated at 800 MWth, and the capacity of stand-alone stoves at 1 550 MWth.

In view of the 2005 oil crisis and the introduction of financial incentives for the installation of wood-fired boilers, the aggregate output of useful heat from this energy source will surely continue to grow in the years to come, while the energy-efficiency criterion for the award of financial incentives will limit the consumption of timber resources as far as possible.

More information on wood-burning for domestic heating purposes may be obtained from the Facilitator for Wood-fired Heating at http://www.valbiom.be
(e-mail: marchal@cra.wallonie.be)

3.3 Combustion of animal and vegetable by-products

3.3.1 Situation in the Walloon region

(a) The situation in 2005

The term ‘vegetable by-products’ covers wood, woodworking waste such as sawdust and wood shavings, forestry waste such as bark, papermaking waste such as black liquor and solid vegetable products such as straw and cereal crops. Animal by-products are animal fats or abattoir waste which are processed to generate electricity or heat through combustion. Two companies, namely Seva in Mouscron and Aigremont in Liège, were using both kinds of by-product as energy sources in 2005, which is why we have bracketed these two sources together. Moreover, the IEA deals with these two sources under the same heading of ‘wood/wood wastes/other solid wastes’.

The recovery of by-products of the papermaking process for energy generation in Wallonia is largely confined to the Burgo Ardennes factory in Harnoncourt, which imports some 80% of its wood from France and Germany.

Two smaller wood-fired cogeneration units operate in the Secobois works in Mariembourg and in the Recybois plant in Virton.

By-products of the timber industry are also used to fire boilers in about 50 other plants, namely sawmills and timber-processing works. The pertinent data are derived from estimates based on the findings of a survey of various businesses which own wood boilers.

Lastly, Electrabel has retrofitted its Les Awirs coal-fired power station to burn wood pellets. The converted plant, with a nominal electrical power rating of 80 MW, became operational in September 2005 and has achieved a considerable increase in its output, which is now estimated at 600 GWh per annum. At the present time the bulk of its wood pellets are imported from Poland and Canada. Strictly speaking, then, it is not contributing to primary production in the Walloon region.

The output of steam and electricity from animal and vegetable by-products is shown in the following table. Primary ‘consumption’ amounts to 3 498 gigawatt-hours (301 kilotonnes of oil equivalent), since local primary production accounts for 807 GWh or 69 ktoe, while a volume of 2 691 GWh (230 ktoe) is imported.

Total	Primary consumption	Heat output	Gross electricity output	Net electricity output
in ktoe	300.9	200.7	34.8	29.8
in GWh	3 498.3	2 333.5	405.0	346.1
in TJ	12 593.8	8 400.7	1 458.2	1 245.9

Table 20 – Energy output generated by means of animal and vegetable by-products in Wallonia, 2005

(b) Trend

Primary consumption was 45% higher in 2005 than in 2004, and electricity output rose by 73%.

Year	in TJ	in ktoe	in GWh	1993 = 100
1993	**2 458.5**	**58.7**	**683**	**100.0**
1994	2 458.5	58.7	683	100.0
1995	4 603.8	110.0	1 279	187.3
1996	3 514.1	83.9	976	142.9
1997	3 452.2	82.5	959	140.4
1998	5 534.1	132.2	1 537	225.1
1999	7 362.1	175.9	2 045	299.5
2000	7 121.3	170.1	1 978	289.7
2001	6 795.1	162.3	1 888	276.4
2002	8 712.3	208.1	2 420	354.4
2003	8 673.1	207.2	2 409	352.8
2004	10 638.2	254.1	2 955	432.7
2005	12 593.8	300.9	3 498	512.3

Table 21 – Development of the consumption of primary energy generated with the aid of animal and vegetable by-products in the Walloon region, 1993-2005

(c) Projects for the future in the Walloon region

The policy aim laid down in the Plan for Sustainable Energy Management (PMDE) is to achieve a heat output of 4 100 GWh and an electricity output of 370 GWh from wood and vegetable by-products by 2010.

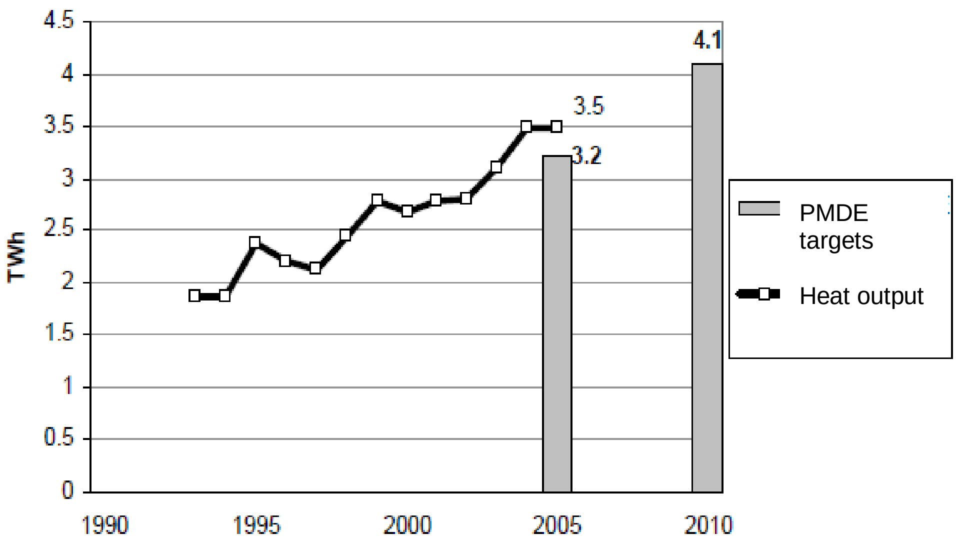


Figure 13 – Development of heat output from wood (logs and waste products) and targets of the Plan for Sustainable Energy Management for 2005 and 2010 (in TWh)

Source: ICEDD - Plan for Sustainable Energy Management (December 2003)

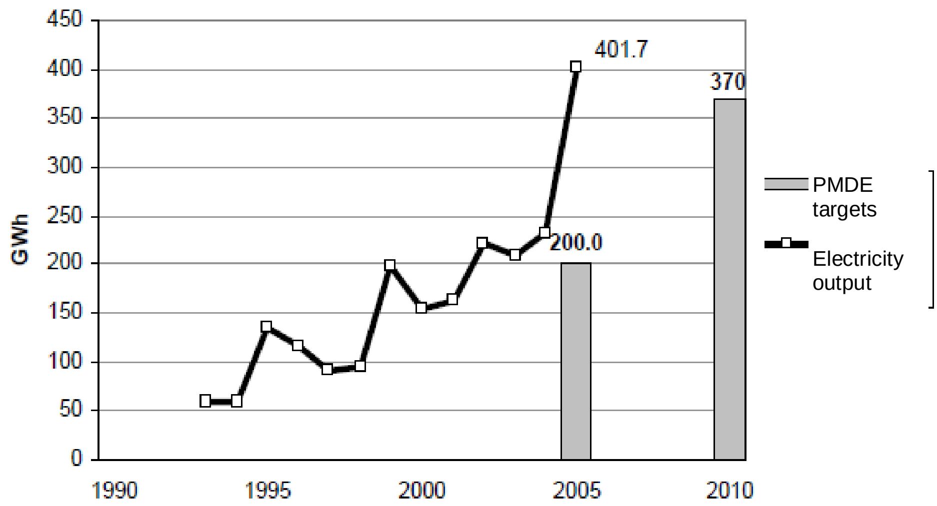


Figure 14 – Development of electricity output from wood and targets of the Plan for Sustainable Energy Management for 2005 and 2010 (in GWh)

Source: ICEDD - Plan for Sustainable Energy Management (December 2003)

As Figure 14 illustrates, the electricity-output target set for 2010 has already been achieved and surpassed.

It should also be emphasised that targets have been set for electricity generation from energy crops; these targets are fixed at 55 GWh for 2005 and 225 GWh for 2010.

Numerous projects for the economic exploitation of wood resources are being implemented or are under consideration in the Walloon region.

For example, about ten wood-fired cogeneration plants are in the offing. The Régal experimental plant has been operating since 2002, and both Secobois and Recybois have gone into production. Wood-fired urban district-heating systems are also being considered.

Installation projects are being monitored by the two facilitators with responsibility for wood as part of their respective remits. These are the Facilitator for Corporate Energy Production from Biomass (e-mail: irco@skynet.be) and the Facilitator for Wood-fired Heating, who is responsible for the public domain (e-mail: pbe@frw.be).

3.3.2 Wood-fired energy production in Europe

Since the publication with the data for 2005 is not yet available, we shall focus on the information that was reported for 2004.

In 2004, primary energy output from wood-fired installations amounted to 47 million tonnes of oil equivalent for the 15 older Member States of the European Union and 55 million toe for all 25 Member States. Most primary energy derived from wood takes the form of heating for individual dwellings, blocks of flats or public buildings.

Although the bulk of the primary energy output from wood is used for household, industrial or collective heating, it is also used in cogeneration plants to produce electricity. According to the IEA, electricity accounts for 16.6% of the primary energy output of wood-fired installations.

