

## **Annex 4.1 – CO<sub>2</sub> reference approach and comparison with sectoral approach**

The GHG emissions in the energy sector can be estimated using two approaches: the reference approach (RA) and the sectoral approach (SA).

The reference approach is a top-down method that uses the carbon balance of a country, requiring information about the production, import, export and stored amount of fuels.

The sectoral approach is a bottom-up method, using detailed information about the fuel consumption in each distinct sub-sector (power and thermal energy production, processing and construction industry, different ways of transport, trade, institutional and residential sectors, as well as agriculture and other economic branches).

Differences between the reference and sectoral approach are outlined in the next table.

<b>Year</b>	<b>Fuel consumption (%)</b>	<b>CO<sub>2</sub> emissions (%)</b>
<b>1989</b>	16.6	20.7
<b>1990</b>	12.9	10.2
<b>1991</b>	19.8	17.8
<b>1992</b>	9.9	11.4
<b>1993</b>	11.2	12.0
<b>1994</b>	10.0	10.3
<b>1995</b>	14.4	14.8
<b>1996</b>	6.5	6.6
<b>1997</b>	5.9	8.3
<b>1998</b>	8.6	10.1
<b>1999</b>	11.2	11.8
<b>2000</b>	9.2	9.2
<b>2001</b>	8.8	9.5
<b>2002</b>	2.1	2.4
<b>2003</b>	4.6	4.1
<b>2004</b>	1.8	3.7
<b>2005</b>	3.5	5.0
<b>2006</b>	8.3	8.4
<b>2007</b>	8.2	9.3
<b>2008</b>	14.6	16.6
<b>2009</b>	8.6	9.9

A comparison between the SA and the RA indicates differences in both the energy consumption data and CO<sub>2</sub> emissions. One of the reasons for these differences refers to the fact that the RA deals with the non-energy uses of fuels as if they are combustion activities. A correction is done by the carbon stored from non-energy fuel use, but the information related to this area is limited in the national energy balance. The highest difference is observed in 1989 due to the large amount of non-energy use of fuels. Another reason is probably caused by the statistical differences reported in the energy balance.

For the year 2009 there was a decrease for value of RA-SA differences because the statistics differences in the EB for year 2009 have a lower value (14,193,219 GJ) against the value registered in the EB for statistics differences for the year 2008 (30,937,221 GJ).

Another reason is the fact that the RA does not estimate the fuel delivered for international bunkers consumption. In the SA, the fuel consumption is divided into domestic and international bunkers (the later not being included in the overall sectoral fuel consumption).