Estimations of contribution expected from each renewable energy technology (Tables 4b, 10, 11 and 12)

1. The total contribution expected of each renewable energy technology to meet the mandatory 2020 targets should be indicated. This means more specifically that:

1.1. In Tables 10a and 10b, the hydro figures should be differentiated in accordance with the template into figures for '<1MW', '1MW–10 MW', '>10MW' and 'of which pumping'.

Pumping is not taken into consideration. The entire row therefore = 0.

	2005		2010		2011		2012		2013		2014	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
total	108.15	350.4	112.3	362.2	112.3	368.3	112.3	372.8	112.3	377.3	120.1	384
<1M	7.2	20.38	7.4	21.0	7.4	21.3	7.4	21.6	7.4	21.9	8.0	22.2
1-10MW	50.2	188.	52.1	195.1	60. 5	198.4	60.5	200.8	52.1	203.3	55.8	206.9
>10MW	50.8	141.3	52.7	146.1	45.3	148.5	45.3	150.4	52.7	152.2	56.4	154.9

	2015		2016		2017		2018		2019		2020	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
total	120.1	390.7	120.1	399.7	120.1	408.6	120.1	419.1	120.1	429.5	140	440
<1M	8.0	22.6	8.0	26.5	8.0	23.7	8.0	24.3	8.0	24.9	9.3	25.5
1-10MW	55.8	210.5	55.8	185.6	55.8	220.1	55.8	225.8	55.8	231.4	65.0	237.0
>10MW	56.4	157.6	56.4	187.6	56.4	164.8	56.4	169.0	56.4	173.2	65.7	177.5

1.2. In Tables 10a and 10b, the wind figures should be differentiated in accordance with the template into figures for 'onshore' and 'offshore'.

	2005		2010		2011		2012		2013		2014	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Wind	190.2	319.6	733.2	990.5	1016.2	1745.5	1222.7	2866.2	1429.7	4171.9	1738.9	5281.5
on-shore	190.2	319.6	684.2	839.5	811.2	1110.5	719.7	1308.2	569.7	1505.9	616.9	1802.5
off-shore	0	0	49	151	205	635	503	1558	860	2666	1122	3479

	2015		2016		2017		2018		2019		2020	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Wind	2048.6	6084.1	2461.6	7402.5	2874.6	8505	3356.4	9286.3	3838.2	9975.7	4320	10474
on-shore	763.6	2100.1	878.6	2495.5	1063.6	2891	1441.4	3349.3	1850.2	3812.7	2320	4274
off-shore	1285	3984	1583	4907	1811	5614	1915	5937	1988	6163	2000	6200

1.3. In Tables 10a and 10b, it should be indicated in accordance with the template what the contribution of 'Tide, wave, ocean' is.

The Belgian national strategy for renewable energy was drawn up in such a way as to take account of the substantial uncertainty surrounding the contribution that will be made by still immature technologies towards achieving the national objective in 2020 (and, to an even greater extent, in the intermediate periods).

For that reason, no contribution by technologies exploiting the energy potential of waves, the tide or the ocean has been provided for in the national action plan. It should be pointed out, however, that Belgium has already carried out some research in this area and is continuing to do so. In this context, it of course intends to take advantage of any opportunities which may arise in the event of such technologies undergoing a favourable development in the years ahead.

To conclude, the contribution expected from 'tide, wave, ocean' is zero.

1.4. In Tables 10a and 10b, it should be indicated in accordance with the template how much of the total renewable sources in electricity is in CHP.

	2005		2010		2011		2012		2013		2014	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Biomass	340	540	617.6	3006.9	762.3	3640.5	867.9	4102.9	973.5	4565.3	1131.8	5258.8
of which in CHP	54.4	75.6	148.2	661.5	183.0	837.3	199.6	984.7	223.9	1095.7	260.3	1314.7

	2015		2016		2017		2018		2019		2020	
	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh	MW	GWh
Biomass	1290	5952	1501	6877.1	1713	7801.9	1959	8880.8	2205	9959.6	2451.5	11039
of which in CHP	296.7	1488.1	360.3	1719.3	428.1	2028.5	509.3	2309.0	595.4	2689.1	661.9	2980.4

1.5. In Table 11, the figures for renewable energy in heat pumps should be differentiated in accordance with the template into figures for 'aerothermal', 'geothermal' and 'hydrothermal'.