On the basis of production figures for the three years up to and including 2004, Europe will have to increase its output by 31 megatonnes of oil equivalent by 2010 in order to meet the White Paper target of 100 Mtoe of energy generated from wood.

3.4 Anaerobic fermentation

3.4.1 Fermentation of sewage sludge

(a) The situation in 2005

In 2005, biogas derived from the anaerobic digestion of sewage sludge was produced in seven sewage-treatment plants in Wallonia; the output amounted to 499 800 resident equivalents. The 521 000 cubic metres of biogas that were produced were mainly used to heat sludge and to fuel heating systems in buildings.

Total	**Primary production**	**Heat output**	**Gross electricity output**	**Net electricity output**
toe	296.6	238.0	36.6	35.6
MWh	3 449	2 768	425.8	413.6
TJ	12.4	10.0	1.5	1.5

Table 22 – Output of energy from the methanisation of sludge from sewage-treatment plants, 2005

Location	**Use of recovered energy**
Bastogne	Heating the digester and some of the plant premises
Herve	Heating the buildings and digester and fuelling the flare stack
Hodeige	Heating the buildings and digester and fuelling the flare stack
Leuze	Heating premises and digester
Marche-en-Famenne	Cogeneration: heating premises and digester and generating electricity
Wasmuël	Cogeneration: heating sludge and generating electricity
Waterloo	Heating sludge for anaerobic digestion

Table 23 – Use of energy recovered from sludge at sewage-treatment plants

(b) Trend

Primary production was 35.5% lower than in 2004. As the table below shows, primary energy production is steadily declining. Although electricity output plummeted drastically in 2003 [1998?], it has subsequently grown six-fold since the year 2000, which is no doubt an effect of the system of green certificates.

Year	Primary production in GJ	Primary production in toe	Primary production in MWh	1993=100	Gross electricity output in MWh
1993	**32 570**	**778**	**9 047**	**100**	**1 406**
1994	49 500	1 183	13 750	152	1 043
1995	49 469	1 182	13 741	152	1 048
1996	51 976	1 242	14 438	160	1 310
1997	52 543	1 255	14 595	161	884
1998	26 698	638	7 416	82	73
1999	26 308	628	7 308	81	73
2000	28 159	673	7 822	86	73
2001	26 676	637	7 410	82	166
2002	26 008	621	7 224	80	166
2003	18 331	438	5 092	56	563
2004	19 250	460	5 347	59	607
2005	12 418	297	3 449	38	426

Table 24 – Development of the use of energy from primary production at sewage-treatment plants in Wallonia, 1993-2005

(c) Projects for the future in the Walloon region

The desire of the Walloon Region to improve sewage treatment will lead to an increase in the number of treatment plants. The system of green certificates might prompt a good number of plants to recover the biogas they produce so that it can be used to generate energy. Some plants have obtained green certificates for improving their output of biogas for electricity generation.

3.4.2 Fermentation of agricultural effluent

(a) The situation in 2005

The few installations that recover energy from by-products of animal husbandry by means of biomethanisation and cogeneration are located on a pig farm run by Mr Rudi Lenges in Recht, on Fasscht Farm in Attert, which belongs to the Kessler brothers, and at the Heck farm in Nidrum. The Agricultural Technology Centre in Strée has an experimental and pilot installation which is used from time to time to heat a greenhouse. A total of 1.6 cubic metres of biogas was produced in Wallonia. Electricity output was 63% higher than in 2004.

Total	**Primary production**	**Heat output**	**Gross electricity output**	**Net electricity output**
in toe	842	129	267	240
in MWh	9 792	1 495	3 104	2 795
in TJ	35.2	5.4	11.2	10.1

Table 25 – Energy output from biomethanisation of effluent from animal husbandry in Wallonia, 2005

(b) Trend

Year	Primary production in GJ	Primary production in toe	Primary production in MWh	1999=100	Gross electricity output in MWh
1999	**972**	**23.2**	**270**	**100**	**133**
2000	972	23.2	270	100	161
2001	5 400	129.0	1 500	556	330
2002	6 575	157.1	1 826	676	498
2003	20 362	486.4	5 656	2 095	1 782
2004	20 080	479.7	5 578	2 066	1 907
2005	35 250	842.1	9 792	3 627	3 104

Table 26 – Development of primary production of effluent from animal husbandry in Wallonia, 1999-2005

3.4.3 Fermentation of industrial effluent

(a) The situation in 2005

A large percentage of the energy recovered by means of biomethanisation in the industrial sector comes from the purification of the water used to wash sugar beet in refineries. This process still takes place in five sugar refineries. Biogas is no longer recovered in Genappe, following the closure of the refinery, and at Brugelette it is burned in a flare stack.

The biogas produced at the refineries in Oreye, Hollogne-sur-Geer and Frasnes is used for the sole purpose of drying beet pulp. At Fountenoy and Warcoign, it fuels a boiler to generate steam, which is used to generate electricity in combined heating and power plants. A total of almost 2.3 million cubic metres of biogas was recovered in 2005.

Apart from the sugar refineries, only one other agrifood enterprise is involved in the biomethanisation of industrial effluent, namely the Van den Broeke - Lutosa company in Leuze-en-Hainaut.

In fact, at the end of November 2002, Lutosa, in partnership with Electrabel, inaugurated Belgium’s largest biogas-fired cogeneration plant. Two generator units have been installed with a total capacity of 2.5 megawatts of electrical and two megawatts of thermal power and a steam output of two tonnes per hour.

Total	Primary energy	Heat output	Gross electricity output	Net electricity output
in toe	2 812	1 779	543	527
in MWh	32 702	20 683	6 309	6 130
in TJ	117.7	74.5	22.7	22.1

Table 27 – Output of primary energy from biomethanisation in the industrial sector, 2005

(b) Trend

Primary production was up by 30% on the previous year. Electricity output had increased 25-fold since 2002, following the inauguration of the Lutosa cogeneration facility.

Year	Primary production in GJ	Primary production in toe	Primary production in MWh	1993=100	Gross electricity output in MWh
1993	**57 200**	**15 889**	**1 366**	**100**	**no data**
1994	102 650	28 514	2 452	179	1 945
1995	69 879	19 411	1 669	122	2 004
1996	66 128	18 369	1 580	116	2 459
1997	66 886	18 579	1 598	117	1 715
1998	73 990	20 553	1 768	129	440
1999	80 785	22 440	1 930	141	217
2000	98 419	27 339	2 351	172	168
2001	91 438	25 399	2 184	160	52
2002	89 201	24 778	2 131	156	252
2003	76 455	21 237	1 826	134	4 042
2004	90 852	25 237	2 170	159	4 625
2005	117 726	32 702	2 812	206	6 309

Table 28 – Development of primary production of methanised organic waste in the industrial sector in Wallonia, 1993-2005

Many other projects of this type are likely to appear in the Walloon landscape following the introduction of the green-certificates system.

3.4.4 Recovery of gas from waste-disposal sites

(a) The situation in 2005

Once it is buried in landfill sites, organic waste undergoes anaerobic (i.e. oxygen-free) decomposition, which results in the production of biogas. In Wallonia, gas was recovered from waste-disposal sites in eleven locations, three new plants having become operational in 2005. A total of almost 68 million cubic metres of gas has been used to fuel generator units with a total capacity of 17.7 megawatts.

Location	Operator	Entry into service	Capacity in MWe
Hallembaye	Intradel SCRL	January 1996	2.048
Mont-Saint-Guibert	Cetem SA	1997	9.023
Engis	Watco	1998	1.780
Braine-le-Château	Biffa	October 1998	3.041
Anton	Spaque	October 1999	0.451
Montzen	Electrabel	December 1999	0.409
Tenneville	Idelux	November 2003	0.693
Froidchapelle	Intersud	2004	0.249
Habay-La-Neuve	Idelux	2004	0.319
Happe-Chapois	BEP	2005	0.260
Les Isnes	Spaque	2005	0.049

Table 29 – Characteristics of waste-disposal sites and installations with gas-recovery capacity in Wallonia

Total	Primary energy	Heat output	Gross electricity output	Net electricity output
in ktoe	28.6	0.3	8.9	8.5
in GWh	332.5	4.0	103.9	99.4
in TJ	1 197.0	14.0	374.0	358.0

Table 30 – Energy output generated with gas recovered from waste-disposal sites in Wallonia, 2005

(b) Trend

Year	Gas recovered (1000 m³)	Primary energy in TJ	Primary energy in GWh	1996 = 100	Heat recovered (TJ)	Gross electricity output (GWh)	Net electricity output (GWh)	Total gross output (TJ)	No of recovery sites
1996	**1 714**	**17.3**	**4.8**	**100**	**0**	**3.0**	**2.7**	**10.8**	**1**
1997	8 261	80.9	22.5	468	0	12.6	11.7	45.5	2
1998	23 389	441.8	122.7	2 555	0	38.0	35.9	136.8	3
1999	38 667	680.8	189.1	3 937	0	61.2	58.7	220.4	5
2000	46 272	805.2	223.7	4 656	17.8	74.9	71.8	287.3	6
2001	56 011	980.6	272.4	5 671	11.3	80.2	77.0	300.1	6
2002	57 482	994.8	276.3	5 753	8.4	83.3	79.5	308.5	6
2003	55 244	950.3	264.0	5 496	39.7	78.8	76.7	323.3	7
2004	76 411	1 311.8	364.4	7 586	48.9	105.9	99.9	430.1	8
2005	68 472	1 197.1	332.5	6 923	14.4	103.9	99.4	388.4	11

