Submission by Hungary and the European Commission on behalf of the European Union and its Member States

Budapest, 8 April, 2011

Subject: **Submission of information on forest management reference levels by the European Union as requested by Decision 2/CMP.6: The Cancún Agreements: Land use, land-use change and forestry**

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Submission of information on forest management reference levels by the European Union as requested by Decision 2/CMP.6: The Cancún Agreements: Land use, land-use change and forestry

Decision 2/CMP.6, paragraph 4 requests Parties to submit information concerning the forest management reference levels (FM-RL) inscribed in Annex 1 to the Decision. This submission by the European Union (EU) responds to that request, and complements the submissions made by its 27 Member States (MSs) individually, which are provided as separate annexes to this submission. This submission updates and replaces previous information informally submitted by the EU, most recently dated 23rd July 2010.

This submission also reflects updates to the methodologies used by MSs in their national GHG inventories of 2011 (covering UNFCCC forest emissions and removals data for 1990-2009 and, where applicable, Art 3.4 Forest Management emissions and removals data for 2008-2009)[1], which required modifications of FM-RLs proposed by EU MSs in Annex I to decision 2/CMP.6, if necessary.

The FM-RLs presented in this submission are based on the EU's understanding of how FM-RLs are to be applied – currently described in the draft LULUCF accounting rules, as contained in FCCC/KP/AWG/2010/CRP.4/Rev.4. If, later and in the course of negotiations, FM-RLs are to be understood, substantially modified or used differently, the EU may revisit these values before adoption in a final LULUCF decision.

Consistent with the EU's GHG inventories, the RL for the EU data is the sum of RLs provided by individual MSs. For the time being, the totals for the EU are not included because one MS, i.e., Poland, has not made its submission yet. When Poland's submission is made (expected before the end of April), the EU will re-submit its report on FM-RLs, including the totals for the EU, and reflecting the necessary updates in the text to reflect Poland's methodology.

As described in more detail below, the methodologies used by EU MSs to derive reference levels include: (i) country-specific approaches (9 MSs); (ii) an approach elaborated by the Joint Research Centre (JRC) of the European Commission relying on independent EU modelling groups coordinated by the International Institute for Applied Systems Analysis (IIASA) (15 MSs); (iii) linear extrapolation of historical trends (1990-2008) of forest land remaining forest land (2 MSs). For the full detail on each of these approaches please consult the relevant annexes.

[1] Due to the timing of the present submission, in some cases it was not possible to include all the methodological updates that EU MSs will include in their GHG inventories 2011 (to be submitted to UNFCCC by 15th April). The EU expects that the review will make use of the most recent NIRs available on the UNFCCC website.

1 Forest management reference level value

The EU proposes the FM-RLs contained in **Table 1**. Two values are presented for each MS and for the European Union, depending on how the accounting for Harvested Wood Products (HWP) is made. One is based on a first order decay function as described in FCCC/KP/AWG/2010/CRP.4/Rev.4 and, for transparency and comparability reasons, another value is provided based on instantaneous oxidation of HWP at the time of harvest.

The proposed FM-RLs assume that future Art 3.4 FM accounting rules will contain a provision allowing for technical corrections, ensuring methodological consistency between methodologies and data used in calculating the proposed FM-RLs and the methodologies and data used for reporting and accounting during the second commitment period.

The proposed FM-RLs also assume that future Art 3.4 FM accounting rules will contain provisions for the treatment of *force majeure*, generically understood as low probability large emissions beyond the control of Parties. Some FM-RLs contain a background level of forest disturbance emissions, based on historical data. That level is expected to occur during the commitment period and in some cases, where noted in the submissions by MSs, excludes emission levels associated with low probability large levels of disturbances. For more details, please consult the individual MSs' submissions (**Annex 2** of this submission).

The EU assumes that credits and debits resulting from the comparison between FM-RLs and the emissions and removals reported during the commitment period will be subject to quantitative limitations.

FM-RLs were calculated as averages of the projected emissions and removals from areas under Art 3.4 FM for the period 2013-2020, taking into account the impact of policies implemented before mid-2009. The FM-RL for the EU is the sum of values proposed by its 27 MSs.

All MS Annexes are of the responsibility of the respective MS.

Table 1. Proposed Forest Management Reference Levels for the European Union and its MSs.

Member State	Proposed Reference Level (GgCO2eq per year)	
	applying first order decay function for HWP	assuming instantaneous oxidation of HWP
Austria	-6,516	-2,121
Belgium	-2,501	-2,435
Bulgaria	-9,177	-9,522
Cyprus	-156	-164
Czech Republic	-5,576	-3,577
Denmark	359	243
Estonia	-2,683	-1,728
Finland	-20,100	-19,300
France	-66,834	-62,741
Germany	-21,582	-2,067
Greece	-1,560	-800
Hungary	-452	-572
Ireland	-207	-73
Italy	-16,239	-14,331
Latvia	-16,115	-14,293
Lithuania	-4,387	-4,034
Luxembourg	-418	-418
Malta	-49	-49
The Netherlands	1,438	-1,578
Poland	*	*
Portugal	-6,827	-6,480
Romania	-28,465	-28,044
Slovakia	-1,631	-216
Slovenia	-3,171	-3,033
Spain	-23,889	-21,442
Sweden	-41,336	-36,057
UK	-8,268	-3,442
European Union	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of the 27 MS and will be reported after the submission of Poland has been completed.*

2 General description

Different approaches were applied to arrive at each of the values for FM-RLs, as presented in **Table 1**. These differences are justified by the diversity of forests types and management systems in MSs and the national differences with respect to the availability of data and applicability of models.

The approach followed by all MSs was to calculate the FM-RL as an annual average of projected emissions and removals for the period 2013-2020, including the impacts of policies adopted and implemented by mid-2009, to address the notion of additionality of action during the second commitment period.

The methodologies applied by MSs to arrive at projected emissions and removals for the period 2013-2020 can be grouped as described below (see **Table 2** for details). Of the 26 MSs for which data estimates are already available, the first group comprises 9 MSs that developed country-specific methodologies for the estimation of FM-RLs. The relevant Annexes contain details on the methodology used by these MSs. A second group comprises 15 MSs for which EU DG JRC developed projections in collaboration with independent EU modelling groups (identified as *JRC/IIASA/EFI projections*). Additional details on the methodology used by this group are included in **Annex 1** to this submission. The third group contains 2 MSs for which the linear extrapolation of historical data (1990-2008) of forest land remaining forest land was used. This latter approach was followed because insufficient data were available for these countries to produce a robust projection by models[2].

Table 2. Type of methodology used to develop the estimates for projected emissions and removals by each MS.

Member State	Type of methodology
Austria	Country-specific methodology
Belgium	JRC/IIASA/EFI
Bulgaria	JRC/IIASA/EFI
Czech Republic	JRC/IIASA/EFI
Cyprus	Extrapolation of historical data
Denmark	Country-specific methodology
Estonia	JRC/IIASA/EFI
Finland	Country-specific methodology
France	JRC/IIASA/EFI
Germany	Country-specific methodology
Greece	JRC/IIASA/EFI
Hungary	JRC/IIASA/EFI
Ireland	Country-specific methodology
Italy	JRC/IIASA/EFI
Latvia	JRC/IIASA/EFI
Lithuania	JRC/IIASA/EFI
Luxembourg	JRC/IIASA/EFI
Malta	Extrapolation of historical data
Netherlands	JRC/IIASA/EFI
Poland	*
Portugal	Country-specific methodology
Romania	JRC/IIASA/EFI
Slovakia	JRC/IIASA/EFI
Slovenia	Country-specific methodology
Spain	JRC/IIASA/EFI
Sweden	Country-specific methodology
United Kingdom	Country-specific methodology

JRC/IIASA/EFI: *Elaboration by JRC (Joint Research Centre of the European Commission) of projections produced by IIASA (International Institute for Applied Systems Analysis) and EFI (European Forest Institute)*
Extrapolation of historical data*: Linear extrapolation of historical data (1990-2008) of forest land remaining forest land, as submitted in the context of the EU GHG monitoring mechanism (Council Decision 280/2004/EC)*

** Information for Poland will be reported later.*

When constructing the RL, the elements mentioned in footnote 1 of paragraph 4 of the decision 2/CMP.6: The Cancún Agreements: Land use, land-use change and forestry, have been taken into account as follows. Please refer also to individual MS Annexes for detail on how this was done for MSs using country-specific methodologies.

[2] Given the small forest area concerned the impact of this latter approach on the EU reference level is very small (in the period 1990-2008 the sink reported for forest land remaining forest land by these two countries was equivalent to 0,05% of the total EU sink).

(a) Removals or emissions from forest management as shown in greenhouse gas inventories and relevant historical data: MSs have devoted significant efforts to ensure methodological consistency between the proposed FM-RLs emissions and removals reported in historical data (notably, GHG inventories). For Cyprus and Malta (which are not Annex-I Parties) the GHG inventories submitted to EU in the context EU GHG Monitoring mechanism (Council Decision 280/2004/EC) were used.

(b) Age-class structure: MSs have used the latest available information on age structure in their estimates.

(c) Forest management activities already undertaken: these are indirectly taken into account through the use of the latest available forest time series data (from national forest inventory or other country statistics), and, in some cases, by considering macroeconomic drivers and the application of policies adopted and implemented in MSs by mid-2009.

(d) Projected forest management activities under a business as usual scenario: the approach generally followed by MS was to make full correspondence between the proposed FM-RL and the average annual emissions and removals resulting from the projected management activities under a business as usual scenario, limited to the impact of policies adopted and implemented by mid-2009.

(e) Continuity with the treatment of forest management in the first commitment period: Some of the proposed FM-RLs has considered this element.

(f) The need to exclude removals from accounting in accordance with decision 16/CMP.1, paragraph 1: The EU considers that dynamic effects of age class structure have the biggest effect and are explicitly factored out by the RL approach. The other effects are factored out to a reasonable approximation by taking the difference between the RL and the net removals.

Consistency with the inclusion of carbon pools: All MSs ensure in the construction of their FM-RL consistency with the provisions of paragraph 25 of FCCC/KP/AWG/2010/CRP.4/Rev.4. Full consistency will be ensured between the carbon pools and GHG sources included in FM-RLs and the carbon pools and GHG sources included in the reporting and accounting during the second commitment period.

RLs including and excluding force majeure should be provided: Some MSs have included a background level of disturbance emissions in their FM-RLs. However, these emissions do not generally include assumptions about large scale, low probability events, whose occurrence is unpredictable.

3 Pools and gases

Table 3 presents a summary of all the carbon pools and greenhouse gases included in the proposed FM-RL by each MS.

Table 3. A broad summary of C pools and GHG sources included in the reference level by MS. For further details please refer to the submissions of the individual MSs.

Member State	Change in C pool included in the reference level						GHG sources included in the reference level					
	Above-ground biomass	Below-ground biomass	Litter	Dead wood	Soil			Drainage	Liming	Biomass burning		
					mineral	organic	N_2O	N_2O	CO_2	CO_2	CH_4	N_2O
Austria	Yes	Yes	Yes	Yes						Yes		
Belgium	Yes	Yes	Yes	Yes	Yes							
Bulgaria	Yes	Yes								Yes	Yes	Yes
Cyprus	Yes	Yes										
Czech Republic	Yes	Yes							Yes	Yes	Yes	Yes
Denmark	Yes	Yes	Yes	Yes								
Estonia	Yes	Yes				Yes				Yes	Yes	Yes
Finland	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes
France	Yes	Yes	Yes	Yes	Yes					Yes	Yes	Yes
Germany	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Greece	Yes	Yes								Yes	Yes	Yes
Hungary	Yes	Yes								Yes	Yes	Yes
Ireland	Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes
Italy	Yes	Yes								Yes	Yes	Yes
Latvia	Yes	Yes				Yes		Yes		Yes	Yes	Yes
Lithuania	Yes	Yes	Yes	Yes	Yes	Yes		Yes		Yes	Yes	Yes
Luxembourg	Yes	Yes										
Malta	Yes	Yes										
Netherlands	Yes	Yes	Yes	Yes								
Poland	*	*	*	*	*	*	*	*	*	*	*	*
Portugal	Yes	Yes	Yes	Yes	Yes					Yes	Yes	Yes
Romania	Yes	Yes								Yes	Yes	Yes
Slovakia	Yes	Yes								Yes	Yes	Yes
Slovenia	Yes	Yes										
Spain	Yes	Yes								Yes	Yes	Yes
Sweden	Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes
UK	Yes	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes

"Yes" indicates a pool or gas that is included in MS FM-RL (including pools and gases "included elsewhere" in the accounting). ***Empty cells*** *indicate a carbon pool which is not expected to be a source in the second commitment period or a carbon pool/GHG source which is negligible or "not occurring". In some cases, emissions are reported elsewhere or will be reported later, e.g. as soon the necessary methodology will be ready. In any case, full consistency will be ensured with paragraphs 15 quater, 15 quinquies and 25 of the document FCCC/KP/AWG/2010/CRP.4/Rev.4. For further details please refer to the submissions of the individual MSs.*

** Data for Poland will be submitted later.*

In general, pools and gases included above are the same as those used by MSs in their last submitted National Inventory to the UNFCCC and KP. For more details please refer to the individual MS submissions.

4 Approaches, methods and models used

As already indicated the EU FM-RLs results from the compilation of the FM-RLs proposed by its individual MSs, or estimated with their agreement by JRC. Detailed descriptions of the approaches, methods and models that were used in the FM-RLs are given in **Annex 1** and in the individual MS submissions.