	2005	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Renewable energy from heat pumps	*7.09*	*52.2*	*75.7*	*92.8*	*110*	*135.7*	*161.4*	*195.7*	*230*	*270*	*310*	*350*
of which aerothermal	*3.545*	*26.1*	*37.093*	*44.544*	*52.8*	*65.136*	*77.472*	*93.936*	*110.4*	*129.6*	*148.8*	*168*
of which geothermal	*2.836*	*20.88*	*31.037*	*38.048*	*45.1*	*55.637*	*67.788*	*82.194*	*96.6*	*113.4*	*130.2*	*147*
of which hydrothermal	*0.709*	*5.22*	*7.57*	*9.28*	*11*	*13.57*	*16.14*	*19.57*	*23*	*27*	*31*	*35*

1.6. In Table 11, it should be indicated in accordance with the template how much of the total renewable sources in heating and cooling is in district heating.

		2005	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
In GWh	*of which district heating*	*44.2*	*212.6*	*230.5*	*248.5*	*266.4*	*284.3*	*302.3*	*320.2*	*338.2*	*356.1*	*374.0*	*392.0*	*394.6*
in ktoe		*3.8*	*18.3*	*19.8*	*21.4*	*22.9*	*24.4*	*26.0*	*27.5*	*29.1*	*30.6*	*32.2*	*33.7*	*33.9*

1.7. In Table 11, it should be indicated in accordance with the template how much of the total renewable sources in heating and cooling is biomass in households.

ktoe	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Flemish Region	89	97	102	107	112	117	121	126	130	135	139	143
Walloon Region	98.6	125.4	131.9	139.4	144.8	151.3	156.5	163	168	175	179.7	184.9
Brussels Capital Region	3.7	**3.7**	**4.0**	**4.2**	**4.5**	**4.7**	**5.0**	**5.2**	**7.2**	**7.5**	**7.7**	**8.0**
Belgium	191.3	238.9	250.8	263.8	274.6	286.5	296.8	310	322	334	343.5	353.8

2. It should be clarified for the years 2015-2020 (where entries in row H and I in Table 4b are non-zero) why the entries in row C in Table 4b are different from the entries in the 'total' row in Table 12.

In the 'total' row in Table 12, account is taken of the double counting of quantities of biofuels from wastes, residues, non-food cellulosic material and ligno-cellulosic material and the factor of 2.5 applied to electricity from renewable energy sources consumed by road transport, as provided for in the Directive.

<u>Buildings (Q4.2.3):</u>

3. The projected increase of renewable energy use in buildings until 2020 should be provided, either in the form of Table 6 or otherwise according to the template for the National Renewable Energy Action Plans.

Insufficient data are available to allow a separate breakdown for residential, commercial, public and industrial buildings. Only an overall figure exists.

(%)	*2005*	*2010*	*2015*	*2020*
Residential	*NA*	*NA*	*NA*	*NA*
Commercial	*NA*	*NA*	*NA*	*NA*
Public	*NA*	*NA*	*NA*	*NA*
Industrial	*NA*	*NA*	*NA*	*NA*
Total	*1.2*	*2.3*	*6.2*	*10.5*

NA: not available

Renewable energy in transport support schemes (Q4.5):

4. The concrete obligations/targets per year (per fuel or technology) should be provided. They should refer to the period until 2020, as the reference period for the action plan.

The renewable energy target for transport in Belgium will be achieved mainly through the use of biofuels and, to a lesser extent, through an increase in the number of electric vehicles on the roads.

Various studies were taken into account in drawing up the tables. The figures were the product of intensive research. Particular attention was paid to:

- *developments in fuel consumption based on the BIOSES study. An extrapolation was made from the 2008 oil figures and the percentage rise and fall in petrol and diesel consumption;*
- *developments in biofuels, taking account of BIOSES studies and the application of existing legislation on mandatory blending to the developments foreseen in corresponding standards EN228 and EN590.*

2010	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
E4/B4	*E4/B4*	*E5/B5*	*E5/B5*	*E6/B6*	*E6/B6*	*E7/B6*	*E8/B6*	*E9/B7*	*E9/B8*	*E9/B9*

- *developments in electricity in transport on the basis of the BIOSES and MIRA studies;*
- *developments in the use of electricity from renewable sources in transport: obtained by multiplying electricity in transport by the European average for green electricity.*

Biomass supply (Q4.6.1):

4.1. It should be clarified whether Table 7a refers to 2006 (as was required by the template for the National Renewable Energy Action Plans), rather than 2020 as the title suggests; or otherwise an updated Table 7a should be provided with figures for 2006.