Table 31 – Development of energy production using gas recovered from waste-disposal sites in Wallonia, 1996- 2005

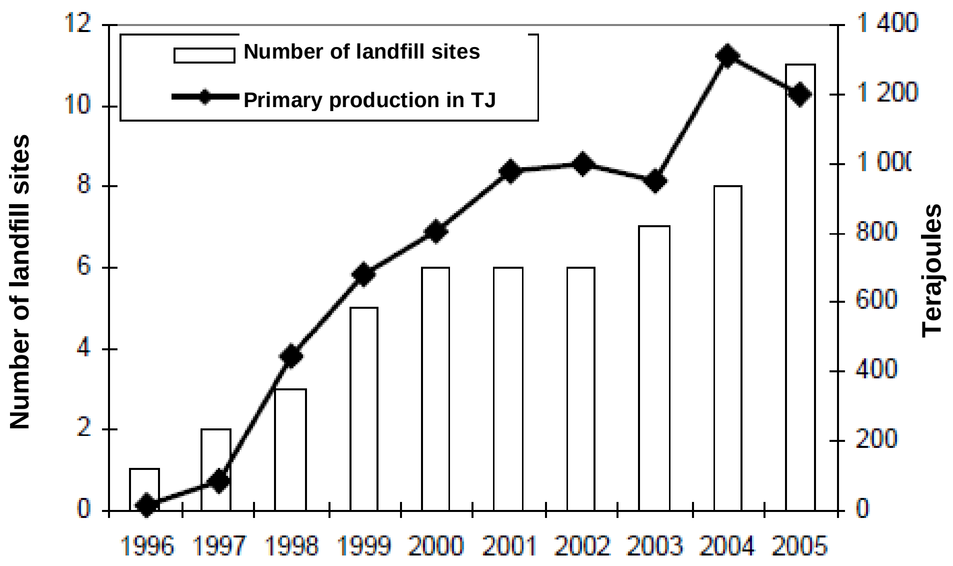


Figure 15 – Development of the number and primary production of waste-disposal sites in Wallonia, 1996-2005

3.4.5 Biodigestion of organic household waste

In August 2000, the biomethanisation plant operated by Itradec, an intermunicipal cooperative, was inaugurated at Havré, near Mons. It had required investment of EUR 15 million and will eventually be able to treat 54 000 tonnes of organic waste a year. The waste is pumped into the two digester tanks, each with a capacity of 3 800 cubic metres, where it ferments for three weeks before decomposing. During the fermentation process a renewable gas, with 55% methane content, is discharged.

In practice, the start-up in 2000 was a more laborious process than had been anticipated, and output was not particularly high. The installation comprises four 459-kilowatt motors and four boilers, each with 1 350 kilowatts of thermal power.

In 2005, a volume of about 47 terajoules of biogas was recovered, from which 4.1 gigawatt-hours of electricity and an estimated 10 terajoules of heat were generated, the latter being used to heat the fermentable waste prior to biomethanisation.

Total	Primary energy	Heat output	Gross electricity output	Net electricity output
in tep	1 133	239	354	285
in MWh	13 169	2 778	4 114	3 317
in TJ	47	10	15	12

Table 32 – Production of energy from biomethanised organic waste in Wallonia, 2005

Primary energy production has increased by 43% since start-up, although a fall of one per cent was registered from 2004 to 2005.

It should be noted that this is the first plant of its kind in the region, the only other installation of the same type in Belgium being located at Brecht, in Flanders.

3.4.6 Biomethanisation scoreboard

The overall output of biogas in the Walloon region is summarised in the table below. The preceding subsections have examined each of the production categories in greater detail.

Total	Primary energy	Heat output	Gross electricity output	Net electricity output
in ktoe	33.7	2.7	10.1	9.6
in GWh	391.7	31.7	117.8	112.0
in TJ	1409.9	114.2	424.2	403.2

Table 33 – Production of energy by means of biomethanisation in 2005

Year	Primary energy in TJ	Primary energy in GWh	1993=100	Heat recovered (TJ)	Gross electricity output (GWh)	Net electricity output (GWh)
1993	**89.6**	**24.9**	**100**	**56.6**	**1.5**	**1.4**
1994	152.2	42.3	170	137.3	1.0	0.9
1995	119.3	33.2	133	77.2	3.1	2.4
1996	135.4	37.6	151	78.7	6.8	6.2
1997	200.4	55.7	224	101.2	15.2	14.1
1998	542.5	150.7	606	72.3	38.5	36.4
1999	788.9	219.1	880	68.6	61.6	59.1
2000	932.7	259.1	1 041	108.3	75.3	72.1
2001	1 104.1	306.7	1 232	109.6	80.7	77.5
2002	1 090.6	302.9	1 217	117.9	87.0	82.7
2003	1 126.4	312.9	1 257	118.8	90.5	87.3
2004	1 489.9	413.9	1 663	131.8	117.5	110.9
2005	1 409.9	391.7	1 574	114.2	117.8	112.0

Table 34 – Development of energy production by means of biomethanisation in Wallonia, 1993-2005

Primary production of energy fell by 5% from 2004 to 2005, but the output of electricity rose by 0.3%.

3.4.7 Projects for the future in the Walloon region

The following two figures depict the recorded output of heat and electricity respectively from waste-disposal sites, sewage-treatment plants, biomethanisation of household or agricultural waste and biogas from the agrifood industry.

Four projects for the installation of large-scale digesters for organic household waste are currently under consideration in the Walloon region; these would take the fermentable element of household waste from the intermunicipal refuse centres; the waste would normally be sorted at source.

For more information, the Facilitator for Corporate Energy Production from Biomass and the Facilitator for Biomethanisation can be contacted by e-mail at the following address: irco@skynet.be.

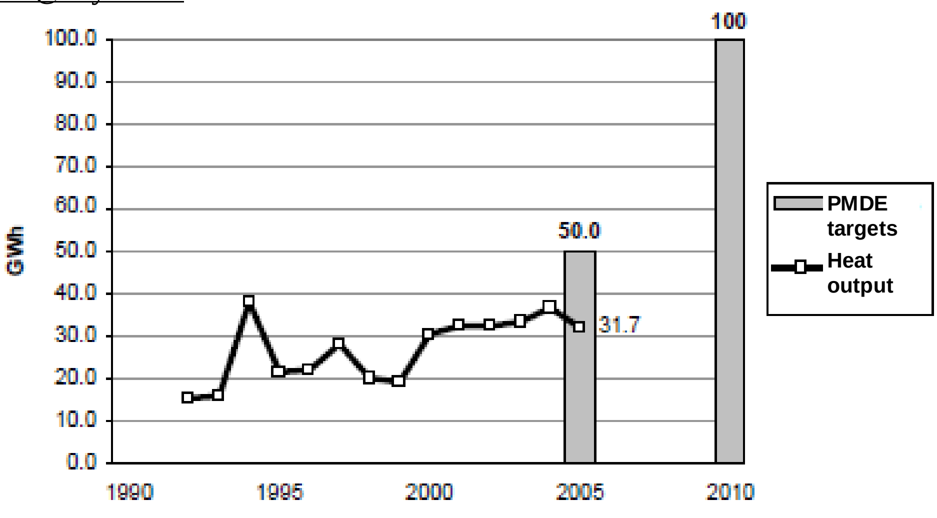


Figure 16 – Development of heat output from biogas and targets of the Plan for Sustainable Energy Management for 2005 and 2010 (in GWh)

Source: ICEDD – Plan for Sustainable Energy Management, December 2003

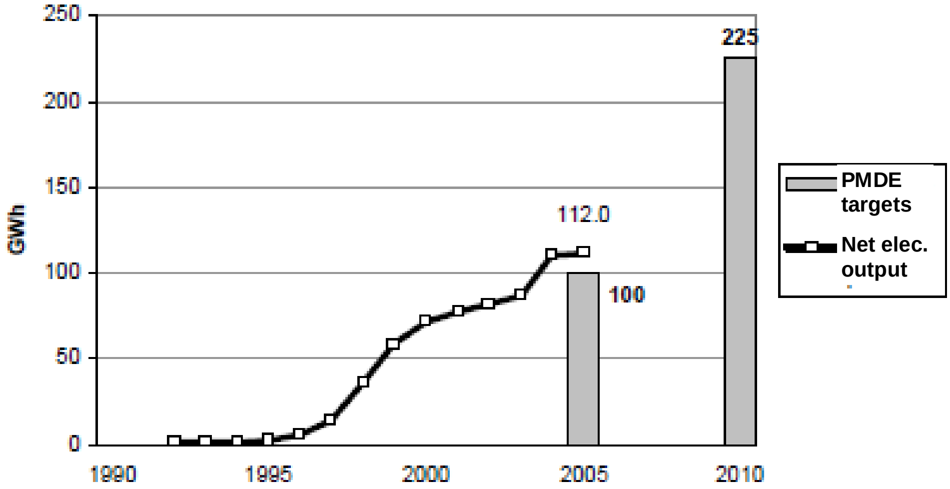


Figure 17 – Development of net electricity output from biogas and targets of the Plan for Sustainable Energy Management for 2005 and 2010 (in GWh)

Source: ICEDD – Plan for Sustainable Energy Management, December 2003

3.4.8 Biogas in Europe

Since the publication with the data for 2005 is not yet available, we shall reproduce the comments for 2004.