5 Description of construction of reference levels

5.1 Elements considered in the construction of the forest management reference level

5.1.1 Area under forest management

Table 4 presents a summary of the forest areas that were, in general, considered in the respective FM-RLs. For comparison, the area reported for forest land remaining forest land is also included. For detailed information on how these areas were considered in the construction of FM-RLs please refer to **Annex 1** and individual MS submissions.

Table 4. Area of forest management reported under KP (if FM was elected) and area forest land remaining forest land reported under the Convention in 2008.

Member State	Area reported under Forest Management (1000ha)	Area reported under Forest land remaining forest land (1000ha)
Austria		3,994
Belgium		692
Bulgaria		3,595
Cyprus		173
Czech Republic	2,563	2,563
Denmark	533	533
Estonia		2,318
Finland	21,873	22,031
France	21,345	21,345
Germany	10,873	10,873
Greece	1,167	3,356
Hungary	1,657	1,979
Ireland		485
Italy	7,451	8,839
Latvia	3,132	3,221
Lithuania	1,905	2,150
Luxembourg		85
Malta		1
The Netherlands		327
Poland	*	*
Portugal	3,766	3,404
Romania	6,696	6,728
Slovakia		1,880
Slovenia	1,185	1,185
Spain	12,577	12,577
Sweden	28,376	27,829
UK	1,376	1,398
European Union	**	**

** Data for Poland will be submitted later.*

In most cases, areas reported under “forest land remaining forest land” are very similar to those reported for “forest management”. Please refer to specific country Annexes for more information on the reasons for the differences in the case of MSs using country-specific methodologies.

5.1.2 Emissions and removals from forest management

5.1.2.1 Historical and projected emissions and removals from forest management

Emissions and removals from forest management are the sum of emissions and removals from all the pools listed in **Table 3**.

The tables below present the latest estimates for historic and projected emissions and removals from forest management reported for the period between 1990 and 2020. **Tables 5a** and **5b** include all emissions and removals from all carbon pools and gases listed in **Table 3**, including the HWP pool, estimated using the first order decay functions described in document FCCC/KP/AWG/2010/CRP.4/Rev.4. **Tables 6a** and **6b** include all emissions and removals from all carbon pools and gases listed in **Table 3**, assuming instantaneous oxidation of all harvested wood.

Table 5a. Historical emissions and removals from forest management (all pools listed in **Table 3**, including HWP applying a first order decay function, and GHG, Gg CO_2 eq).

Member State	Net Removals (-) or Net Emissions (+) (GgCO2eq per year)																		
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	average of
Austria	-14,384	-18,912	-13,600	-17,281	-17,255	-16,421	-12,310	-20,989	-19,190	-23,212	-17,412	-20,977	-18,503	-17,454	-17,538	-17,569	-14,173	-12,192	**-17,187**
Belgium	-3,508	-3,015	-3,309	-3,236	-3,258	-3,091	-3,138	-3,155	-3,051	-3,631	-2,636	-2,787	-4,043	-4,165	-3,815	-3,934	-3,511	-2,934	**-3,345**
Bulgaria	-13,628	-13,797	-12,620	-12,163	-12,192	-12,719	-11,792	-11,858	-11,666	-11,635	-10,202	-10,919	-11,436	-11,474	-11,949	-11,792	-11,894	-11,556	**-11,961**
Cyprus	-160	-168	-169	-119	-134	-166	-170	-155	15	-183	-148	-111	-160	-146	-153	-157	-148	-110	**-141**
Czech Republic	-5,165	-9,614	-10,854	-9,816	-7,646	-7,753	-7,955	-7,084	-7,572	-7,627	-8,339	-8,651	-8,350	-6,948	-7,321	-7,703	-5,461	-3,323	**-7,621**
Denmark	-1,060	-1,183	-867	-1,376	-1,031	-1,174	-778	-800	-654	-374	587	860	552	670	777	377	-464	-925	**-381**
Estonia	-8,051	-7,801	-9,495	-9,261	-6,950	-6,991	-7,174	-5,647	-5,333	-1,558	-1,644	-3,809	-3,409	-5,546	-7,911	-7,931	-8,713	-8,784	**-6,445**
Finland	-23,967	-37,312	-31,111	-29,089	-21,461	-21,188	-30,470	-27,187	-25,128	-28,079	-29,994	-33,596	-34,640	-35,740	-35,336	-38,041	-41,930	-34,291	**-31,031**
France	-50,765	-45,611	-49,395	-56,550	-62,030	-58,210	-61,045	-65,597	-66,841	-71,102	-59,758	-65,631	-69,676	-70,459	-74,124	-75,574	-81,134	-81,086	**-64,699**
Germany	-75,997	-72,479	-72,432	-72,628	-76,355	-75,763	-75,203	-76,221	-75,437	-75,752	-79,499	-75,096	-33,488	-35,937	-40,189	-41,831	-43,369	-43,574	**-63,403**
Greece	-1,730	-1,808	-1,912	-2,729	-2,310	-2,410	-2,315	-1,788	-1,851	-1,954	-2,189	-2,261	-2,489	-2,387	-2,375	-2,463	-2,269	-2,464	**-2,206**
Hungary	-2,975	-3,003	-3,414	-5,007	-5,751	-5,337	-1,326	-1,678	-2,370	-744	254	-1,145	-545	-2,387	-1,330	-3,662	-1,466	-1,720	**-2,422**
Ireland	-1,925	-2,374	-2,162	-2,106	-1,907	-1,962	-1,832	-1,650	-1,924	-2,015	-1,828	-1,497	-1,871	-2,216	-1,949	-2,198	-2,136	-1,857	**-1,967**
Italy	-17,830	-30,142	-27,447	-17,161	-27,854	-32,585	-30,243	-23,554	-21,385	-27,371	-24,484	-30,902	-33,215	-27,487	-31,033	-32,812	-32,155	-17,430	**-26,949**
Latvia	-16,915	-18,568	-19,451	-18,795	-18,523	-18,217	-19,348	-17,560	-16,776	-16,625	-17,335	-17,554	-16,542	-18,082	-19,005	-20,016	-23,194	-23,690	**-18,678**
Lithuania	-5,203	-5,240	-5,231	-4,895	-4,977	-5,179	-5,631	-5,442	-5,282	-5,191	-5,393	-5,545	-5,677	-5,724	-5,770	-5,672	-4,977	-4,959	**-5,333**
Luxembourg	205	28	-343	-454	-285	-388	-563	-605	-350	-474	-476	-547	-552	-564	-523	-500	-394	-396	**-399**
Malta	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	**-49**
Netherlands	-2,999	-2,796	-2,413	-2,588	-2,860	-2,975	-3,235	-3,201	-2,641	-3,141	-3,117	-1,144	-1,454	-1,706	-2,008	-2,495	-1,152	302	**-2,312**
Poland	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Portugal	-6,433	-5,329	-8,236	-8,519	-9,590	-7,819	-10,565	-10,979	-9,772	-10,387	-10,119	-10,341	-10,144	-4,196	-7,963	-2,581	-8,307	-8,899	**-8,343**
Romania	-34,511	-34,782	-36,100	-37,513	-36,910	-36,329	-35,169	-35,784	-38,127	-37,448	-36,913	-37,952	-36,184	-36,616	-36,402	-37,668	-37,333	-37,016	**-36,598**
Slovakia	-4,562	-5,598	-6,166	-5,824	-5,081	-4,946	-4,301	-3,047	-3,701	-3,606	-5,172	-5,926	-6,141	-5,981	-4,798	-2,326	-4,546	-4,996	**-4,818**
Slovenia	-8,324	-8,250	-8,244	-8,247	-8,340	-8,390	-8,499	-8,471	-8,705	-8,716	-9,509	-9,561	-9,640	-9,731	-9,827	-9,910	-9,987	-10,124	**-9,026**
Spain	-22,046	-21,881	-21,144	-21,062	-21,219	-21,402	-21,582	-21,180	-20,817	-22,651	-23,352	-24,002	-23,732	-23,459	-23,343	-22,873	-23,600	-22,612	**-22,331**
Sweden	-52,044	-52,188	-48,194	-46,505	-47,250	-48,007	-48,049	-50,918	-50,311	-48,418	-50,979	-48,231	-50,555	-50,277	-47,134	-47,698	-46,937	-46,444	**-48,897**
UK	-14,783	-15,321	-15,922	-16,223	-16,390	-16,068	-15,811	-15,486	-15,290	-15,084	-15,454	-15,415	-15,497	-15,575	-15,678	-15,625	-15,268	-14,820	**-15,539**
European Union	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of 27 MSs and will be reported after the submission of Poland has been completed.*

Table5b. Projected emissions and removals from forest management (all pools listed in **Table 3**, including HWP applying a first order decay function, and GHG, Gg CO_2 eq).

Member State	Net Removals (-) or Net Emissions (+) (GgCO2eq per year)													
	2008	2009	2010	2011	2012	average of 2008-2012	2013	2014	2015	2016	2017	2018	2019	2020	average of 2013-2020
Austria	-11,225	-6,022	-8,209	-8,048	-7,884	**-8,278**	-7,723	-7,575	-7,418	-6,871	-6,349	-5,863	-5,396	-4,932	**-6,516**
Belgium	-2,884	-2,322	-2,747	-2,650	-2,572	**-2,635**	-2,511	-2,458	-2,413	-2,447	-2,484	-2,523	-2,566	-2,608	**-2,501**
Bulgaria	-12,237	-9,336	-9,055	-9,143	-9,232	**-9,801**	-9,320	-9,409	-9,498	-9,347	-9,193	-9,040	-8,884	-8,728	**-9,177**
Cyprus	-161	-120	-144	-146	-148	**-144**	-151	-153	-155	-157	-157	-159	-161	-167	**-157**
Czech Republic	-6,450	-7,213	-6,140	-6,007	-5,872	**-6,336**	-5,733	-5,595	-5,454	-5,492	-5,528	-5,565	-5,600	-5,637	**-5,575**
Denmark	-1,891	-916	272	264	254	**-403**	242	237	241	236	440	471	490	518	**359**
Estonia	-9,105	-5,554	-5,001	-4,643	-4,286	**-5,718**	-3,930	-3,574	-3,219	-2,863	-2,506	-2,149	-1,792	-1,434	**-2,683**
Finland	-38,395	-19,134	-18,087	-18,982	-19,338	**-22,787**	-19,808	-19,584	-19,262	-19,177	-19,434	-20,045	-20,961	-22,042	**-20,039**
France	-80,204	-70,761	-76,625	-74,939	-73,358	**-75,177**	-71,850	-70,395	-68,978	-67,528	-66,097	-64,679	-63,271	-61,870	**-66,834**
Germany	-29,721	-14,641	-23,672	-22,578	-21,810	**-22,484**	-21,271	-23,373	-23,112	-22,457	-21,930	-21,495	-19,667	-19,347	**-21,582**
Greece	-2,451	-2,598	-2,356	-2,223	-2,091	**-2,344**	-1,960	-1,828	-1,697	-1,598	-1,498	-1,398	-1,298	-1,198	**-1,559**
Hungary	-2,821	-499	-1,283	-1,129	-983	**-1,343**	-842	-707	-573	-481	-389	-298	-208	-119	**-452**
Ireland	-1,474	-974	-1,096	-840	-124	**-902**	206	-494	-870	-278	-536	-505	346	478	**-207**
Italy	-27,521	-25,558	-25,439	-23,821	-22,280	**-24,924**	-20,792	-19,341	-17,916	-16,723	-15,542	-14,368	-13,200	-12,036	**-16,240**
Latvia	-17,794	-18,645	-17,850	-17,563	-17,278	**-17,826**	-16,996	-16,716	-16,435	-16,208	-15,980	-15,754	-15,527	-15,301	**-16,115**
Lithuania	-4,948	-5,262	-4,888	-4,803	-4,718	**-4,924**	-4,633	-4,547	-4,461	-4,404	-4,347	-4,290	-4,234	-4,178	**-4,387**
Luxembourg	-432	-409	-386	-396	-405	**-406**	-415	-425	-434	-428	-421	-415	-408	-402	**-418**
Malta	-49	-49	-49	-49	-49	**-49**	-49	-49	-49	-49	-49	-49	-49	-49	**-49**
Netherlands	-1,889	-1,915	-1,871	-1,781	-1,699	**-1,831**	-1,622	-1,550	-1,480	-1,443	-1,406	-1,371	-1,336	-1,302	**-1,439**
Poland	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Portugal	-8,725	-9,211	-6,037	-5,991	-5,951	**-7,183**	-6,037	-6,621	-6,727	-6,835	-6,942	-7,049	-7,155	-7,251	**-6,827**
Romania	-33,963	-33,748	-31,682	-31,371	-31,046	**-32,362**	-30,711	-30,370	-30,025	-29,126	-28,226	-27,324	-26,422	-25,520	**-28,465**
Slovakia	-4,055	-4,930	-3,135	-2,926	-2,716	**-3,552**	-2,505	-2,295	-2,084	-1,800	-1,516	-1,232	-950	-666	**-1,631**
Slovenia	-10,087	-7,836	-7,406	-7,407	-7,406	**-8,028**	-3,179	-3,177	-3,175	-3,172	-3,170	-3,167	-3,164	-3,162	**-3,171**
Spain	-21,327	-24,696	-23,903	-23,754	-23,690	**-23,474**	-23,684	-23,721	-23,788	-23,837	-23,901	-23,976	-24,060	-24,148	**-23,889**
Sweden	-44,439	-48,478	-45,032	-44,478	-43,970	**-45,279**	-43,495	-43,044	-42,611	-41,817	-41,047	-40,295	-39,555	-38,825	**-41,336**
UK	-14,327	-13,485	-12,382	-11,824	-11,036	**-12,611**	-10,270	-9,639	-9,294	-8,634	-8,036	-7,515	-6,615	-6,138	**-8,268**
European Union	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of 27 MSs and will be reported after the submission of Poland has been completed..*

Table 6a. Historical emissions and removals from forest management (all pools listed in **Table 3**, excluding HWP (i.e. assuming instantaneous oxidation of wood at harvest), and GHG, Gg CO_2 eq).