Table: Biomass supply in Belgium in 2006 (corrected)

Sector of origin	*Amount of domestic resource (ktonnes)*	*Imported (ktonnes)*		*Exported EU/Non-EU ktonnes)*	*Net amount (ktonnes)*	Primary energy production (ktoe)
		EU	*Non-EU*			
A) Biomass from forestry, of which :	**1 166.68**	**904.58**	**49.48**	**0.00**	**2 120.31**	**818.07**
1. direct supply of wood biomass from forests and other wooded land for energy generation	*532.17*	*0.00*	*0.00*	*0.00*	*532.17*	*211.54*
2. indirect supply of wood biomass for energy generation	*633.98*	*904.58*	*49.48*	*0.00*	*1 588.14*	*602.83*
B) Biomass from agriculture and fisheries	**1 835.35**	**74.40**	**33.26**	**0.00**	**1 913.01**	**87.39**
1. crops and fishery products	*30.00*	*0.00*	*33.26*	*0.00*	*63.26*	*29.69*
2. by-products and residues	*1 805.35*	*74.40*	*0.00*	*0.00*	*1 879.75*	*57.88*
C) Biomass from waste	**1 857.33**	**152.90**	**0.00**	**0.00**	**2 010.14**	**289.00**
1. biodegradable fraction of municipal solid waste	*1 528.50*	*152.90*	*0.00*	*0.00*	*1 681.30*	*232.51*
2. biodegradable fraction of industrial waste (including paper, cardboard, pallets)	*248.66*	*0.00*	*0.00*	*0.00*	*248.66*	*46.38*
3. sewage sludge	*80.17*	*0.00*	*0.00*	*0.00*	*80.17*	*10.09*

4.2. The conversion factor/calculation methodology used for Table 7a for the conversion of the amount of available resources to primary energy should be explained.

The following factors were used to convert the Flemish biomass inventory:

	GJ/tonne
Wood chips	*15.5*
Wood waste	*12.3*
Wood shavings	*15.9*
Wood pulp	*14.5*
Sawdust	*12.0*
Wood pellets	*17.0*
Olive stones	*14.2*
Sludge	*10*
Animal fat	*39*
Vegetable oil	*37*
Biogas yield from manure	*0.5*
Biogas yield from organic biological waste	*2.6*

In some cases enterprise-specific values were used.

The Walloon Region used the following conversion factors :

Biomass	*LHV*	*unit*
Wood, SRC (short rotation coppice) willow	*5*	*kWh/kg*
Bioethanol	*0.508*	*toe/m³*
Biodiesel	*0.5*	*toe/m³*
Miscanthus	*4.7*	*kWh/kg*
Straw	*3.8*	*kWh/kg*
Straw	*342*	*m³ biogas/TMF*
Beet leaf	*75*	*m³ biogas/TMF*
Maize by-products	*4.8*	*kWh/kg*
Maize straw	*402*	*m³ biogas/TMF*
Maize silage	*200*	*m³ biogas/TMF*
Green waste	*60*	*m³ biogas/TMF*
Fermentable fraction of household refuse	*115*	*m³ biogas/TMF*
Food processing by-products	*350*	*m³ biogas/TMF*
Agri-food industry waste	*500*	*m³ biogas/TMF*
Sludge from sewage treatment plants	*400*	*m³ biogas/TMF*
Vegetable fats	*10.8*	*kWh/kg*

The conversion factors used by the Brussels Capital Region are as follows :
1 tonne of wood = 0.3 toe
1 tonne de organic waste = 0.1014 toe

4.3. It should be specified on what basis the biodegradable fraction of municipal solid waste and of industrial waste was calculated for Table 7a.