Between 1990 and 2000, the number of biogas plants in Europe grew slowly but steadily. From 2001 to 2002, output surged upward by 9.8% to 2 760 kilotonnes of oil equivalent. By 2003, the EU Member States' aggregate gross output had reached 3 219 ktoe, an increase of 7.3% on the previous year. These (2003) figures were corrected in 2004, with production put at 3 682 ktoe. The upward trend continued in 2004.

Country	2002	2003	2004
United Kingdom	1 076	1 253	1473
Germany	659	1 229	1291
France	302	204	210
Spain	168	257	275
Italy	155	201	203
Netherlands	149	109	110
Sweden	147	119	120
Portugal	76	76	76
Austria	59	38	42
Denmark	62	83	93
Belgium	56	42	43
of which Wallonia	*28*	*27*	*36*
Greece	42	32	32
Ireland	28	19	19
Finland	18	16	17
Luxembourg	2	4	5
Total EU 15	**2 999**	**3 682**	**4 009**
10 New Member States		90	108
Total EU 25		3 772	4 117

Table 35 – Gross output of biogas in the European Union in kilotonnes of oil equivalent, 2002-2004
Source: EurObserv'ER, European Barometer, 2004 (data for Wallonia from the ICEDD)

It should be noted, however, that the scorecard submitted to the IEA put Belgian output at 73 ktoe rather than the figure of 43 ktoe shown in the table above

3.5 Biofuels

3.5.1 Biofuels for transport

According to our information, there has been no biofuel production in Wallonia since 1995. Data from EurObserv'ER, however, indicate that the Pantochim company, part of the Sisas Group, continued to produce 20 000 tonnes a year at its Feluy works until 2000. It appears that this entire output was exported and was therefore not part of the Belgian energy mix. Besides, all production of biofuels was discontinued when BASF took over Pantochim in 2001.

Several large-scale production projects were launched following the Belgian Government's call for tenders for the production of biofuels as additives to fossil fuels in Belgium in general and Wallonia in particular.

The Néochim plant in Feluy is due to start producing biodiesel towards the end of 2006 and has a production capacity of 200 000 tonnes. In Wanze, a factory is likely to start producing bioethanol, a petrol additive; it will have an annual capacity of 300 million litres of bioethanol, to be produced chiefly from cereal crops. A sewage-treatment works with facilities for biogas recovery is also said to be planned for the same site, as is a biomass boiler for the recycling of by-products – altogether a fine integrated project in prospect. There are other projects in the pipeline, but appropriation decisions will have to be taken before any funds can be invested.

There are eight sites in Wallonia, located on farms, where rapeseed oil is pressed for use as agricultural fuel and for cogeneration. As soon as legislation permits, some of these installations will be able to sell oil to the general public as a tax-free motor fuel. The manufacturers' addresses are available from the Biofuels Facilitator through the website at energie.wallonie.be.

3.5.2 Other liquid biofuels

Lastly, in the IEA classification, vegetable oils which are used to generate electricity and/or heat are categorised under the heading of 'Other liquid biofuels'. This means that they are not bracketed together with motor fuels.

The output of two new installations will find its way into future statistics on other liquid biofuels, namely a 17.6-MW power plant in Mouscron belonging to Electrawinds and a combined heating and power plant operated by Renogen next to the Delhez timber-processing works with a cogeneration capacity of 3 MWe and 3.5 MWth.

3.6 Total energy generated from biomass

The following table summarises the data on primary production of thermal and electrical energy from biomass in 2005. Most of this biomass comprises vegetable by-products used in industry and fuel wood.

Renewable energy source	**Primary production in ktoe**	**Primary production in GWh**	**Trend, 2004 to 2005**	**Share (%)**	**Net electrical output (GWh)**	**Heat output (GWh)**	**Total recovery (GWh)**
Incineration of organic household waste	19.0	221.4	-20%	4.2%	32.9	0.0	32.9
Domestic fuel wood	98.7	1147.1	+ 6%	21.8%	0.0	1147.1	1147.1
Animal and vegetable by-products	300.9	3498.3	+ 18%	66.5%	346.1	2333.5	2679.6
Biodigestion of organic waste	1.1	13.2	-1%	0.3%	3.3	2.8	6.1
Fermentation of sewage sludge	0.3	3.4	-35%	0.1%	0.4	2.8	3.2
Fermentation of industrial effluent (1)	2.8	32.7	+ 30%	0.6%	6.1	20.7	26.8
Fermentation of agri-cultural effluent	0.8	9.8	+ 76%	0.2%	2.8	1.5	4.3
Gas from landfill sites	28.6	332.5	-9%	6.3%	99.4	4.0	103.4
Total	**452.2**	**5258.4**	***+11%***	***100%***	**491**	**3 512**	**4 003**

Table 36 – Summary of energy generation from biomass in Wallonia, 2005

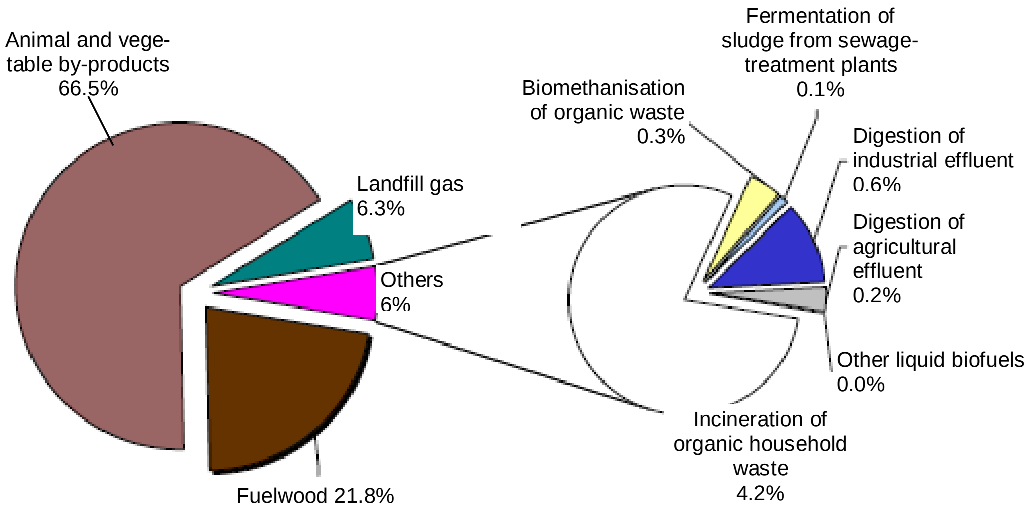


Figure 18 – Distribution by source of all energy generated from biomass in Wallonia, 2005

Further information is available which distinguishes between the use of biomass to generate electricity alone and its use in cogeneration systems.

Cogeneration plants fuelled by renewables have a total capacity of 41.3 megawatts of electrical power and 416 megawatts of thermal power, and their net electrical output has risen to 219 gigawatt-hours, which is more than 44% of the total net output of electricity from biomass. The heat output of cogeneration plants accounts for 61% of the total heat generated from renewable sources.

The table below gives details of Wallonia's cogeneration plants by renewable energy source. The column labelled 'Cogen. share of elec. output' shows the percentage contribution of cogeneration plants to the total electricity output from each renewable energy source. Similarly, the 'Cogen. share of heat output' shows their contribution to the total output of thermal energy.

Renewable energy source	**Number of cogen. plants**	**Electrical power (MWe)**	**Thermal power (MWth)**	**Primary production (GWh)**	**Gross elec. output (GWh)**	**Net elec. output (GWh)**	**Cogen. share of elec. output**	**Heat output (GWh)**	**Cogen. share of heat output**
Animal and vegetable by-products	5	30.9	398.6	2802.7	241.5	183.6	53.1%	2117.2	90.7%
Biodigestion of organic waste	1	1.6	5.4	13	4.1	3.3	100.0%	2.8	100.0%
Fermentation of sewage sludge	2	0.5	0.6	1	0.4	0.4	100.0%	0.8	27.6%
Fermentation of industrial effluent (1)	3	2.7	5.0	25	6.3	6.1	100.0%	13.0	62.7%
Fermentation of agricultural effluent	3	0.5	0.9	10	3.1	2.8	100.0%	1.5	99.7%
Gas from landfill sites	7	5.1	5.5	66	23.4	22.6	22.8%	4.0	100.0%
Total	**21**	**41.3**	**416**	**2918**	**278.9**	**219**	**44.6%**	**2 139**	**60.9%**

Table 37 – Summary of electrical and thermal energy cogenerated from biomass in Wallonia, 2005

4. General summary

4.1 Primary production

<u>General summary:</u>

Renewable primary energy: 488.0 ktoe (5 674 GWh)

of which 35.7 ktoe (416 GWh) came from sources other than biomass (7%)

and 452.2 ktoe (5 258 GWh) came from biomass (93%)

The production of renewable primary energy from biomass and other sources is summarised in the bar chart below.