Member State	Net Removals (-) or Net Emissions (+) (GgCO2eq per year)																	
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	average of 1990-2007
Austria	-11,401	-17,198	-12,055	-15,832	-14,800	-14,108	-9,510	-18,551	-16,792	-21,254	-16,016	-18,780	-15,149	-13,519	-14,350	-14,381	-10,538	-7,295	**-14,529**
Belgium	-3,248	-2,761	-3,061	-2,994	-3,022	-2,861	-2,913	-2,936	-2,837	-2,871	-2,841	-3,467	-3,274	-3,331	-3,221	-3,240	-3,209	-3,164	**-3,069**
Bulgaria	-13,725	-13,743	-13,583	-13,144	-13,146	-13,742	-12,829	-12,876	-12,666	-12,621	-10,936	-11,527	-11,991	-12,039	-12,173	-12,163	-12,086	-10,738	**-12,540**
Cyprus	-154	-169	-171	-108	-125	-160	-163	-158	17	-180	-156	-128	-178	-166	-174	-177	-168	-110	**-146**
Czech Republic	-4,667	-9,126	-10,781	-9,490	-7,021	-7,047	-7,265	-6,458	-7,076	-7,024	-7,278	-7,594	-7,318	-5,485	-5,875	-6,349	-3,069	-316	**-6,624**
Denmark	-845	-984	-883	-1,095	-932	-1,094	-1,033	-1,093	-1,093	-705	373	357	161	286	246	169	-382	-1,251	**-544**
Estonia	-7,994	-7,746	-9,513	-9,209	-6,944	-6,868	-6,998	-5,093	-4,829	-882	-696	-2,707	-2,275	-4,486	-7,102	-7,250	-8,077	-8,408	**-5,949**
Finland	-23,145	-37,565	-31,003	-29,044	-20,908	-20,858	-29,784	-25,678	-24,150	-26,934	-28,357	-32,864	-33,846	-34,586	-34,304	-37,726	-41,473	-32,650	**-30,271**
France	-45,567	-40,927	-44,950	-51,878	-56,107	-54,030	-56,591	-60,622	-61,099	-65,191	-53,306	-60,478	-65,523	-66,904	-69,578	-71,286	-77,248	-77,852	**-59,952**
Germany	-65,424	-65,418	-65,313	-65,367	-65,325	-65,319	-65,291	-65,276	-65,254	-65,250	-65,247	-65,230	-20,337	-20,343	-20,373	-20,379	-20,371	-20,361	**-50,327**
Greece	-1,296	-1,337	-1,746	-1,920	-1,602	-1,826	-1,911	-1,810	-2,006	-2,051	-2,015	-2,049	-2,052	-2,052	-2,051	-2,051	-2,049	-2,003	**-1,879**
Hungary	-2,566	-2,845	-3,510	-5,069	-5,512	-5,528	-1,556	-1,752	-2,699	-957	125	-1,281	-644	-2,649	-1,532	-3,539	-1,512	-1,735	**-2,487**
Ireland	-1,251	-1,378	-1,235	-1,202	-1,045	-944	-880	-825	-924	-950	-695	-592	-721	-1,076	-795	-848	-946	-1,224	**-974**
Italy	-15,841	-28,225	-26,528	-15,839	-26,147	-29,454	-28,320	-20,719	-18,492	-24,213	-22,068	-28,533	-31,130	-25,399	-28,818	-30,379	-29,417	-14,186	**-24,650**
Latvia	-16,760	-18,416	-19,531	-19,159	-18,477	-17,771	-18,635	-16,020	-14,956	-14,418	-15,129	-15,453	-14,456	-15,924	-16,999	-17,901	-21,004	-22,337	**-17,408**
Lithuania	-5,048	-5,089	-5,083	-5,085	-5,084	-5,083	-5,082	-5,081	-5,004	-4,999	-4,996	-5,192	-5,211	-5,101	-5,114	-5,043	-4,348	-4,418	**-5,003**
Luxembourg	205	28	-343	-454	-285	-388	-563	-605	-350	-474	-476	-547	-552	-564	-523	-500	-394	-396	**-399**
Malta	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	-49	**-49**
Netherlands	-2,317	-2,693	-2,450	-2,673	-2,688	-2,559	-2,753	-2,489	-2,578	-2,519	-2,288	-2,341	-2,418	-2,415	-2,356	-2,282	-2,232	-2,046	**-2,450**
Poland	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Portugal	-4,527	-3,548	-6,930	-7,465	-8,633	-7,010	-9,436	-10,137	-9,364	-9,619	-9,143	-9,476	-9,135	-2,973	-6,967	-1,750	-7,403	-8,305	**-7,323**
Romania	-35,583	-37,041	-37,846	-39,131	-39,734	-38,987	-38,003	-38,390	-40,481	-39,208	-37,999	-39,007	-36,536	-36,174	-35,492	-37,181	-37,200	-36,114	**-37,784**
Slovakia	-4,436	-5,474	-6,045	-6,123	-5,195	-4,388	-3,955	-2,704	-3,117	-2,784	-4,301	-5,533	-5,624	-5,137	-3,510	-159	-2,555	-2,718	**-4,098**
Slovenia	-8,257	-8,289	-8,321	-8,353	-8,385	-8,418	-8,456	-8,495	-8,633	-8,676	-9,424	-9,483	-9,542	-9,602	-9,663	-9,725	-9,768	-9,813	**-8,961**
Spain	-18,475	-18,368	-18,558	-18,574	-18,087	-18,497	-18,608	-18,513	-18,514	-18,563	-18,470	-18,573	-18,530	-18,485	-18,514	-18,377	-18,072	-18,595	**-18,465**
Sweden	-47,544	-48,571	-45,178	-42,142	-42,823	-42,551	-43,756	-44,922	-44,902	-43,397	-44,135	-42,910	-44,912	-43,966	-40,773	-39,592	-37,680	-36,924	**-43,149**
UK	-12,170	-12,792	-13,511	-13,782	-14,095	-13,402	-13,041	-12,526	-12,260	-12,216	-12,278	-12,623	-13,147	-13,537	-13,965	-13,265	-12,446	-11,381	**-12,913**
European Union	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of 27 MSs and will be reported after the submission of Poland has been completed.*

Table 6b. Projected emissions and removals from forest management (all pools listed in **Table 3**, excluding HWP (i.e. assuming instantaneous oxidation of wood at harvest), and GHG, Gg CO_2 eq).

Member State	Net Removals (-) or Net Emissions (+) (GgCO2eq per year)														
	2008	2009	2010	2011	2012	average of 2008-2012	2013	2014	2015	2016	2017	2018	2019	2020	average of 2013-2020
Austria	-6,575	-5,252	-3,930	-3,680	-3,420	**-4,571**	-3,160	-2,910	-2,650	-2,320	-1,980	-1,650	-1,320	-980	**-2,121**
Belgium	-3,088	-2,383	-2,445	-2,423	-2,400	**-2,548**	-2,378	-2,355	-2,332	-2,383	-2,433	-2,483	-2,534	-2,584	**-2,435**
Bulgaria	-12,027	-9,648	-9,365	-9,464	-9,563	**-10,013**	-9,662	-9,761	-9,860	-9,700	-9,539	-9,379	-9,218	-9,057	**-9,522**
Cyprus	-175	-157	-158	-159	-160	**-162**	-161	-162	-163	-164	-164	-165	-166	-167	**-164**
Czech Republic	-4,414	-4,312	-4,189	-4,043	-3,898	**-4,171**	-3,752	-3,607	-3,461	-3,494	-3,526	-3,559	-3,591	-3,624	**-3,577**
Denmark	-1,958	-986	202	176	155	**-482**	140	129	122	118	320	346	371	397	**243**
Estonia	-8,666	-4,556	-4,151	-3,779	-3,407	**-4,912**	-3,035	-2,662	-2,290	-1,916	-1,542	-1,168	-794	-420	**-1,728**
Finland	-37,954	-16,687	-18,270	-18,905	-19,038	**-22,171**	-19,312	-18,913	-18,428	-18,339	-18,600	-19,221	-20,152	-21,252	**-19,277**
France	-77,795	-71,729	-71,484	-70,155	-68,827	**-71,998**	-67,498	-66,170	-64,842	-63,456	-62,069	-60,683	-59,297	-57,911	**-62,741**
Germany	-20,331	-280	-278	-276	-274	**-4,288**	-272	-2,747	-2,745	-2,743	-2,741	-2,739	-1,277	-1,275	**-2,067**
Greece	-2,045	-1,804	-1,714	-1,564	-1,414	**-1,708**	-1,264	-1,114	-964	-847	-729	-611	-493	-376	**-800**
Hungary	-2,784	-1,437	-1,375	-1,241	-1,106	**-1,589**	-971	-837	-702	-606	-510	-413	-317	-221	**-572**
Ireland	-873	-653	-828	-877	-149	**-676**	-2	-458	-761	-141	-336	-256	624	749	**-73**
Italy	-25,586	-23,834	-23,267	-21,831	-20,395	**-22,983**	-18,958	-17,522	-16,085	-14,863	-13,640	-12,417	-11,194	-9,972	**-14,331**
Latvia	-16,712	-16,320	-15,929	-15,663	-15,396	**-16,004**	-15,130	-14,864	-14,597	-14,382	-14,166	-13,951	-13,735	-13,520	**-14,293**
Lithuania	-4,478	-4,446	-4,415	-4,348	-4,281	**-4,394**	-4,215	-4,148	-4,081	-4,043	-4,005	-3,966	-3,928	-3,890	**-4,034**
Luxembourg	-432	-409	-386	-396	-405	**-406**	-415	-425	-434	-428	-421	-415	-408	-402	**-418**
Malta	-49	-49	-49	-49	-49	**-49**	-49	-49	-49	-49	-49	-49	-49	-49	**-49**
Netherlands	-2,056	-2,004	-1,953	-1,886	-1,820	**-1,944**	-1,753	-1,687	-1,621	-1,585	-1,549	-1,513	-1,477	-1,442	**-1,578**
Poland	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Portugal	-8,299	-8,791	-5,566	-5,550	-5,533	**-6,748**	-5,639	-6,240	-6,362	-6,483	-6,603	-6,721	-6,839	-6,945	**-6,479**
Romania	-33,032	-32,123	-31,215	-30,886	-30,557	**-31,563**	-30,228	-29,899	-29,570	-28,690	-27,811	-26,931	-26,051	-25,172	**-28,044**
Slovakia	-1,816	-1,727	-1,639	-1,441	-1,243	**-1,573**	-1,045	-848	-650	-379	-108	163	433	704	**-216**
Slovenia	-9,858	-7,653	-7,259	-7,259	-7,259	**-7,858**	-3,033	-3,033	-3,033	-3,033	-3,033	-3,033	-3,033	-3,033	**-3,033**
Spain	-18,607	-20,097	-20,501	-20,657	-20,813	**-20,135**	-20,969	-21,125	-21,281	-21,398	-21,515	-21,632	-21,750	-21,867	**-21,442**
Sweden	-37,887	-44,527	-38,460	-38,173	-37,885	**-39,386**	-37,598	-37,311	-37,023	-36,451	-35,878	-35,305	-34,732	-34,159	**-36,057**
UK	-10,711	-9,798	-7,495	-7,306	-6,345	**-8,331**	-5,206	-4,660	-4,181	-3,839	-3,576	-3,322	-2,030	-722	**-3,442**
European Union	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of 27 MSs and will be reported after the submission of Poland has been completed.*

5.1.2.2 The relationship between forest management and forest land remaining forest land

Emissions/removals from Forest land remaining Forest land and Forest management, Afforestation and Deforestation are available from the latest reports of the MSs under the Convention and the Kyoto Protocol. Differences between the Forest land remaining Forest land and Forest management are explained in the MS Annexes.

5.1.3 Forest characteristics and related management

Forest characteristics are very variable between MSs, since there are big differences in relation to tree species, climatic zones, legal frameworks, intended wood or forest use, etc. There is no Common EU Forest Policy, and the different legal frameworks at MS level also play a role in the main forest characteristics. Detailed forest characteristics and how those relate to the proposed FM-RLs can be found in MSs' submissions.

5.1.3.1 Age class structure

The indicative evolution of the age class structure for the whole EU is presented in **Figure 1** (based on the database and assumptions used by Efiscen model). Data suggests that age class structure will go through gradual changes, mainly in the first two age classes. The area of forests older than 100 years will decrease according to projections.