Flemish Region :
On the basis of data from the household waste sorting campaign in Flanders in 2006 the renewable fraction of residual waste amounts to 47.78% on an energy basis. The method is described in the report entitled 'Bepaling van het hernieuwbaar aandeel van restafval' (Vito, April 2009) [Determining the renewable fraction of residual waste].

Walloon Region :
The biodegradable organic fraction of incinerated waste is estimated by default at 41%. This mass fraction rose from 30% in 1990-96 to 35 % in 1997-99, 40% in 2000 and 45% in 2001-03. Specific information on the organic fraction has been available since 2000 […] The LHV (lower heating value) of the organic fraction of waste is estimated at 4.24 GJ/t (ULB) (ICEDD)

Brussels Capital Region:
The regional incinerator treats over 500 000 tonnes of waste per year, 53% of which (mass fraction - data IBGE) is organic matter (i.e. 265 ktonnes). Based on an LHV of the organic fraction of 4.24 GJ/tonne (ADEME), that corresponds to 27.18 ktoe.

4.4. For Table 7b clarification should be provided regarding the agricultural biomass supply to be used for biofuels production: it should be clarified whether the data provided in the columns 'primary energy production' (2015 and 2020) include the final energy contained in biofuels or the primary energy from raw feedstock used to produce such biofuels.

When the Commission asked for primary energy from biomass, we supplied data corresponding to the primary energy contained in raw agricultural feedstock.

4.5. The plan indicates that biomass *from agricultural by-products / processed residues and fishery by-products* for energy generation amounted to 57.88 ktoe (1 879.75 tonnes) in 2006, and is estimated at 1 447.9 ktoe (2 460 tonnes) in 2015 and 540 ktoe in 2020 (5 450 tonnes). Considering that the 2015 estimate expressed in ktoe is very high compared to the two other figures, this should be clarified.

Table 7b: Estimated biomass domestic supply in 2015 and 2020 (corrected)

Sector of origin	2015		2020	
	Amount of domestic resource (ktonnes)	Primary energy production (ktoe)	Amount of domestic resource (ktonnes)	Primary energy production (ktoe)
A) Biomass from forestry, of which:	**1 892.78**	**732.03**	**2227.631**	**868.59**
1. direct supply of wood biomass from forests and other wooded land for energy generation	572.3	226.1.	572.3	225.1
2. indirect supply of wood biomass for energy generation	1 320.48	505.93	1 655.331	643.49
Biomass from agriculture and fisheries	**3 958.5**	**440.5**	**8 855.6**	**1 030.3**
1. agricultural crops and fishery products directly provided for energy generation	1 497.7	221.6	3 404.7	489.8
2. by-products and residues	2 460.8	218.9	5 450.9	540.5
C) Biomass from waste	**2 401**	**482.6**	**3 225.7**	**457.0**
1. biodegradable fraction of municipal solid waste	1 751.6	334.7	2 263.7	290.8
2. biodegradable fraction of industrial waste (paper, cardboard, pallets)	558.3	138.4	868	155.8
3. Sewage sludge	91.1	9.5	94	10.4

4.6. It should be specified what the estimated role of imported biomass is up to 2020 in terms of quantities expected (ktoe) with indication of possible import countries. This should amongst others clarify the figures of Table 12 which indicate no imports for

biofuels whereas the amount for agricultural crops in Table 7b would not seem sufficient for the level of biofuels.

The quantity of biomass which will have to be imported is estimated at 3 100 ktoe. The question of possible import countries depends on developments on the international biomass market. Belgium imports wood pellets from Canada, United States, Germany, Netherlands, Portugal, Estonia, Latvia, Lithuania and South Africa.

Generally speaking, it seems rather unrealistic to consider it possible to supply precise data on the origin of imports in 2020. We can however estimate that most will come from the same sources as at present.

Biomass mobilisation (Q4.6.2):

5. Where it concerns impact on other sectors, although it is indicated how developments in agriculture and forestry could have an impact, it should be clarified what kind of development is expected in other *sectors based on* agriculture and forestry that could have an impact on energy use.

At this stage, Belgium has no information that would allow it to estimate expected developments in other sectors based on agriculture and forestry which could have an impact on energy recovery from biomass.