Total primary production of renewables for use in Wallonia, including imported energy sources, came to 488 kilotonnes of oil equivalent in 2005, an increase of 10% on the previous year. It should, however, be pointed out that imports in the form of wood products account for almost 230 ktoe, which cannot therefore be regarded as local production in the strict sense of the term.

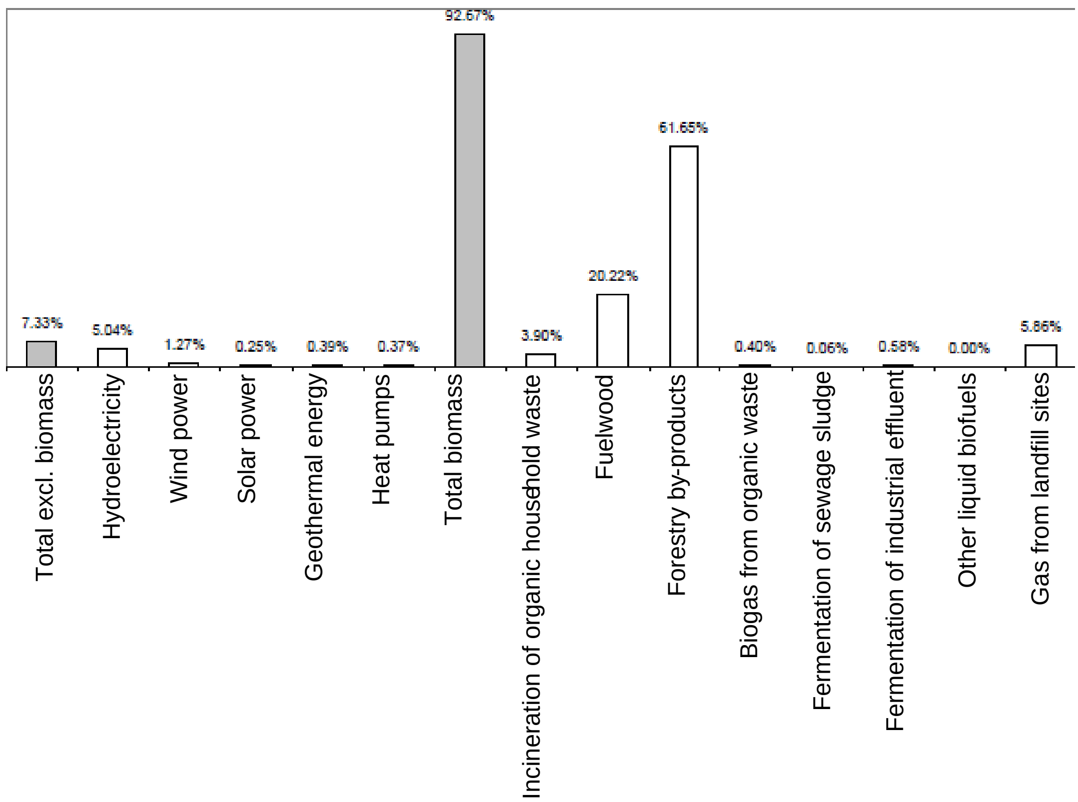


Figure 19 – Contribution of the various renewable energy sources to total production of renewable primary energy in Wallonia, 2005

With the incineration statistics being limited to the renewable element of household waste, it is observable that biomass accounts for the lion's share – 93% – of renewable energy sources and that fuel wood and forestry by-products alone make up 82% of the total. Of the sources other than biomass, only hydroelectric power plays a significant role with a share of slightly more than 5%.

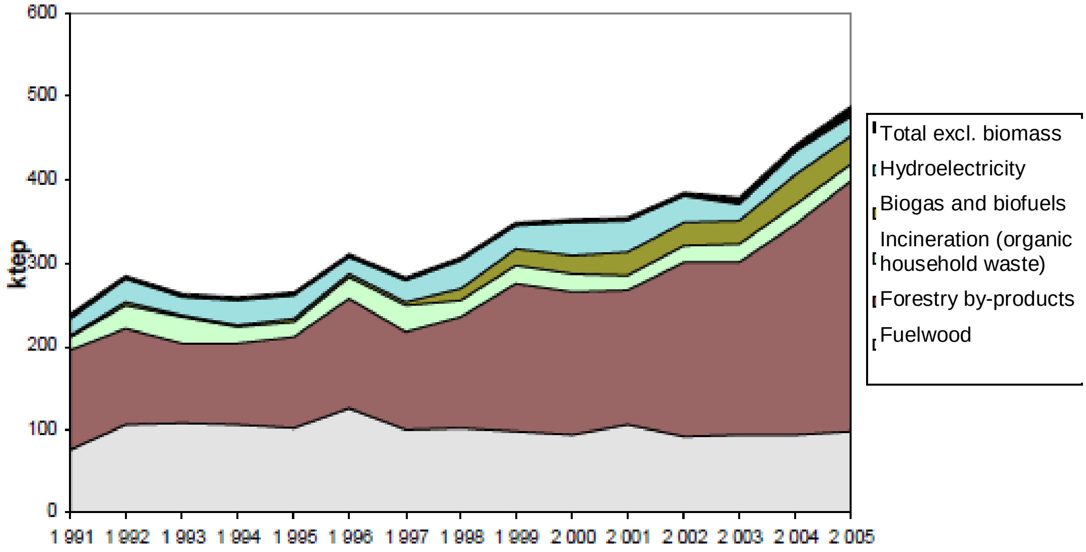


Figure 20 – Development of the contribution of the various renewable energy sources to total production of renewable primary energy in Wallonia, 1991-2005

Figure 20 above shows the rate of growth of renewable energy sources in the Walloon region.

From the 238 kilotonnes of oil equivalent recorded in 1991, which excludes the non-organic element of incinerated household waste, the contribution of renewables rose to 488 ktoe in 2005, an increase of 105%..

In terms of progress since 1991, biogas clearly leads the way, with a thirteen-fold rise, followed by forestry by-products, which have registered a 150% increase. The volume of fuel wood has evidently risen by only 30% and hydroelectricity by 25%.

It should be stressed, however, that wind power, which was not being harnessed at all in 1991, has advanced by 250% in the space of two years.

4.2 Electricity output

<u>General summary:</u>

Net electricity output: 842.4 GWh (72.4 ktoe)

of which 351.4 GWh came from sources other than biomass (42%)

and 491.0 GWh came from biomass (58%),

of which 32.9 GWh resulted from the incineration of organic material

The sharp increase in electricity output (+24%) continued from the previous year. Electricity generation from renewables other than biomass had peaked at 455 gigawatt-hours in the year 2000 and slumped to 269 GWh in 2003 before rising again to 355 GWh in 2004 and remaining close to that level in 2005, thanks to the progress of wind power. The volume of electricity generated from biomass was only 171 GWh in 2000, since when it has kept rising, reaching 325 GWh in 2004 and rocketing up to 491 GWh in 2005.