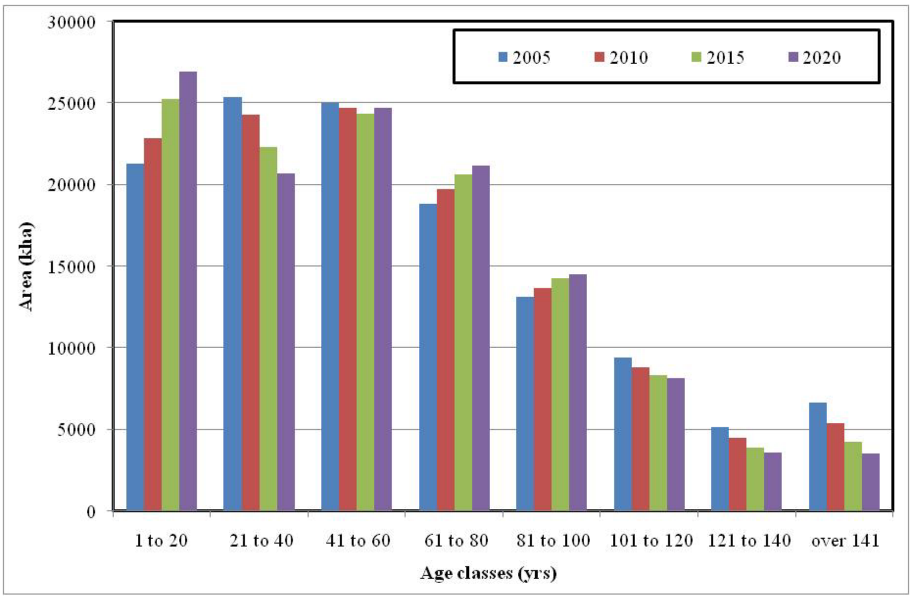

Figure 1. Historical and projected age class structure for all MSs, based on the EFISCEN database.

Note that the differences in age class structure are significant between different MSs and forest types. Please refer to specific country Annexes for more information on the age-class structure of the individual MSs.

5.1.3.2 Increment

Volume increment of forest areas depends on tree species, other forest characteristics like age structure and local general ecological conditions such as soil, weather and forest management. Both historical and projected specific increments as projected by JRC or the individual MSs are presented in the respective country annexes.

5.1.3.3 Rotation length

Rotation length varies with tree species, climatic zone, legal framework, intended wood use, etc. Details for each MS are provided in the MS annexes, or in **Annex 1.**

5.1.3.4 Information on forest management activities under business as usual

Refer to MS annexes for information on this topic.

5.1.3.5 Other relevant information

Refer to MS annexes for information on this topic.

(a) Harvesting rates

Data on historical harvesting rates usually come from national statistics and/or the international databases of UNECE and FAO. National level data include harvest from all forests, including Art 3.3 and Art 3.4 FM activities. In most cases, the national total is very similar to the 3.4 FM total, due to relatively small harvesting areas associated with Art3.3. Therefore, many MS assumed all harvest to take place in 3.4 Forest Management.

Table 7 below presents the reported historical harvesting and projected harvesting values used by each MS in the setting of their FM-RLs. Please refer to the specific annexes for more details.

Table 7. Historical and projected harvesting rates

Member State	Harvest rate (roundwood overbark, 1000 m3)				
	2000	2005	2010	2015	2020
Austria	16,049	19,900	28,550	29,700	31,000
Belgium	3,457	4,104	4,066	4,028	3,990
Bulgaria	4,836	6,469	6,237	6,005	5,773
Cyprus	NA	NA	NA	NA	NA
Czech Republic	15,710	18,147	18,989	19,831	20,673
Denmark	3,672	2,962	2,720	2,613	2,572
Estonia	9,600	7,410	8,548	9,685	10,822
Finland	61,500	58,684	62,787	64,483	66,179
France	63,637	57,498	59,425	61,352	63,279
Germany	74,989	82,947	95,723	101,573	104,099
Greece	2,207	1,870	2,250	2,629	3,009
Hungary	6,179	6,632	6,998	7,363	7,728
Ireland	2,940	2,755	1,883	2,402	3,182
Italy	14,965	14,496	16,284	18,071	19,858
Latvia	11,040	10,864	11,356	11,848	12,341
Lithuania	6,163	6,925	6,702	6,480	6,257
Luxembourg	298	305	309	312	316
Malta	NA	NA	NA	NA	NA
Netherlands	1,090	1,204	1,188	1,171	1,155
Poland	*	*	*	*	*
Portugal	8,877	10,993	11,137	11,065	11,279
Romania	14,827	17,104	16,926	16,749	16,571
Slovakia	6,599	8,821	9,110	9,399	9,688
Slovenia	2,609	3,236	3,374	7,245	7,245
Spain	17,023	17,755	18,246	18,738	19,229
Sweden	74,100	115,900	NA	88,825	87,780
UK	9,878	8,753	14,781	16,632	18,307
European Union	**	**	**	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of 27 MSs and will be reported after the submission of Poland has been completed.*

5.1.3.6 Harvested wood products

Data are reported below in **Table 8a** and **8b** applying the three types of wood products using the product categories, half lives and methodologies outlined in para 27, page 31 of document FCCC/KP/AWG/2010/CRP.4/Rev.4. The methods are rather country specific, and are described in the MS Annex according to the methodological approach adopted (see **Table 2**).

Table 8a. Historical emissions and removals from HWP applying the first order decay function.

Member State	Net Removals (-) or Net Emissions (+) (GgCO2eq per year)																		
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	average of 1990-2007
Austria	-2,982	-1,714	-1,545	-1,449	-2,455	-2,314	-2,800	-2,437	-2,398	-1,958	-1,396	-2,198	-3,354	-3,934	-3,188	-3,188	-3,636	-4,897	**-2,658**
Belgium	-260	-254	-248	-242	-236	-230	-225	-219	-214	-760	205	680	-769	-834	-594	-694	-302	230	**-276**
Bulgaria	97	-54	963	981	954	1,023	1,037	1,018	1,000	986	734	608	555	565	224	371	192	-818	**580**
Cyprus	-6	1	2	-11	-9	-6	-7	3	-2	-3	8	17	18	20	21	20	20	0	**5**
Czech Republic	-498	-488	-73	-326	-625	-706	-690	-626	-496	-603	-1,061	-1,057	-1,032	-1,463	-1,446	-1,354	-2,392	-3,007	**-997**
Denmark	-215	-199	16	-281	-99	-80	255	293	439	331	214	503	391	384	531	208	-82	326	**163**
Estonia	-57	-55	18	-52	-6	-123	-176	-554	-504	-676	-948	-1,102	-1,134	-1,060	-809	-681	-636	-376	**-496**
Finland	-823	253	-109	-45	-553	-330	-686	-1,509	-979	-1,145	-1,638	-732	-794	-1,154	-1,032	-315	-457	-1,641	**-761**
France	-5,198	-4,684	-4,445	-4,672	-5,923	-4,180	-4,454	-4,975	-5,742	-5,911	-6,452	-5,153	-4,153	-3,555	-4,546	-4,288	-3,886	-3,234	**-4,747**
Germany	-10,573	-7,061	-7,119	-7,261	-11,030	-10,444	-9,912	-10,945	-10,183	-10,502	-14,252	-9,866	-13,151	-15,594	-19,816	-21,452	-22,998	-23,213	**-13,076**
Greece	-434	-471	-166	-809	-708	-584	-404	22	155	97	-174	-212	-437	-335	-324	-412	-220	-461	**-327**
Hungary	-409	-158	96	62	-239	191	230	74	329	213	129	136	99	262	202	-123	46	15	**64**
Ireland	-675	-995	-927	-905	-862	-1,018	-952	-825	-1,000	-1,064	-1,134	-905	-1,149	-1,140	-1,154	-1,351	-1,190	-633	**-993**
Italy	-1,989	-1,917	-919	-1,322	-1,707	-3,131	-1,923	-2,835	-2,893	-3,158	-2,416	-2,369	-2,085	-2,088	-2,215	-2,433	-2,738	-3,244	**-2,299**
Latvia	-155	-152	80	364	-46	-446	-713	-1,540	-1,820	-2,207	-2,206	-2,101	-2,086	-2,158	-2,006	-2,115	-2,190	-1,353	**-1,269**
Lithuania	-155	-151	-148	190	107	-96	-549	-361	-278	-192	-397	-353	-466	-623	-656	-629	-629	-541	**-329**
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Netherlands	-682	-103	37	85	-172	-416	-482	-712	-63	-622	-829	1,197	964	709	348	-213	1,080	2,348	**137**
Poland	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Portugal	1,905	1,781	1,306	1,054	957	809	1,129	842	408	768	976	865	1,009	1,223	997	830	904	594	**1,020**
Romania	1,072	2,259	1,746	1,618	2,824	2,658	2,834	2,606	2,354	1,760	1,086	1,055	352	-442	-910	-487	-133	-902	**1,186**
Slovakia	-126	-124	-121	299	114	-558	-346	-343	-584	-822	-871	-393	-517	-844	-1,288	-2,167	-1,991	-2,278	**-720**
Slovenia	-67	39	77	106	45	28	-43	24	-72	-40	-85	-78	-98	-129	-164	-185	-219	-311	**-65**
Spain	-3,571	-3,513	-2,586	-2,488	-3,132	-2,905	-2,974	-2,667	-2,303	-4,088	-4,882	-5,429	-5,202	-4,974	-4,829	-4,496	-5,528	-4,017	**-3,866**
Sweden	-4,500	-3,617	-3,016	-4,362	-4,427	-5,456	-4,292	-5,996	-5,410	-5,021	-6,844	-5,321	-5,644	-6,311	-6,361	-8,105	-9,258	-9,520	**-5,748**
UK	-2,613	-2,529	-2,411	-2,441	-2,295	-2,666	-2,770	-2,960	-3,030	-2,868	-3,176	-2,792	-2,350	-2,038	-1,713	-2,360	-2,822	-3,439	**-2,626**
European Union	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of 27 MSs and will be reported after the submission of Poland has been completed.*

Table 8b. Projected emissions and removals from HWP applying the first order decay function.

Member State	Net Removals (-) or Net Emissions (+) (GgCO2eq per year)														
	2008	2009	2010	2011	2012	average of 2008-2012	2013	2014	2015	2016	2017	2018	2019	2020	average of 2013-2020
Austria	-4,650	-769	-4,279	-4,368	-4,464	-3,706	-4,563	-4,665	-4,768	-4,551	-4,369	-4,213	-4,076	-3,952	**-4,395**
Belgium	204	61	-302	-227	-172	-87	-133	-103	-81	-64	-51	-40	-32	-24	**-66**
Bulgaria	-210	312	310	321	331	213	342	352	362	353	346	339	334	329	**345**
Cyprus	14	37	14	13	12	18	10	9	8	7	7	6	5	0	**7**
Czech Republic	-2,036	-2,901	-1,951	-1,964	-1,974	-2,165	-1,981	-1,988	-1,993	-1,998	-2,002	-2,006	-2,009	-2,013	**-1,999**
Denmark	67	70	70	88	99	79	102	108	119	118	120	125	119	121	**117**
Estonia	-439	-998	-850	-864	-879	-806	-895	-912	-929	-947	-964	-981	-998	-1,014	**-955**
Finland	-441	-2,447	183	-77	-300	-616	-496	-671	-834	-838	-834	-824	-809	-790	**-762**
France	-2,409	968	-5,141	-4,784	-4,531	-3,179	-4,352	-4,225	-4,136	-4,072	-4,028	-3,996	-3,974	-3,959	**-4,093**
Germany	-9,390	-14,361	-23,394	-22,302	-21,536	-18,197	-21,000	-20,626	-20,368	-19,715	-19,190	-18,756	-18,390	-18,072	**-19,515**
Greece	-406	-794	-642	-659	-677	-636	-696	-714	-733	-751	-769	-787	-805	-822	**-760**
Hungary	-37	938	92	112	123	246	129	130	129	125	121	115	109	102	**120**
Ireland	-601	-321	-269	37	25	-226	207	-36	-109	-138	-199	-249	-278	-271	**-134**
Italy	-1,935	-1,724	-2,172	-1,990	-1,885	-1,941	-1,834	-1,819	-1,831	-1,860	-1,902	-1,951	-2,006	-2,064	**-1,908**
Latvia	-1,082	-2,325	-1,921	-1,900	-1,882	-1,822	-1,866	-1,852	-1,838	-1,826	-1,814	-1,803	-1,792	-1,781	**-1,822**
Lithuania	-470	-816	-473	-455	-437	-530	-418	-399	-380	-361	-342	-324	-306	-288	**-352**
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Netherlands	167	89	82	105	121	113	131	137	141	142	143	142	141	140	**140**
Poland	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Portugal	426	420	471	441	418	435	398	381	366	352	339	327	316	305	**348**
Romania	-931	-1,625	-467	-485	-489	-799	-483	-471	-455	-436	-415	-393	-371	-348	**-422**
Slovakia	-2,239	-3,203	-1,496	-1,485	-1,473	-1,979	-1,460	-1,447	-1,434	-1,421	-1,408	-1,395	-1,383	-1,370	**-1,415**
Slovenia	-229	-183	-147	-148	-147	-171	-146	-144	-142	-139	-137	-134	-131	-129	**-138**
Spain	-2,720	-4,599	-3,402	-3,097	-2,877	-3,339	-2,715	-2,596	-2,507	-2,439	-2,386	-2,344	-2,310	-2,281	**-2,447**
Sweden	-6,551	-3,951	-6,572	-6,305	-6,085	-5,893	-5,897	-5,733	-5,587	-5,367	-5,170	-4,990	-4,823	-4,666	**-5,279**
UK	-3,616	-3,687	-4,887	-4,518	-4,691	-4,280	-5,064	-4,979	-5,113	-4,795	-4,460	-4,193	-4,585	-5,416	**-4,826**
European Union	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**

** Data for Poland will be reported later.*

*** Totals for the EU are the sum of 27 MSs and will be reported after the submission of Poland has been completed.*

5.1.3.7 Disturbances

MSs in general include in their FM emission estimates emissions from natural disturbances in the context of force majeure. In most cases, emissions from disturbances refer to wildfire emissions only. Please refer to MS Annexes for more details on these emissions.

5.1.3.8 Factoring out in accordance with paragraph 1(h) (i) and 1(h) (ii) of decision 16/CMP.1

The EU considers that dynamic effects of age class structure have the biggest effect and are explicitly factored out by the RL approach. The other effects are factored out to a reasonable approximation by taking the difference between the RL and the net removals.

5.2 Description of any other relevant elements considered or treated in the construction of the forest management reference level

5.2.1 Policies included

5.2.1.1 Pre-2010 domestic policies included

Only policies adopted and implemented before mid-2009 have been considered in the FM-RLs that are based on projections. Given the diversity of forests and forest management systems within the EU, please refer to the individual MS submissions for details on policies considered in each case.

5.2.1.2 Confirmation of factoring out policies after 2009

No MS has included estimates of the impact of expected future policies introduced after mid-2009.

Annex 1: Additional methodological information related to projections elaborated by JRC based on modelling work by IIASA and EFI

Annex 1-1. General methodological information

Projections provided by the Joint Research Centre of the European Commission (JRC) are based on elaboration of the results of independent EU modeling groups, coordinated by the International Institute for Applied Systems Analysis (IIASA), assisted by the JRC and funded by the European Commission Directorate General of Climate Action (DG CLIMA). The 15 MSs[3] which used these projections to set their FM-RLs cover about 43% of forest area, 60% of the sink and 40% of the harvest of EU in 2008. The list of countries which used these projections is shown in table 2.

Approaches, methods and models used

The models used to project emissions and removals from FM are G4M (from IIASA) and EFISCEN (from the European Forest Institute, EFI). The following text thus refers to JRC/IIASA/EFI projections. The table and figure below provide the essential features of the main models involved and an overview of the modeling architecture. More details for each model are provided in the Annex 1-1.

Table A-1. Essential features of the main models involved in the projection.

G4M	The Global Forest Model (G4M) provides spatially explicit estimates of annual above- and belowground wood increment, and development of above- and belowground forest biomass; the costs of forestry options such as forest management, afforestation and deforestation is also provided by comparing the income of alternative land uses.
EFISCEN	The European Forest Information Scenario Model (EFISCEN) is a large-scale model that assesses the supply of wood and biomass from forests and projects forest resource development on regional to European scale, based on forest inventory data. EFISCEN provides projections on basic forest inventory data (stemwood volume, increment, age-structure), as well as carbon in forest biomass and soil.
GLOBIOM	GLOBIOM is a global static partial equilibrium model integrating the agricultural, livestock, bioenergy and forestry sectors with the aim to give policy advice on global issues concerning land use competition between the major land-based production sectors.

[3] For the time being, Poland is not included. If necessary, this Annex will be updated once Poland's submission is made.

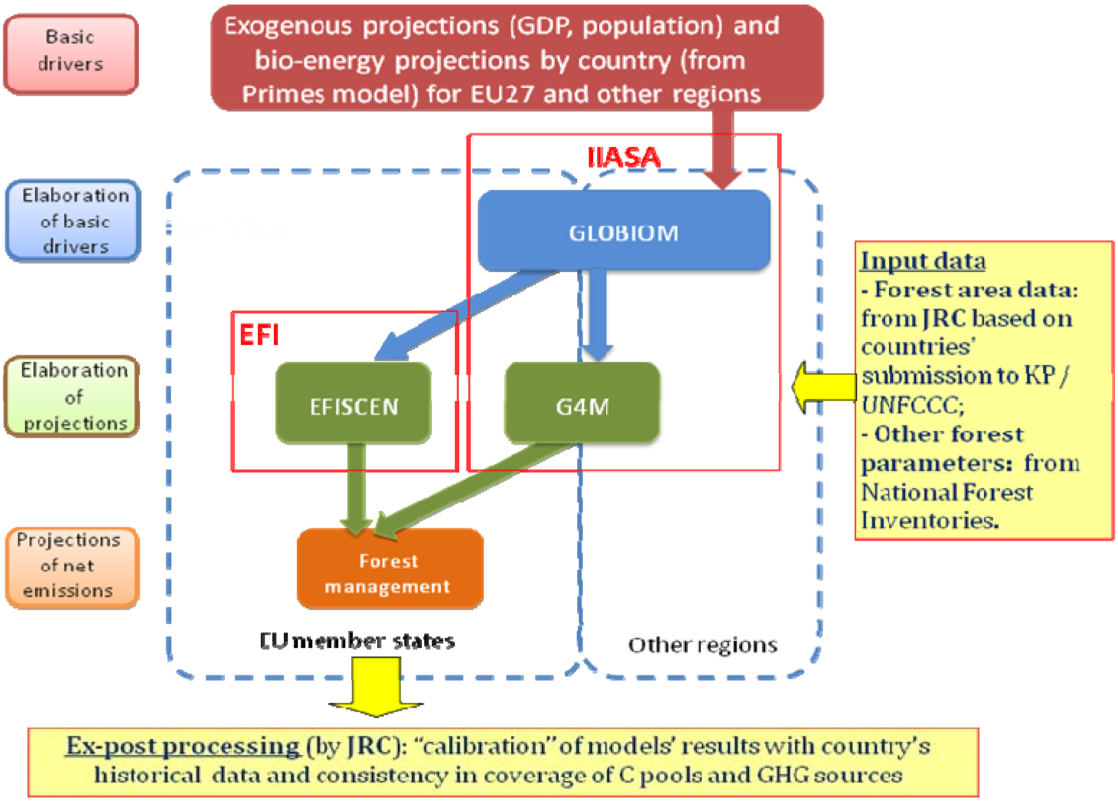

Figure A-1. Synthetic flowchart of information exchange between models.

The modelling approach included the following main steps:

1) *Collection of relevant input data*

1. Forest area used by the models was taken from national forest inventories and scaled to match the area reported in GHG inventories by the MS (EFISCEN) or from recent literature (G4M), see **Table A-2**.

2. Main forest and forest management parameters (age structure, increment, historical harvest) were taken from national forest inventories or other country statistics (for details please refer to specific EU members states' submission).

3. Future harvest demand under a business as usual (BAU) scenario (see **Table A-4**) was derived from key macroeconomic drivers (GDP, population), considering the policies and measures enacted by MSs up to April 2009 (the EU 2020 renewable target and the 20% GHG reduction targets are not included in this scenario). In particular, projections of GDP and population were exogenous to the models used. They reflect the recent economic downturn, followed by sustained economic growth resuming after 2010. This data is entering the GLOBIOM model that uses these projections to translate them into demand for timber (see main assumptions for the BASELINE scenario on pp.13-16 in Capros et al. (2010)[4] for more information). Bioenergy demand was projected by the PRIMES biomass model[5]. The biomass system model is incorporated in the baseline scenario of the

[4] P. Capros, L. Mantzos, N. Tasios, A. De Vita, N. Kouvaritakis (2010), EU energy trends to 2030 — UPDATE 2009, European Commission, Directorate-General for Energy in collaboration with Climate Action DG and Mobility and Transport DG. Luxembourg: Publications Office of the European Union, 2010. ISBN 978-92-79-16191-9. Available online: http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2030_update_2009.pdf

[5] http://www.e3mlab.ntua.gr/e3mlab/PRIMES%20Manual/THE_NEW_PRIMES_BIOMASS_MODEL.pdf

PRIMES large scale energy model for Europe[6]. It is an economic supply model that computes the optimal use of resources and investment in secondary and final transformation, so as to meet a given demand of final biomass energy products, driven by the rest of sectors. The primary supply of biomass and waste has been linked with resource origin, availability and concurrent use (land, forestry, municipal or industrial waste etc.). The total primary production levels for each primary commodity are restricted by the technical potential of the appropriate primary resource. See Annex 1.2 for more information on specific policies included in FM-RLs.

It should be noted that the historical input data (i.e. forest characteristics in points a and b above) were sent to MSs through a formal consultation process (April 2010), and comments and/or new data received were considered by models.

2) *Elaboration of input data*

The above input data (including the outputs from the GLOBIOM and PRIMES models), were elaborated by the two forest models (G4M and EFISCEN) to produce annual estimates of emissions and removals from FM until 2020 (for the above and below ground biomass carbon pools). See Annex 1.1 for more details on each forest model. The two models produced different time series, and we took the average of two different sets of outputs (**Table A-3**) to make the future trend estimate more robust.

Elaborations also included a simulation of the impact of +/-10% harvest as compared to BAU harvest levels (see sensitivity analysis in **Table A-3**).

3) *Ex-post processing of models' results:* In order to ensure consistency between models' results and historical data reported by the country, the emissions and removals estimated by the models for the entire time series (up to 2020) were "calibrated" (i.e. adjusted) using historical data from the country for the period 2000-2008 (for which we had both data from the GHG inventories and data projected by the models). To this aim, an "offset" was calculated for two components:

- Biomass: offset calculated as difference between [average of country's emissions and removals from biomass for the period 2000-2008] and [average of models' estimated emissions and removals from biomass for the period 2000-2008]

- Non-biomass pools and GHG sources: offset calculated as the sum of non-biomass pools and GHG sources as reported by the country for the period 2000-2008, and not estimated by models.

The calibrated average of models, which is used for the setting of the reference level, is obtained by adding the total offset (biomass offset + non-biomass pools and GHG sources offset) to the models' average. In other words, models' results were adjusted to match the average historical data provided by each country for the period 2000-2008. This ensures consistency between country data and models' data in terms of:

(i) Absolute level of emissions and removals from biomass, i.e. the calibration „reconciles" differences in estimates which may be due to a large variety of factors, including different input data, different parameters, different estimation methods (e.g., some country uses a „stock-change approach", while the models essentially use a „gain-loss approach");

(ii) Coverage of non-biomass pools and GHG sources.

[6] http://www.e3mlab.ntua.gr/manuals/PRIMsd.pdf

This "calibration" procedure represents an application to projected estimates of the "overlap" method proposed by IPCC GPG LULUCF and IPCC 2006 GL to ensure time-series consistency when different estimation methods are used over time[7].

The calibration procedure automatically incorporates into the projections the average rate (for the period 2000-2008) of the GHG impact of past natural disturbances, which are not explicitly estimated by the models (e.g. emissions from fires etc.).

The future *trend* of emissions and removals up to 2020 as predicted by the models is not affected by this calibration procedure, but only by the current (and projected) forest characteristics (e.g., age structure,...) and the future harvest demand (for which no ex-post processing is applied).

Note that, to maintain consistency in the future, technical corrections (as referred in para 15 quarter and 15 quinquies of the document FCCC/KP/AWG/2010/CRP.4/Rev.4) will be needed in the following cases:

(i) if recalculations of emissions and removals from FM (or forest land remaining forest land) for the period 2000-2008 will be carried out in any future submission of annual GHG inventories of a country;

(ii) if any future decision on "force majeure" indicates that events in the 2000-2008 period can be considered "force majeure", in which case the impact (in terms of GHG) should be removed from historical FM emissions/removals (according to provisions of any future decisions on force majeure), which might affect the calibration procedure described above. For transparency reasons, the section "Natural disturbances" below reports the emissions from forest fires for the period 1990-2008.

Description of construction of reference levels

(a) Area under forest management

For countries with the JRC/IIASA/EFI projections, **Table A-2** reports information between 2000 and 2020. For these countries, two time series are available as the data source for the two modelling exercises were different.

[7] According to IPCC GL 2006 (Vol.1, p. 5.8), in the "overlap method" the emission or removal estimates for those years when the new method cannot be used directly are developed by proportionally adjusting the previously developed estimates, based on the relationship observed during the period of overlap. The relationship can either be a ratio or a constant difference. In our case the constant difference was applied because the ratio gave erroneous results in some cases (i.e. if a number was close to zero, the ratio could be very high or very low).

Table A-2. Area of land under forest management that was applied by the two models for countries with JRC/IIASA/EFI projections (kha).