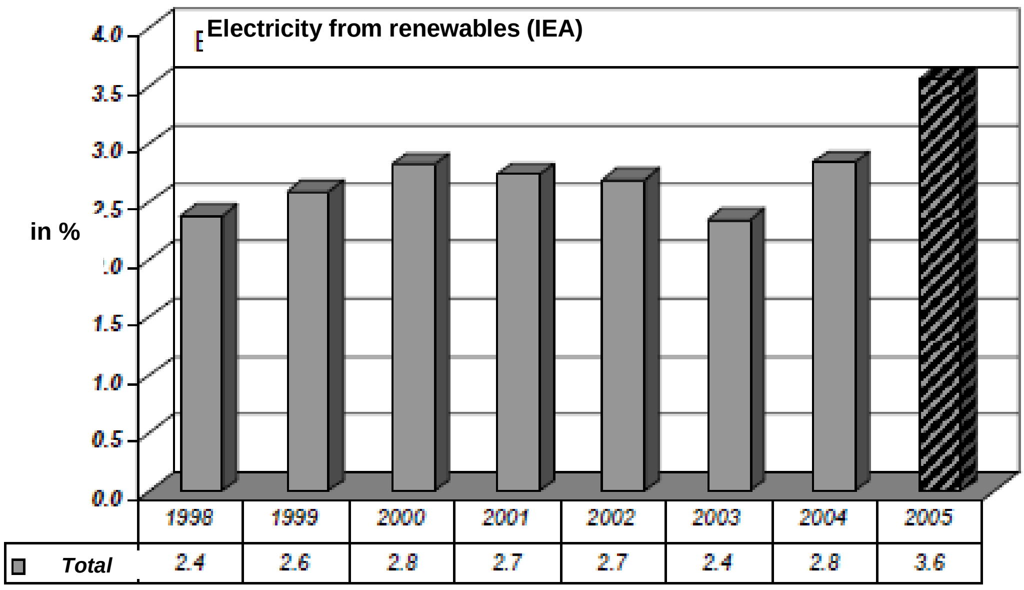


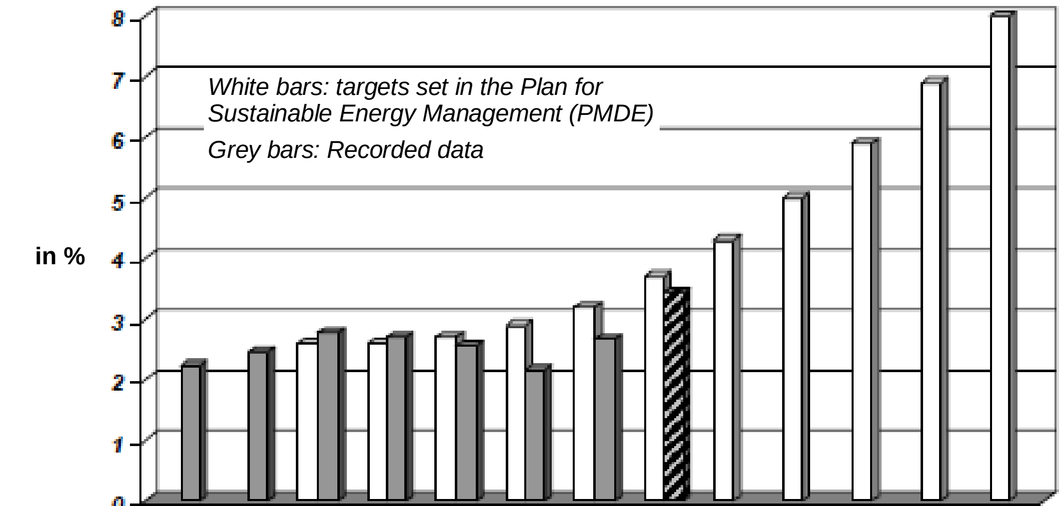
Figure 21 – Development of the contribution of green electricity to total electricity consumption in Wallonia, 1998-2005

The total output of electricity from renewable sources, including the incineration of organic material, represents 3.6% of the region's total electricity consumption, which was estimated at 23.6 terawatt hours for 2005.

The target set by the Plan for Sustainable Energy Management is to obtain 8% of Wallonia's electricity output from renewable sources by 2010, gradually increasing the percentage of green electricity from a starting point of 2.6% in 2000. These figures exclude electricity generated by means of incineration.

By way of comparison, an output of 809.5 GWh of green electricity represents 3.4% of estimated electricity consumption in 2005.

In Figure 22 below, we compare the targets set in the Plan for Sustainable Energy Management of December 2003 for the proportion of green electricity in total Wallonian electricity consumption with the statistics that have been recorded to date. The renewables drive seems to be getting back on course, and the forecasts for 2006 suggest that the target for that year will be met.



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ER PMDE			2.6	2.6	2.7	2.9	3.2	3.7	4.3	5.0	5.9	6.9	8.0
ER Réalité	2.2	2.4	2.8	2.7	2.6	2.2	2.7	3.4					

Figure 22 – Recorded trend in the contribution of electricity from renewable sources (excluding incineration) to electricity consumption in Wallonia and targets set in the Plan for Sustainable Energy Management, 1998-2010

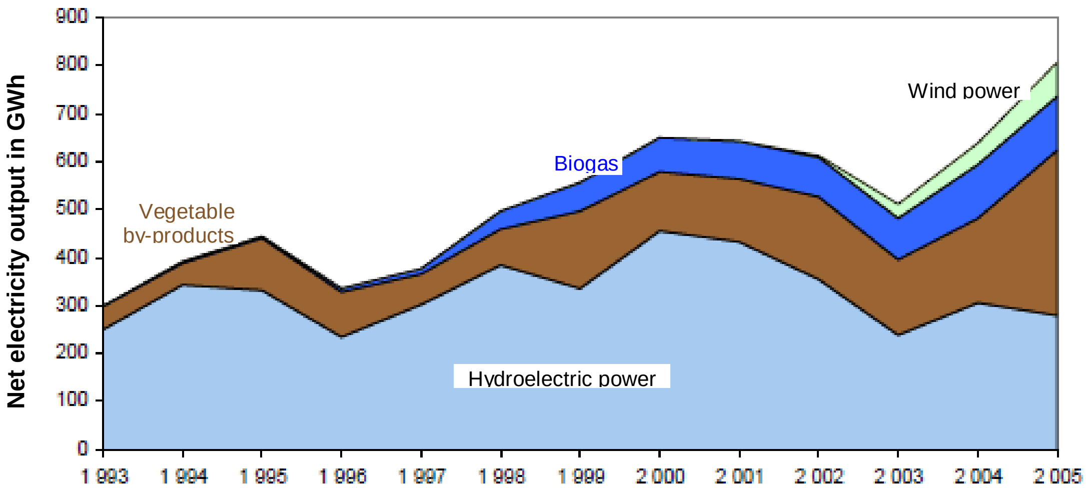


Figure 23 – Development of the contribution of various renewable energy sources (excluding incineration) to the total net output of electricity in Wallonia, 1993-2005

It is clearly observable, on analysing the above graph, that the only contributions to green electricity in 1993 were made by hydroelectric power and the combustion of vegetable by-products.

With the passage of time, new renewable energy sources have begun to make their mark, particularly the recovery of biogas produced in sewage-treatment plants, in landfill waste-disposal sites and, most recently, in agriculture. Lastly, wind power was first harnessed in 1997 but only began to make a perceptible impact from 2003 onwards.

The only energy sources represented in Figure 23 are those that account for 5% or more of green electricity output. Solar power, for example, is not yet a sufficiently significant factor to feature in the graph.

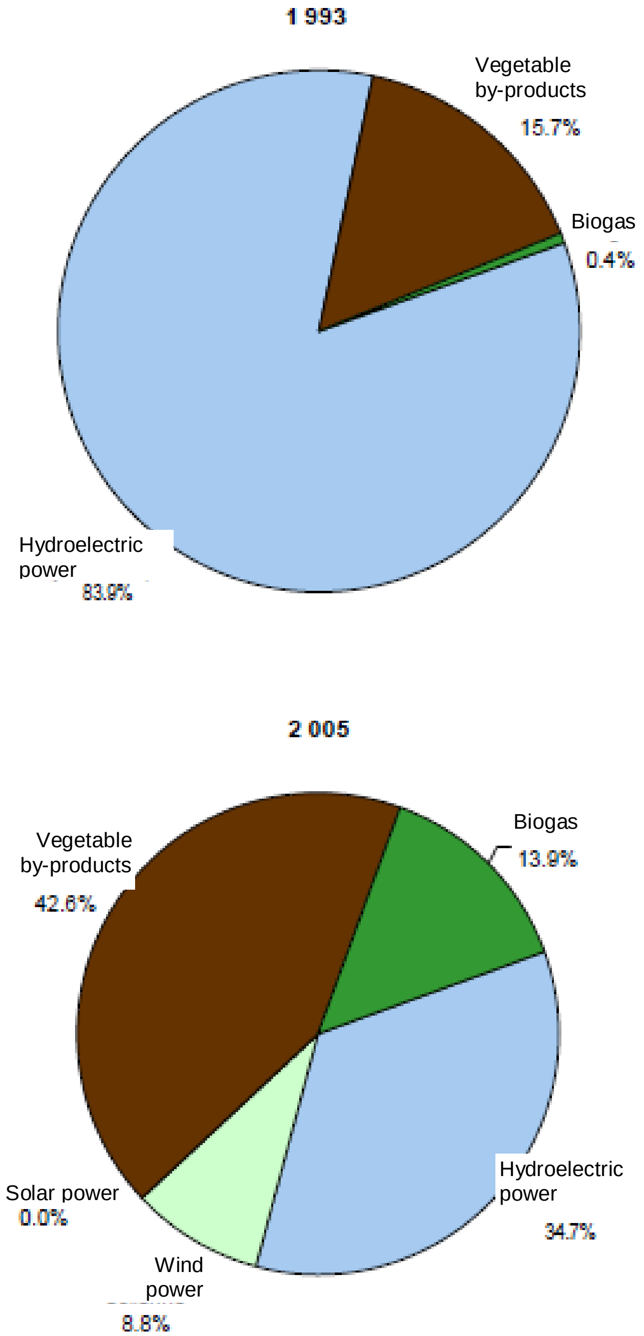


Figure 24 – Comparison of the contributions of the various renewable energy sources (excluding incineration) to net electricity output in Wallonia in 1993 and 2005