		2000	2005	2008	2010	2015	2020	Source of historical data (up to 2008)	Projected data (2010-2020)
Belgium	G4M	664	653	648	645	640	636	(1)	(4)
	EFISCEN	700	688	683	680	675	671	(2)	
Bulgaria	G4M	3.375	3.374	3.373	3.373	3.372	3.371	(1)	(4)
	EFISCEN	3.755	3.754	3.753	3.753	3.752	3.751	(2)	
Czech Republic	G4M	2.279	2.275	2.273	2.272	2.270	2.268	(1)	(4)
	EFISCEN		2.565	2.563	2.561	2.559	2.557	(3)	
Estonia	G4M	2.179	2.157	2.145	2.138	2.123	2.112	(1)	(4)
	EFISCEN	2.113	2.090	2.079	2.072	2.057	2.045	(2)	
France	G4M	14.786	14.602	14.517	14.468	14.360	14.266	(1)	(4)
	EFISCEN	14.931	14.708	14.627	14.574	14.466	14.371	(3)	
Greece	G4M	4.357	4.356	4.355	4.355	4.354	4.354	(1)	(4)
	EFISCEN	Efiscen does not provide estimates for Greece							
Hungary	G4M	1.649	1.646	1.644	1.642	1.627	1.610	(1)	(4)
	EFISCEN		1.874	1.871	1.869	1.857	1.844	(3)	
Italy	G4M	8.883	8.880	8.878	8.877	8.874	8.871	(1)	(4)
	EFISCEN		7.453	7.451	7.449	7.446	7.444	(3)	
Latvia	G4M	3.246	3.246	3.246	3.246	3.246	3.246	(1)	(4)
	EFISCEN		3.221	3.221	3.221	3.221	3.221	(3)	
Lithuania	G4M	2.007	2.007	2.007	2.007	2.007	2.007	(1)	(4)
	EFISCEN	2.000	2.000	2.000	2.000	2.000	2.000	(2)	
Luxembourg	G4M	87	87	87	87	87	87	(1)	(4)
	EFISCEN	89	87	87	87	87	87	(2)	
Netherlands	G4M	344	335	331	329	325	322	(1)	(4)
	EFISCEN		352	349	346	343	339	(2)	
Poland*	G4M								
	EFISCEN								
Romania	G4M	6.332	6.308	6.294	6.284	6.256	6.230	(1)	(4)
	EFISCEN	6.685	6.685	6.670	6.660	6.633	6.608	(2)	
Slovakia	G4M	1.573	1.572	1.571	1.570	1.569	1.568	(1)	(4)
	EFISCEN	1.918	1.917	1.916	1.915	1.914	1.913	(2)	
Spain	G4M	15.678	15.675	15.675	15.675	15.673	15.670	(1)	(4)
	EFISCEN	12.581	12.579	12.577	12.576	12.573	12.570	(3)	

* Data for Poland will be reported later.

Notes:
(1) G4M model: Gallaun, H., G. Zanchi, G. J. Nabuurs, G. Hengeveld, M. Schardt and P. J. Verkerk (2010). "EU-wide maps of growing stock and above-ground biomass in forests based on remote sensing and field measurements." Forest Ecology and Management 260(3): 252-261 (Based on CORINE and TBFRA). G4M is a spatially explicit forestry model and relies on the information from forest maps for its initialisation. This map served as a basis that was adjusted to the degree possible to data reported by countries (see points 2 and 3 below)
(2) Estimated by the JRC from UNFCCC reporting as: [area of "Forest land" in 1990 (assuming that "managed forest" under UNFCCC equals to land under FM)] - [area deforested since 1990 as included in KP reporting)]
(3) Taken from FM area reported in latest available KP submission for the yr 2008.
(4) Data of 2008 minus the area of Deforestation projected by G4M.

(b) Emissions and removals from forest management

For the historical emissions and removals from forest management, and for the relationship between forest management and forest land remaining forest land as shown in GHG inventories and relevant historical data, please refer to specific MSs' submissions.

The following table shows the modeled emissions and removals from forest management, and illustrates the procedure followed for „calibration" of models' results with historical GHG data from MSs. It also reports the results of the sensitivity analysis.

Table A-3. Emissions and removals from FM as estimated by models (above and below-ground biomass, Gg CO2eq), calibration of models' results, and sensitivity analysis. Numbers refer to the sum of the 15 countries which used JRC/IIASA/EFI projections.

			av. 2000-2008	2000	2005	2010	2015	2020	av. 2013-2020
Step 1: models' results (only biomass)	EFISCEN (1)		-169698	-172327	-169758	-162885	-144192	-119431	-136309
	G4M		-178165	-190834	-176062	-154906	-131090	-109810	-124896
	Average of models		-173932	-181580	-172910	-158896	-137641	-114620	-130602
Step 2: ex-post processing	Offset (2)	biomass	-40561						
		non-biomass pools and GHG sources	5430						
		total offset	**-35131**						
	Calibrated average of models (3)		-209063	-216712	-208042	-194027	-172772	-149752	**-165734**
Sensitivity analysis (4)		*+10% harvest*				*-174835*	*-149860*	*-128184*	*-143198*
		-10% harvest				*-218087*	*-195322*	*-171397*	*-188069*

(1) Efiscen does not estimate data for all countries for 2000 and 2005. When data were missing, backward extrapolation was applied as follow: sink in 2005 = sink in 2010 x ratio of harvest 2010/2005; this approach assumes that in the short term harvest is the main factor determining the sink. Estimates were extrapolated for the following countries: Bulgaria, Czech Republic, Estonia, Hungary, Italy, Latvia, Lithuania, and Netherlands.

(2) The "offset" is distinguished between:
- biomass: calculated as difference between [average of country's emissions and removals from biomass for 2000-2008] and [average of models' estimated emissions and removals from biomass for 2000-2008]
- non-biomass pools and GHG sources: calculated as the sum of non-biomass pools and GHG sources as reported by the country for the period 2000-2008 .

(3) The calibrated average of models, used for the setting of the reference level (see grey cell), is obtained by adding the offset to the average of models.

(4) Simulation of the impact of +/-10% harvest as compared to BAU harvest on the emissions and removals from FM. Data are calibrated averages of models' results.

Overall, for the 15 countries considered, the average of models' results for the period 2000-2008 is a sink (-173932 Gg CO2 eq) which corresponds to about 83% of the sink reported in GHG inventories (-209063 Gg CO2 eq). This difference has been „reconciled" though the calibration process described above. When assessing this difference, the following aspects should be considered:

- Models considered only biomass. The other carbon pools considered by countries accounts for a part of the observed difference in results.
- High uncertainties are typically reported for LULUCF. For example, a preliminary estimate of the uncertainties for GHG emissions in "forest land remaining forest land" at the EU level (based on the aggregation of available information reported by EU MSs in their GHG inventories) suggests a value around 25-30% (estimate by JRC).
- While rather detailed analyses were performed by the modelling team in most countries, in some case due to lack of adequate data only indirect estimates and crude assumptions were possible.
- Methods to estimate GHG from FM differ a lot among countries (e.g. stock change vs gain-loss approaches). A consistent method (as applied by models) cannot always reproduce results from different approaches, at least in the short term. It should be expected, however, that the trend over a period of 5-10 years or more is only driven by the key drivers (e.g., age structure and harvest rate) and is not significantly affected by the method used to estimate emissions and removals.

In any case, all the relevant divergences between models' results and GHG inventories for the period 2000-2008 will be transparently analysed and discussed during the review. Any possible improvement on the assumptions and/or input data used by models, emerging from the discussion with the review team and/or the country concerned, will be considered for possible re-runs of the models within the time limits set by the review process.

The result of the sensitivity analysis indicates that a +/-10% variation in the future harvest demand used by models leads to an average variation of the sink of about +/-12% in the countries concerned (with relevant differences among countries), corresponding on average to +/-0.8% of the total 1990 GHG emissions of the countries concerned.

(c) Forest characteristics and related management

Figure below shows the age structure relative to the sum of the countries which used JRC/IIASA/EFI projections to set their FM-RLs.

For other relevant country-specific forest characteristics (i.e. increment, rotation lengths, species composition, management regimes, etc.) used by models, please refer to the submission of each specific EU MS.

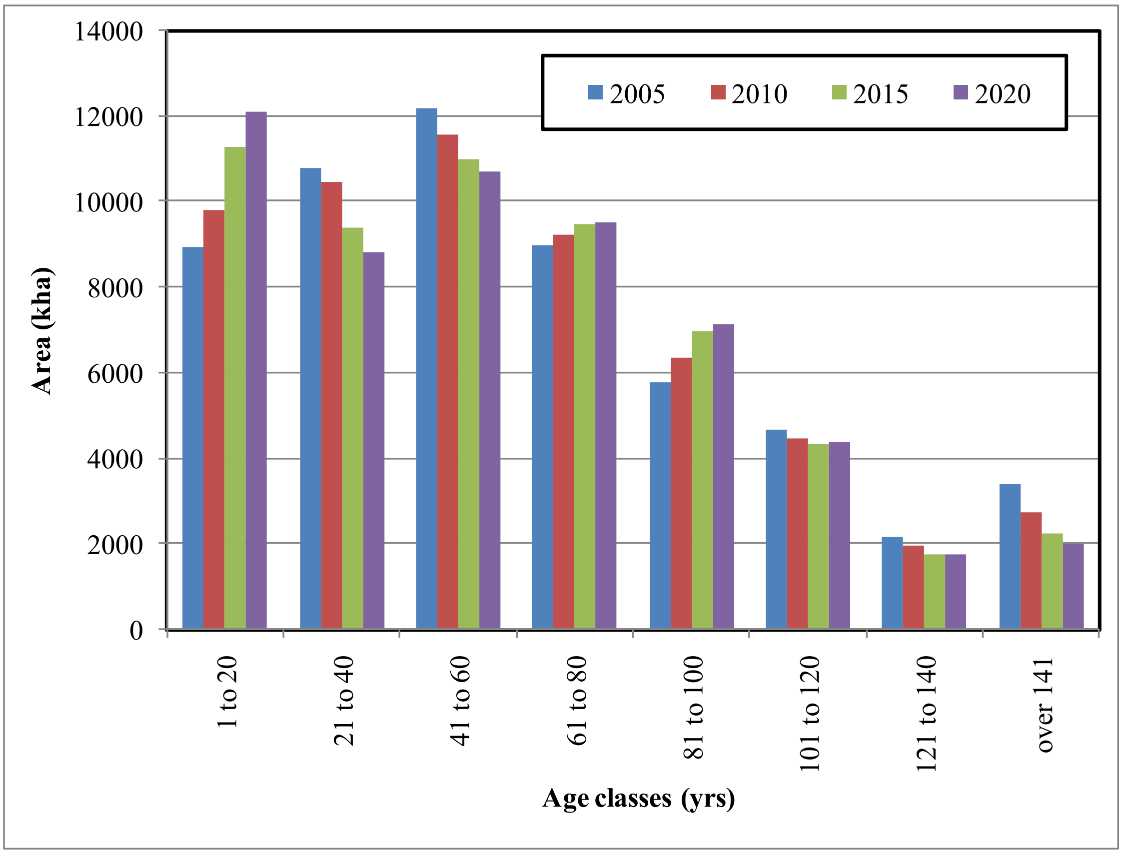

Figure A-2. Evolution of the forest age class structure (in yrs) as modelled by EFISCEN relative to the sum of the 15 countries which used JRC/IIASA/EFI projections to set their FM-RLs.

(d) Harvest rates

The table below shows the historical harvest rate and the projected BAU harvest demand used by models. On average, for the period 2013-2020 models used an harvest demand which is 9% higher than the historical harvest rate of the period 2003-2007.

Table A-4. Historical harvest rate and projected BAU harvest demand used by models (roundwood overbark 1000 m3), for the 15 countries which used JRC/IIASA/EFI projections.

	2000	2005	2010	2015	2020	ratio (av. 2013-2020)/2005	Source of historical data (till 2007)
Belgium	3457	4104	4066	4028	3990	0,98	country data
Bulgaria	4836	6469	6237	6005	5773	0,92	FAO June 2010
Czech Rep.	15710	18147	18989	19831	20673	1,11	FAO June 2010
Estonia	9600	7410	8548	9685	10822	1,35	FAO June 2010
France	63637	57498	59425	61352	63279	1,08	EU subm Nov 2009
Greece	2207	1870	2250	2629	3009	1,47	FAO June 2010
Hungary	6179	6632	6998	7363	7728	1,13	FAO June 2010
Italy	14965	14496	16284	18071	19858	1,28	country data
Latvia	11040	10864	11356	11848	12341	1,10	EU subm Nov 2009
Lithuania	6163	6925	6702	6480	6257	0,93	FAO June 2010
Luxembourg	298	305	309	312	316	1,03	FAO June 2010
Netherlands	1090	1204	1188	1171	1155	0,97	FAO June 2010
Poland*							
Romania	14827	17104	16926	16749	16571	0,98	FAO June 2010
Slovakia	6599	8821	9110	9399	9688	1,08	FAO June 2010
Spain	17023	17755	18246	18738	19229	1,06	FAO June 2010
Total	177631	179606	186634	193662	200690	1,09	

*Data for Poland will be reported later.

Notes: values in the table express 5-yrs average (e.g. 2000 is the average 1998-2002, 2005 is the average 2003-2007). Till 2007, data are from national statistics or other country data. Data for 2020 were estimated by the models Primes (wood for bioenergy) and Globiom (timber). Data between 2008 and 2020 are interpolated.

Please note that a general assumption has been done that all the harvest predicted till 2020 is allocated to FM, i.e. it was assumed that the harvest till 2020 on areas afforested/reforested or deforested after 1990 is negligible as compared to the harvest of forest areas which qualify as FM.

(e) Harvested wood products

Please refer to the specific MSs' Annexes.

(f) Natural disturbances

The calibration procedure described above automatically incorporates the average rate of past disturbances (for the period 2000-2008) into the projections. See further comments in section „Ex-post processing of models' results" on the need of future consistency. For transparency reasons only, the country-specific emissions from forest fires for the period 1990-2008 (expressed in Gg CO2eq.) are included in the table below (only for those MS using JRC/IIASA/EFI projections). It is reasonable to assume that forest fires represent the major natural disturbance type for most of the countries considered. The average of the emissions reported in table below for the period 2000-2008 equals about 0.3% of the total 1990 GHG emissions for the same countries. Furthermore, for any year, emissions from fires reported in table A-5 were always lower than 3% of 1990 total GHG emissions of the respective country.

Table A-5. Emissions from forest fires (Gg CO2eq) for the 15 countries which used JRC/IIASA/EFI projections. Data taken from country reporting to UNFCCC, in some cases elaborated by the JRC.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	av. 2000-2008
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	35	17	178	617	614	19	73	26	236	281	1966	685	221	173	39	49	126	1474	185	546
Czech Rep.	21	9	160	146	105	52	268	461	157	46	52	12	25	175	48	33	59	47	13	52
Estonia	57	1	56	10	35	18	19	30	23	24	37	13	73	11	19	5	120	15	20	35
France	1778	288	388	429	446	586	497	682	597	349	549	397	1396	1491	318	518	182	201	176	581
Greece	93	35	102	107	93	61	25	74	233	15	287	30	3	4	11	10	29	379	59	90
Hungary	0	0	0	0	0	0	0	0	0	2	49	35	35	30	1	104	2	90	2	39
Italy	14038	3768	5735	13419	4713	3084	2641	9259	8854	5022	7359	4750	2829	5776	2584	2725	2092	15184	4037	5260
Latvia	6	2	201	14	1	13	22	11	5	37	31	6	56	15	12	3	80	6	9	24
Lithuania	10	5	70	23	23	23	23	23	4	26	25	8	54	33	19	4	92	3	9	27
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poland*																				
Romania	12	8	20	14	9	6	6	2	4	10	98	28	98	21	3	6	26	80	23	43
Slovakia	10	4	21	23	3	3	7	4	1	1	29	1	1	5	3	4	3	6	1	6
Spain	2077	3226	1134	930	6228	1729	504	1519	1487	926	1928	781	1231	1699	1366	2840	6140	417	260	1851
total	18137	7362	8065	15731	12270	5593	4087	12091	11601	6740	12409	6747	6023	9433	4424	6300	8950	17903	4794	8554

*Data for Poland will be reported later.

Notes: Data are taken from the latest available CRF tables, row "wildfires" of Table LULUCF 5(V) (Biomass burning). Some countries reported CH4 and N2O in this table but did not explicitly included CO2 emissions (i.e. CO2 was implicitly included in tab 5A); in these cases, the JRC indirectly derived CO2 emissions from CH4 and N2O reported emissions, using default factors from IPCC Good Practice Guidance for LULUCF (IPCC GPG 2003, table 3A.1.16) . In some case (e.g. Italy) additional information was taken from the latest NIR.

Policies included

Policy assumptions are made in the baseline scenario of the PRIMES model which underpins the projections for the construction of the RL. For the purpose of this submission, policies and measures included are those implemented by April 2009 and legislative provisions adopted by April 2009 that are defined in such a way that there is almost no uncertainty how they should be implemented in the future. An inventory of legal measures and EU financial support included in the PRIMES model is reproduced from Capros et al. (2010) in Annex II to this submission. However more details are provided on pp.17-21 ("BASELINE") of the publication EU energy trends to 2030 - UPDATE 2009.

Annex 1-2. Description of models

GLOBIOM

The Global Biosphere Management Model (GLOBIOM) has been developed and is used at the International Institute for Applied Systems Analysis (IIASA). GLOBIOM is a global recursive dynamic partial equilibrium model integrating the agricultural, bioenergy and forestry sectors with the aim to provide policy analysis on global issues concerning land use competition between the major land-based production sectors. It is global in the sense that it encompasses all countries of the world, aggregated to 28 world regions. Partial denotes that the model does not include the whole range of economic sectors in a country or region but specialises on agricultural and forestry production as well as bioenergy production. These sectors are, however, modelled in a detailed way accounting for about 20 globally most important crops, a range of livestock production activities, forestry commodities as well as different energy transformation pathways.

GLOBIOM disaggregates available land into several land cover or use classes that deliver raw materials for wood processing, bioenergy processing and livestock feeding. Forest land is made up of two categories (unmanaged forest and managed forest); the other categories include cropland, short rotation tree plantations, grassland (managed grassland) and 'other natural vegetation' (includes unused grassland).

The detailed modelling of land based activities means that the GLOBIOM model relies on a detailed database containing geo-spatial information. This information is made up of different layers: geo-spatial characteristics that do not change over time (due to climate change and/or management practices) such as altitude, slope, and soil are used to form geographical clusters or 'Homogenous Response Units' (HRU). On top of this layer containing time invariant characteristics come country boundaries and a 0.5° x 0.5° grid layer that contains more detailed information such as data on climate, land use/cover, etc. This information forms Simulation Units (SimU) that are the basic geographical unit for the analysis. For each SimU, different management systems are distinguished. For the bulk of global crop production four management systems are available in GLOBIOM; these are irrigated, high input – rainfed, low input – rainfed and subsistence management.

The global agricultural and forest market equilibrium is computed by choosing land use and processing activities to maximize welfare (i.e. the sum of producer and consumer surplus) subject to resource, technological, and policy constraints. These constraints ensure that demand and supply for inter alia irrigation water and land meet but also impose exogenous demand constraints so as to reach, for instance, a certain biofuel target. Prices and international trade flows are endogenously determined for respective aggregated world regions (i.e. in this context for the 28 regions mentioned above). Imported and domestic goods are assumed to be identical (homogenous), but the modelling of trade does take into account transportation costs and tariffs. GLOBIOM includes accounting for greenhouse gas emissions and sinks from agricultural and forestry activities (not used in this study). This includes among others accounting for N2O emissions from fertiliser use whose intensity in turn depends on the management system.

It is possible within the model to convert one land cover or use to another; the total land area spanning all the categories included remains fixed, however (this forms part of the constraints mentioned earlier). The greenhouse gas consequences from land use change are derived from the carbon content of above- and below-ground living biomass of the respective land cover classes.

The model is recursive dynamic in the sense that changes in land use made in one period alter the land availability in the different categories in the next period. Land use change is thus transmitted from one period to the next. As GLOBIOM is a partial equilibrium model, not all economic sectors are modelled explicitly. Instead, several parameters enter the model exogenously, or are pre-determined in other words, including wood and food demand which in turn are derived from changes over time in gross domestic product (GDP), population (same projections as used in PRIMES) and food (calorie) consumption per capita (projections according to FAO 2006). Assumptions on GDP, population growth and calorie consumption per capita are the underlying driver of the model dynamics. The base year for the model is the year 2000, the model horizon in this study is 2030. The exogenous drivers population and GDP growth have been updated to take recent economic downturns into account by relying on 2009 data. In relation to yield development, GLOBIOM typically assumes 0.5 % autonomous technological progress in crop improvement; in addition, the possibility to shift between management systems as well as the relocation of crops to more productive areas also provides for regional average yield changes. When it comes to 'bioenergy dynamics', projections from the POLES model (for regions outside Europe) and the PRIMES model (for EU 27 countries) on regional biomass demand in heat and power (BIOINEL), direct biomass use i.e. for cooking (BIOINBIOD) and liquid transport fuel use (BFP1 and BFP2 or first and second generation biofuels, respectively) over the next two decades are implemented in GLOBIOM as target demands or minimum demand constraints.

Resources for the different types of bioenergy products can be sourced from agricultural and (existing) forestry activities but also from newly planted short rotation tree plantations. First generation biofuels include ethanol made from sugarcane, corn and wheat, and biodiesel made from rapeseed, palm oil and soybeans. Biomass for second generation biofuels is either sourced from existing forests/wood processing or from short rotation tree plantations. Havlík et al (2010) define different scenarios for the sourcing of second generation biofuels. They also conducted an analysis to establish the scale of land available for short rotation tree plantations. Summarised in a few words, they arrive at available area by excluding areas unsuitable for their level of aridity, temperatures, elevation and population density from total arable land area (grassland, cropland, 'other natural vegetation').

GLOBIOM is calibrated so that the baseline solution approaches the observed values through adjustment of the cost of production so that for observed levels of particular activities the marginal cost equals to the marginal revenue. The controlled activities are crop areas, primary forest products supply and animal calories supply.

Recent applications of GLOBIOM have analysed the impacts of different development scenarios in terms of population growth, economic development and technical change on global food production and consumption (Schneider et al, 2011) as well as the global land-use implications of first and second generation biofuel targets (Havlík et al, 2010). The explicit inclusion of water as a resource (along with land and irrigated land) makes GLOBIOM a strong tool for analysing water related impacts of different development scenarios (Sauer et al, 2010).

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EFISCEN

The European Forest Information Scenario (EFISCEN) model (Sallnäs 1990; Schelhaas et al. 2007) is a large-scale model that assesses the supply of wood and biomass from forests and projects forest resource development on regional to European scale (Eggers et al. 2008; Ťupek et al. 2010). The core of the model was developed in the late 1980s, as a forest resource projection model for Sweden.

EFISCEN uses forest inventory data as an input, including:

- area (ha);
- average standing volume of growing stock (m3/ha);
- net annual increment (m3/ha/y).

Based on this data, the state of the forest is described as an area distribution over age- and volume-classes in matrices. During simulations, forest area moves between matrix cells, describing different natural processes (e.g. growth and mortality) and human actions (e.g. forest management). Growth dynamics are simulated by shifting area proportions between matrix cells. In each 5-year time step, the area in each matrix cell moves up one age-class to simulate ageing. Part of the area of a cell also moves to a higher volume-class, thereby simulating volume increment. Growth dynamics are estimated by the model's growth functions whose coefficients are based on inventory data.

Management scenarios are specified at two levels in the model. First, a basic management regime defines the period during which thinnings can take place and a minimum age for final fellings. These regimes can be regarded as constraints on the total harvest level. Thinnings are implemented by moving area to a lower volume class and final fellings by moving area outside the matrix to a bare-forest-land class, from where it can re-enter the matrix. The applied management regimes are based on a country level compilation of management guidelines (Nabuurs et al. 2007). Second, the demand for wood is specified for thinnings and for final felling separately and EFISCEN may simulate to "fell" the demanded wood volume if available. If wood demand is high, management is intensive and rotation lengths are close to the lower limit defined in the management regimes. If wood demand is low, rotation lengths are longer, because less fellings are needed to fulfill the demand.

EFISCEN projects (i) stemwood volume, (ii) increment, (iii) age-classes and (iv) wood removals for five year time-steps. To assess biomass carbon stocks, stemwood volume is converted into carbon in stems, branches, foliage, coarse and fine roots, using basic wood densities, a generic carbon content, and age-dependent biomass distribution factors. Felling residues and litter production of trees, due to turnover and natural mortality, are used as input data for the dynamic soil model YASSO (Liski et al., 2005) and incorporated as independent module.

The soil model **YASSO** in turn is used to estimate changes in the soil C pool by the EFISCEN model. YASSO consists of three litter compartments and five decomposition compartments. For the soil carbon module, the litter is grouped as non-woody litter (foliage and fine roots), fine woody litter (branches and coarse roots) and coarse woody litter (stems and stumps). Each of the litter compartments has a fractionation rate determining the proportion of its contents released to the decomposition compartments in a time step. For the compartment of non-woody litter, this rate is equal to 1, which means that all of its contents is released in one time step, whereas for the woody litter compartments, this rate is smaller than 1. Litter is distributed over the decomposition compartments of extractives, celluloses and lignin-like compounds according to its chemical composition. Each decomposition compartment has a specific decomposition rate, determining the proportional loss of its contents in a time step. Fractions of the losses from the decomposition compartments are transferred into the subsequent decomposition compartments having slower decomposition rates while the rest is removed from the system. The fractionation rates of woody litter and the decomposition rates are controlled by temperature and water availability and are based on litterbag data across Europe (Liski et al., 2003).

The model is especially suited for simulating managed, even-aged forests at large scales. The model has been validated for Finland (Nabuurs et al. 2000) and Switzerland (Thürig and Schelhaas 2006) by running EFISCEN on historic data. Other validations have been performed by comparing its growth functions against growth functions of other models and by comparing projections against projections of other models (e.g. Ťupek et al. 2010).

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GLOBAL FORESTRY MODEL: G4M

The Global Forest Model (G4M) is a geographically explicit agent-based model that simulates decisions made by virtual land owners on deforestation, afforestation and forest management taking into account profitability of forestry and agriculture. The model is applied and developed by IIASA and estimates. By comparing the income from managed forest (difference of wood price and harvesting costs, income by storing carbon in forests) with income by alternative land use on the same place, the decision of afforestation or deforestation is made. As G4M is spatially explicit (currently on a 0.5° x 0.5° resolution) the different deforestation pressure at the forest frontier can also be handled. The model can use external information (like wood prices, prescribed land-use change) from other models or data bases, which guarantee food security and land for urban development or account for disturbances. As outputs, G4M produces estimates of land-use change, carbon sequestration/emissions in forests, impacts of carbon incentives (e.g., avoided deforestation), and supply of biomass for bio-energy and timber.

The model handles age classes of one year width. Afforestation and disturbances cause an uneven age-class distribution over a forest landscape. The model performs final cuts in a manner that all age classes have the same area after one rotation period. During this age class harmonization time the standing biomass, increment and amount of harvest is fluctuating due to changes in age-class distribution and afterwards stabilizing.