4.3 Heat output

<u>General summary:</u>

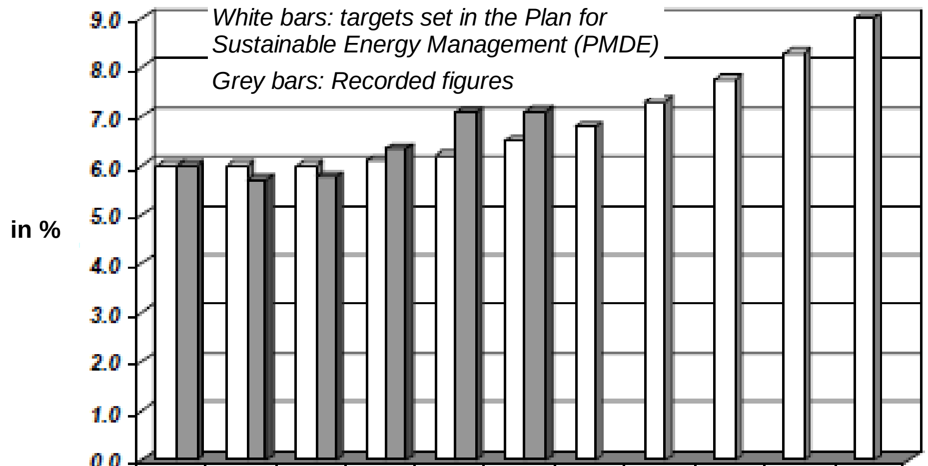
Heat output: 306 ktoe (3 553 GWh)

of which 3.5 ktoe (41.2 GWh) came from sources other than biomass (1%)

and 302.1 ktoe (3 512 GWh) came from biomass (99%)

Pending the appearance of the regional energy balance sheet for 2005, our provisional estimate puts the final heat requirement for the Walloon region at the same level as the total heat output in 2004, that is to say 4 455 kilotonnes of oil equivalent. Our 306 ktoe of heat output generated from renewables would therefore satisfy 6.9% of total demand.

If, however, we take account of the constant level of heat demand hypothesised for the period up to 2010 in the Plan for Sustainable Energy Management and estimated at 50 000 GWh or 4 300 ktoe, the proportion of heat output obtained from renewable energy sources would come to 7.1%, which would maintain the level achieved in 2004.



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ER PMDE	6.0	6.0	6.0	6.1	6.2	6.5	6.8	7.3	7.8	8.3	9.0
ER Réalité	6.0	5.7	5.8	6.3	7.1	7.1					

Figure 25 – Recorded trend in the contribution of heat from renewable sources (excluding incineration) to heat consumption in Wallonia and targets set in the Plan for Sustainable Energy Management, 2000-2010

The original target of 12% was revised downward, a new target of 9% being set for 2010.

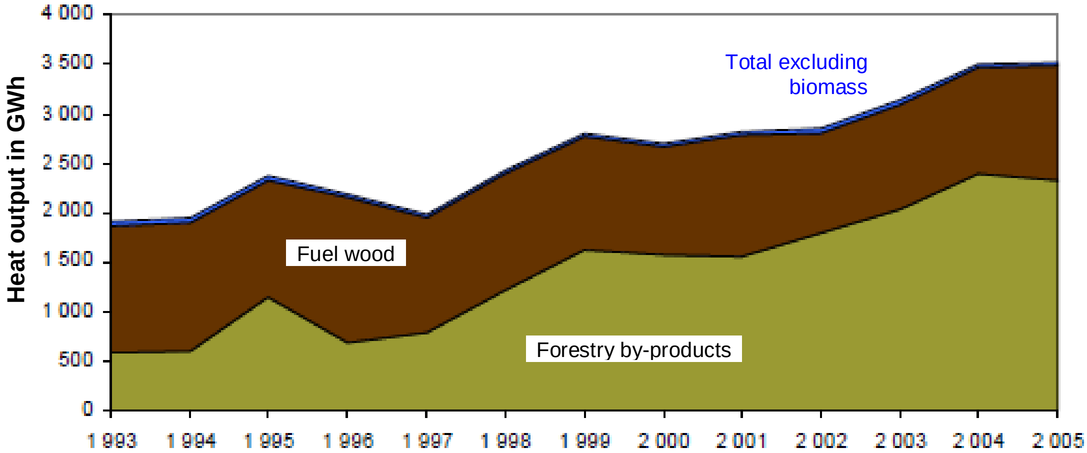


Figure 26 – Development of the contribution of various renewable energy sources to the total net output of useful heat in Wallonia, 1993-2005

The predominant role of wood as a renewable source of thermal energy is manifest, and the contribution of all other renewables is marginal. Accordingly, a representation of the trend for each source based on 1993 values provides more insight into their respective growth rates.

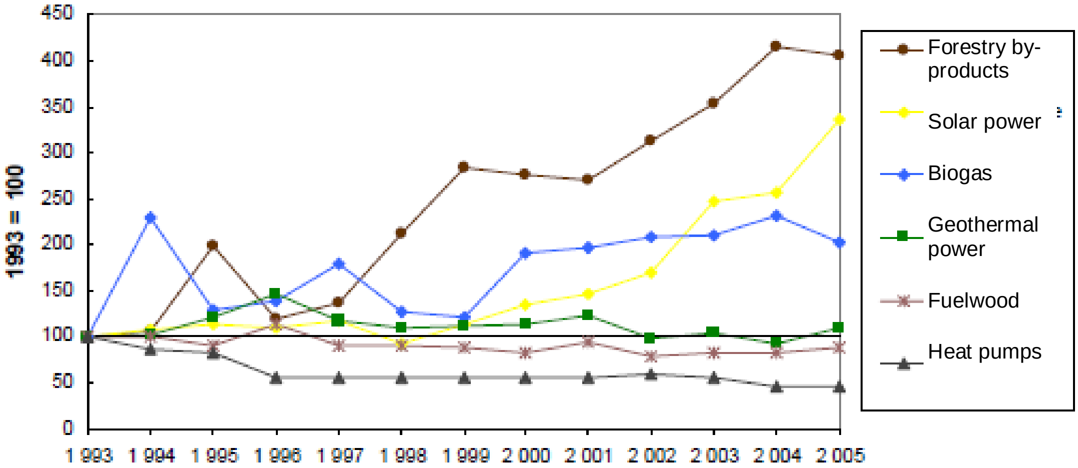


Figure 27 – Development of the output of useful heat by renewable source in relation to 1993 values (1993=100)

The healthiest growth rates have been achieved in the realms of forestry by-products, solar heating and the various forms of biogas from sewage sludge, effluent, landfill waste, etc. The figures for geothermal energy and fuel wood, on the other hand, have remained stable, while the use of heat pumps even seems to be in decline.

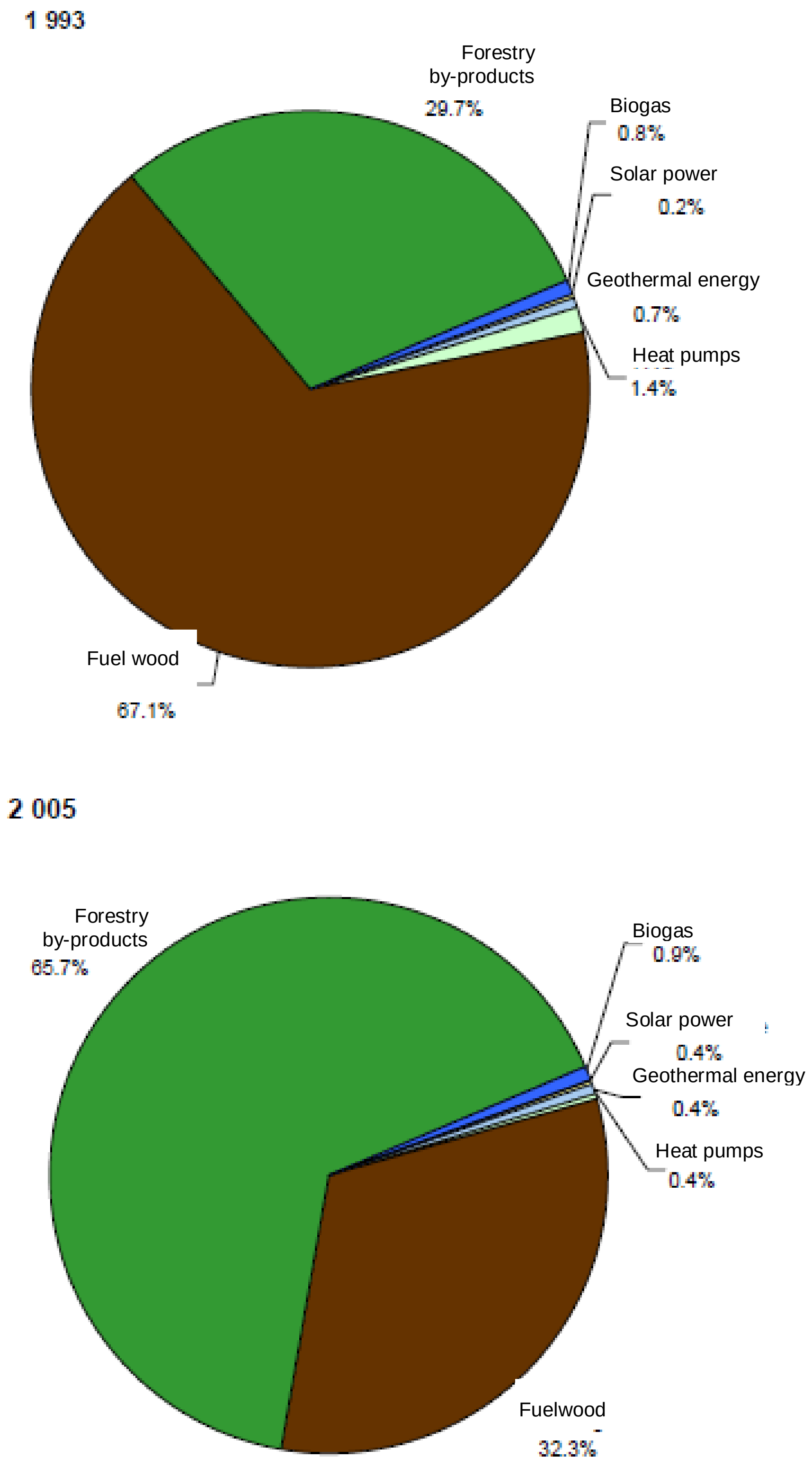


Figure 28 – Comparison of the contributions of the various renewable energy sources to the generation of useful heat in Wallonia in 1993 and 2005