The main forest management options considered by G4M are variation of thinning and choice of rotation length. G4M does not model species explicitly but a change of species can be emulated by adapting NPP, wood price and harvesting costs. The rotation length can be individually chosen but the model can estimate optimal rotation lengths to maximize increment, maximize stocking biomass or maximize harvestable biomass.

An EU-wide forest/ non-forest map was generated, consistent with the national forest areas reported by MCPFE (2007) for the year 2000. For areas where CORINE land cover data are available, the CORINE dataset was aggregated from the original 100 meters to 500 meters spatial resolution. Firstly, the number of forest pixels within each 5 by 5 pixel aggregation unit was calculated. Secondly, a threshold with the minimum number of forested pixels within the aggregation units was determined for each country. This threshold was selected accordingly, to generate a forest map in agreement with the total forest area given by TBFRA 2000 at the national level.

For areas not covered by CORINE data, a similar approach was applied with Vegetation Continuous Fields (VCF) data (Hansen et al. 2002). The area covered with woody vegetation in the VCF data is given in percent. A percentage threshold of the minimum area covered by woody vegetation was defined for each country to match total forest area from TBFRA 2000. Based on FAO data the map distinguishes between managed and unmanaged forest. Criteria of wilderness and remoteness were used to locate the unmanaged forest areas on the map. The initial growing stock per grid cell was taken from the European forest biomass map from Gallaun et al. (2010). For countries outside Europe the forest biomass map compiled by Kindermann et al. (2008) was used.

Increment is determined by a potential Net Primary Prductivity (NPP) map (Cramer et al. 1999) and translated into net annual increment (NAI). At present this increment map is static but can be changed to a dynamic growth model which reacts to changes of temperature, precipitation or CO2 concentration. For the purpose of this study the increment map was scaled at country level to match either MCPFE or reported country data when available. Age structure and stocking degree are used as additional information for adjusting NAI. If the stocking degree of forest modelled with a given age structure (country average) in a grid cell is greater than 1.05, the age structure of the modelled forest is shifted iteratively by a few age classes towards older forest. If stocking degree of forest modelled in a cell is smaller than 0.5 age structure of the modelled forest is shifted iteratively by a few age classes towards younger forest. It is required that the shifts are symmetrical to keep country average age structure close to statistical value. If the age structure shift distribution within a country is skewed towards older forest, the country's average NAI is increased iteratively. If the age structure shift distribution within a country is skewed towards younger forest country MAI is decreased iteratively.

The model uses external projections of wood demand per country to calculate total harvest iteratively. The potential harvest amount per country under a scenario of rotation lengths that maintain current biomass stocks is estimated. If total harvest is smaller than wood demand the model changes grid per grid (starting from the most productive forest) management to a rotation length that optimizes forest increment and thus allows for more harvest. This mimics the typical observation that managed forests in Europe are currently not managed optimally with respect to yield. The rotation length is changed at maximum by 5 years per time step. If the harvest is still too small and unmanaged forest is available the status of the unmanaged forest will change to managed. If total harvest is greater than the demand, the model changes management to maximum biomass rotation length, i.e. manages forests for carbon sequestration. If wood demand is still lower than potential harvest managed forest can be transferred into unmanaged forest.

Thinning is applied to all managed forests. The stands are thinned to maintain a stocking degree specified between 0.5 and 1.05, i.e. thinning mimics natural mortality along the self-thinning line. The model can consider the use of harvest residues e.g. for bioenergy purposes.

Despite the harmonization efforts to reproduce observed data on increment, area and harvest, the forest carbon balance as described in the model might still deviate from the observed forest carbon sink or source. This might be due to differences in forest management or forest disturbances. The model cannot account for such effects. To compensate for processes affecting the carbon balance that cannot be modelled, an adjustment algorithm has been introduced. Rotation length of unmanaged forest is set to the value that yields constant biomass (equal to observed biomass in 2000). If modelled carbon sink/source from forest management (averaged over 1990-1995) is smaller/larger than reported by a country, the rotation length of unmanaged forest is changed to maximizing biomass. The procedure is applied cell by cell within the country's unmanaged forest until the reported stock change is matched.

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The PRIMES Energy Systems Model

A summary description of the energy systems model for is provided on http://www.e3mlab.ntua.gr/manuals/PRIMsd.pdf and of the biomass system model, which is incorporated in the large scale model, on http://www.e3mlab.ntua.gr/e3mlab/PRIMES%20Manual/THE_NEW_PRIMES_BIOMASS_MODEL.pdf

Annex 1.3 – Description of policies and measures included in the Reference Level

The table below has been extracted from pp.17-19 in P. Capros, L. Mantzos, N. Tasios, A. De Vita, N. Kouvaritakis (2010), EU energy trends to 2030 — UPDATE 2009, European Commission, Directorate-General for Energy in collaboration with Climate Action DG and Mobility and Transport DG. Luxembourg: Publications Office of the European Union, 2010. ISBN 978-92-79-16191-9. Available online: http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2030_update_2009.pdf.

Table Annex II-1: Inventory of legal measures and Community financial support included in PRIMES

Measure	How the measure is reflected in PRIMES
I. Regulatory measures	
Energy efficiency	
Eco-design implementing measures	
Eco-design Framework Directive 2005/32/EC	Adaptation of modelling parameters for different product groups. As requirements concern only new products, the effect will be gradual (marginal in 2010; rather small in 2015 and up to full effect by 2030). The potential envisaged in the Eco-design supporting studies and the relationship between cost and efficiency improvements in the model's database were cross-checked.
Stand-by regulation 2008/1275/EC	
Simple Set-to boxes regulation 2009/107/EC	
Office/street lighting regulation 2009/245/EC	
Household lighting regulation 2009/244/EC	
External power supplies regulation 2009/278/EC	
Other energy efficiency	
Labelling Directive 2003/66/EC	Enhancing the price mechanism mirrored in the model
Cogeneration Directive 2004/8/EC	National measures supporting cogeneration are reflected
Directive 2006/32/EC on end-use energy efficiency and energy services	National implementation measures are reflected
Buildings Directive 2002/91/EC	National measures e.g. on strengthening of building codes and integration of RES are reflected
Energy Star Program (voluntary labelling program)	Enhancing the price mechanism mirrored in the model
Energy markets and power generation	
Completion of the internal energy market (including provisions of the 3rd package)	The model reflects the full implementation of the Second Internal market Package by 2010 and Third Internal Market Package by 2015. It simulates liberalised market regime for electricity and gas (decrease of mark-ups of power generation operators; third party access; regulated tariffs for infrastructure use; producers and suppliers are considered as separate companies) with optimal use of interconnectors
EU ETS directive 2003/87/EC as amended by Directive 2008/101/EC and Directive 2009/29/EC	The ETS carbon price is modelled so that the cumulative cap set for GHGs covered by the ETS is respected[8]. The permissible total CDM amount over 2008-2020 is conservatively estimated at 1600 Mt. Banking of allowances is reflected. The model endogenously calculates carbon prices clearing the ETS market that allow to match cumulative emissions over the period 2008-2030 with cumulative allowances assuming the maximum permissible use of CDMs. Resulting carbon prices in the baseline 2009 are: 25 €'08/t CO2eq in 2020 and 39 €'08/t CO2eqin 2030.
Energy Taxation Directive 2003/96/EC	Tax rates (EU minimal rates or higher national ones) are kept constant in real term. The modelling reflects the practice of MS to increase tax rates above the minimum rate due to i.e. inflation.
Large Combustion Plant directive 2001/80/EC	Emission limit values laid down in part A of Annexes III to VII in respect of sulphur dioxide, nitrogen oxides and dust are respected. Some existing power plants had a derogation which provided them with 2 options to comply with the Directive: either to operate only a limited number of hours or to be upgraded. The model selected between the two options on a case by case basis. The upgrading is reflected through higher capital costs.
IPPC Directive 2008/1/EC	Costs of filters and other devices necessary for compliance are reflected in the parameters of the model
Directive on the geological storage of	Enabling measure allowing economic modelling to determine CCS penetration

[8] For the allocation regime for allowances in 2010, the current system based on National Allocation Plans and essentially cost-free allowances is assumed, with price effects stemming from different investment and dispatch patterns triggered by need to submit allowances. For the further time periods, in the power sector there will be a gradual introduction of full auctioning, which will be fully applicable from 2020 onwards, in line with the specifications of the amended ETS directive. For the other sectors (aviation and industry), the baseline follows a conservative approach which reflects the specifications in the directive on the evolution of auctioning shares and the provisions for free allocation for energy intensive sectors based on benchmarking.

Measure	How the measure is reflected in PRIMES
CO2 2009/31/EC	
Directive on national emissions' ceilings for certain pollutants 2001/81/EC	PRIMES model takes into account results of RAINS/GAINS modelling regarding classical pollutants (SO2, NOx). Emission limitations are taken into account bearing in mind that full compliance can also be achieved via additional technical measures in individual MS.
Water Framework Directive 2000/60/EC	Hydro power plants in PRIMES respect the European framework for the protection of all water bodies as defined by the Directive
Landfill Directive 99/31/EC	Provisions on waste treatment and energy recovery are reflected
Transport	
Regulation on CO2 from cars 2009/443/EC	Limits on emissions from new cars: 135 gCO2/km in 2015, 115 in 2020, 95 in 2025 – in test cycle. The 2015 target should be achieved gradually with a compliance of 65% of the fleet in 2012, 75% in 2013, 80% in 2014 and finally 100% in 2015. Penalties for non-compliance are dependent on the number of grams until 2018; starting in 2019 the maximum penalty is charged from the first gram.
Regulation EURO 5 and 6 2007/715/EC	Emission limits introduced for new cars and light commercial vehicles
Fuel Quality Directive 2009/30/EC	Modelling parameters reflect the Directive, taking into account the uncertainty related to the scope of the Directive addressing also parts of the energy chain outside the area of PRIMES modelling (e.g. oil production outside EU).
Biofuels directive 2003/30/EC	Support to biofuels such as tax exemptions and obligation to blend fuels is reflected in the model The requirement of 5.75% of all transportation fuels to be replaced with biofuels by 2010 has not been imposed as the target is indicative. Support to biofuels is assumed to continue. The biofuel blend is assumed to be available on the supply side.
Implementation of MARPOL Convention ANNEX VI - 2008 amendments - revised Annex VI	Amendment of Annex VI of the MARPOL Convention reduce sulphur content in marine fuels which is reflected in the model by a change in refineries output
II. Financial support	
TEN-E guidelines (Decision 1364/2006)	The model takes into account all TEN-E realised infrastructure projects
European Energy programme for Re-covery (Regulation 2009/663/EC)	Financial support to CCS demonstration plants; off-shore wind and gas and electricity interconnections is reflected in the model. For modelling purposes the following amounts for CCS power plants were assumed, following assumptions of summer 2009: Germany: 950 MW (450MW coal post-combustion, 200MW lignite post-combustion and 300MW lignite oxy-fuel), Italy 660 MW (coal post-combustion), Netherlands 1460 MW (800MW coal post-combustion, 660MW coal integrated gasification pre-combustion), Spain 500 MW (coal oxy-fuel), UK 3400 MW (1600MW coal post-combustion, 1800MW coal integrated gasification pre-combustion), Poland 896 MW (306MW coal post-combustion, 590MW lignite post-combustion).
RTD support (7th framework pro-gramme- theme 6)	Financial support to R&D for innovative technologies such as CCS, RES, nuclear and energy efficiency is reflected by technology learning and economies of scale leading to cost reductions of these technologies
State aid Guidelines for Environmental Protection and 2008 Block Exemption Regulation	Financial support to R&D for innovative technologies such as CCS, RES, nuclear and energy efficiency is reflected by technology learning and economies of scale leading to cost reductions of these technologies
Cohesion Policy – ERDF, ESF and Cohesion Fund	Financial support to national policies on energy efficiency and renewables is reflected by facilitating and speeding up the uptake of energy efficiency and renewables technologies.
III. National measures	
Strong national RES policies	National policies on e.g. feed-in tariffs, quota systems, green certificates, subsidies and other cost incentives are reflected
Nuclear	Nuclear, including the replacement of plants due for retirement, is modelled on its economic merit and in competition with other energy sources for power generation except for MS with legislative provisions on nuclear phase out. Several constraints are put on the model such as decisions of MSs not to use nuclear at all (Austria, Cyprus, Denmark, Estonia, Greece, Ireland, Latvia, Luxembourg, Malta and Portugal) and closure of existing plants in some new MSs according to agreed schedules (Bulgaria 1760 MW, Lithuania 2600 MW and Slovakia 940 MW). The nuclear phase-out in Belgium and Germany is respected while lifetime of nuclear power plants was extended to 60 years in Sweden. Nuclear investments are possible in Bulgaria, the Czech Republic, France, Finland, Hungary, Lithuania, Romania, Slovakia, Slovenia and Spain. For modelling the following plans on new nuclear plants were taken into account: Bulgaria (1000 MW by 2020 and 1000 MW by 2025), Finland (1600 MW by 2015), France (1600 MW by 2015 and 1600 MW by 2020), Lithuania (800 MW by 2020 and 800 MW by 2025), Romania (706 MW by 2010, 776 MW by 2020 and 776 MW by 2025), Slovakia (880 MW by 2015). MSs experts were invited to provide information on new nuclear investments/programmes in spring 2009 and commented on the PRIMES baselines results in summer 2009, which had a significant impact on the modelling results for nuclear capacity.

Annex 2. Copy of MS submissions in the format they were submitted to the EU.