KTOE VII = I + II – III + IV – V - VI	Biogas	Wood; vegetable by-products	Black liquor	Household waste	Other solid waste	Biofuels	Total biomass	Steam for heating	Electricity	Total excl. biomass	Total
I. Imports		**67.5**	**163.1**		**0.8**		**231.4**				**231.4**
II. Primary production and recovery	**33.7**	**127.2**	**40.8**	**19.0**	**0.1**		**220.8**	**4.9**	**30.8**	**35.7**	**256.5**
Hydroelectricity									24.6	24.6	24.6
Wind power									6.2	6.2	6.2
Solar electricity									0.0	0.0	0.0
Solar heat								1.2		1.2	1.2
Geothermal energy								1.9		1.9	1.9
Heat pumps								1.8		1.8	1.8
Incineration of household waste				19.0			19.0				19.0
Fuel wood		98.7					98.7				98.7
Animal and vegetable by-products		28.5	40.8		0.1		69.4				69.4
Fermentation of sewage sludge	0.3						0.3				0.3
Fermentation of industrial effluent	2.8						2.8				2.8
Biodigestion of org. household waste	1.1						1.1				1.1
Fermentation of agricultural effluent	0.8						0.8				0.8
Recovery of gas from landfill sites	28.6						28.6				28.6
Other liquid biofuels											
III. Start of transformation	**32.8**	**77.5**	**203.9**	**19.0**	**0.9**		**334.1**				**334.1**
Incineration of household waste				19.0			19.0				19.0
Animal and vegetable by-products		77.5	203.9		0.9		282.3				282.3
Fermentation of sewage sludge	0.1						0.1				0.1
Fermentation of industrial effluent	2.1						2.1				2.1
Biodigestion of org. household waste	1.1						1.1				1.1
Fermentation of agricultural effluent	0.8						0.8				0.8
Recovery of gas from landfill sites	28.6						28.6				28.6
Other liquid biofuels											
IV. End of transformation								**184.0**	**48.2**	**232.1**	**232.1**
Incineration of household waste									3.2	3.2	3.2
Animal and vegetable by-products								182.1	34.8	216.9	216.9
Fermentation of sewage sludge								0.1	0.0	0.1	0.1
Fermentation of industrial effluent								1.1	0.5	1.7	1.7
Biodigestion of org. household waste								0.2	0.4	0.6	0.6
Fermentation of agricultural effluent								0.1	0.3	0.4	0.4
Recovery of gas from landfill sites								0.4	8.9	9.3	9.3
Other liquid biofuels											
V. Consumption of own output									**7.2**	**7.2**	**7.2**
Hydroelectricity									0.5	0.5	0.5
Wind power									0.1	0.1	0.1
Heat pumps									0.7	0.7	0.7
Incineration of household waste									0.4	0.4	0.4
Animal and vegetable by-products									5.1	5.1	5.1
Fermentation of sewage sludge									0.0	0.0	0.0
Fermentation of industrial effluent									0.0	0.0	0.0
Biodigestion of org. household waste									0.1	0.1	0.1
Fermentation of agricultural effluent									0.0	0.0	0.0
Recovery of gas from landfill sites									0.4	0.4	0.4
Other liquid biofuels											
VI. Losses								**0.7**	**2.8**	**3.4**	**3.4**
Hydroelectricity									1.2	1.2	1.2
Wind power									0.3	0.3	0.3
Geothermal energy								0.7		0.7	0.7
Incineration of household waste									0.0	0.0	0.0
Animal and vegetable by-products									0.7	0.7	0.7
Fermentation, various									0.0	0.0	0.0
Recovery of gas from landfill sites									0.4	0.4	0.4
VII. Available for final consumption	**0.8**	**117.2**					**118.1**	**188.3**	**68.9**	**257.2**	**375.3**

Table 38 – Renewables balance sheet for Wallonia, 2005 (in ktoe)

GWh VII = I + II – III + IV – V - VI	Biogas	Wood; vegetable by-products	Black liquor	Household waste	Other solid waste	Biofuels	Total biomass	Steam for heating	Electricity	Total excl. biomass	Total
I. Imports		**785.2**	**1 897.0**		**8.7**		**2 691.0**				**2 691.0**
II. Primary production and recovery	**391.7**	**1 478.7**	**474.3**	**221.4**	**1.4**		**2 567.4**	**57.4**	**358.3**	**415.7**	**2 983.0**
Hydroelectricity									285.9	285.9	285.9
Wind power									72.3	72.3	72.3
Solar electricity									0.0	0.0	0.0
Solar heat								14.3		14.3	14.3
Geothermal energy								21.9		21.9	21.9
Heat pumps								21.2		21.2	21.2
Incineration of household waste				221.4			221.4				221.4
Fuel wood		1 147.1					1 147.1				1 147.1
Animal and vegetable by-products		331.5	474.3		1.4		807.1				807.1
Fermentation of sewage sludge	3.4						3.4				3.4
Fermentation of industrial effluent	32.7						32.7				32.7
Biodigestion of org. household waste	13.2						13.2				13.2
Fermentation of agricultural effluent	9.8						9.8				9.8
Recovery of gas from landfill sites	332.6						332.6				332.6
Other liquid biofuels											
III. Start of transformation	**382.0**	**900.6**	**2 371.3**	**221.4**	**10.1**		**3 885.4**				**3 885.4**
Incineration of household waste				221.4			221.4				221.4
Animal and vegetable by-products		900.6	2 371.3		10.1		3 282.0				3 282.0
Fermentation of sewage sludge	1.4						1.4				1.4
Fermentation of industrial effluent	25.0						25.0				25.0
Biodigestion of org. household waste	13.2						13.2				13.2
Fermentation of agricultural effluent	9.8						9.8				9.8
Recovery of gas from landfill sites	332.6						332.6				332.6
Other liquid biofuels											
IV. End of transformation								**2 139.4**	**560.0**	**2 699.3**	**2 699.3**
Incineration of household waste									37.1	37.1	37.1
Animal and vegetable by-products								2 117.2	405.0	2 522.3	2 522.3
Fermentation of sewage sludge								0.8	0.4	1.2	1.2
Fermentation of industrial effluent								13.0	6.3	19.3	19.3
Biodigestion of org. household waste								2.8	4.1	6.9	6.9
Fermentation of agricultural effluent								1.5	3.1	4.6	4.6
Recovery of gas from landfill sites								4.1	103.9	108.0	108.0
Other liquid biofuels											
V. Consumption of own output									**84.3**	**84.3**	**84.3**
Hydroelectricity									5.8	5.8	5.8
Wind power									1.1	1.1	1.1
Heat pumps									8.5	8.5	8.5
Incineration of household waste									4.2	4.2	4.2
Animal and vegetable by-products									59.0	59.0	59.0
Fermentation of sewage sludge									0.0	0.0	0.0
Fermentation of industrial effluent									0.2	0.2	0.2
Biodigestion of org. household waste									0.8	0.8	0.8
Fermentation of agricultural effluent									0.3	0.3	0.3
Recovery of gas from landfill sites									4.5	4.5	4.5
Other liquid biofuels											
VI. Losses								**7.7**	**32.3**	**40.0**	**40.0**
Hydroelectricity									14.4	14.4	14.4
Wind power									3.7	3.7	3.7
Geothermal energy								7.7		7.7	7.7
Incineration of household waste									0.5	0.5	0.5
Animal and vegetable by-products									8.4	8.4	8.4
Fermentation, various									0.2	0.2	0.2
Recovery of gas from landfill sites									5.1	5.1	5.1
VII. Available for final consumption	**9.7**	**1 363.2**					**1 373.0**	**2 189.0**	**801.7**	**2 990.7**	**4 363.6**

Table 39 – Renewables balance sheet for Wallonia, 2005 (in GWh)