COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 8.3.2011
SEC(2011) 279 final

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

ANNEX II

Accompanying document to the

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS
COMMISSION STAFF WORKING DOCUMENT

Energy Efficiency Plan 2011

COM(2011) 109 final
SEC(2011) 277 final

ANNEX II TO THE IMPACT ASSESSMENT

EU27: PRIMES 2009 Efficiency Scenario

Analytical Results

Primes Ver. 4 Energy Model

E3M Lab

National Technical University of Athens

07/05/2010

SUMMARY ENERGY BALANCE AND INDICATORS (A)

ktoe	1990	1995	2000	2005	2010	2015	2020	2025	2030	'90-'00	'00-'10	'10-'20
										Annual % Change		
Production	**936047**	**950181**	**941860**	**900326**	**822199**	**770370**	**737350**	**732546**	**751835**	**0,1**	**-1,3**	**-1,1**
Solids	366477	277810	213423	196277	167822	152891	139933	133480	130396	-5,3	-2,4	-1,8
Oil	129551	171052	173006	134290	102950	74336	49872	40787	37231	2,9	-5,1	-7,0
Natural gas	162447	188965	207559	188677	164149	129066	111499	91726	75140	2,5	-2,3	-3,8
Nuclear	202589	223028	243761	257360	238917	241308	237522	244981	263509	1,9	-0,2	-0,1
Renewable energy sources	74984	89326	104111	123722	148360	172770	198525	221572	245560	3,3	3,6	3,0
Hydro	25101	28054	30374	26395	27808	28531	29242	30037	30511	1,9	-0,9	0,5
Biomass & Waste	46473	57201	67982	85129	97525	108657	118434	124055	127924	3,9	3,7	2,0
Wind	67	350	1913	6061	13860	23139	34150	45182	55792	39,8	21,9	9,4
Solar and others	153	274	421	807	3262	6224	9009	11367	13618	10,7	22,7	10,7
Geothermal	3190	3447	3421	5331	5904	6218	7690	10932	17715	0,7	5,6	2,7
Net Imports	**756079**	**738600**	**826299**	**986048**	**994588**	**1075329**	**1110582**	**1093649**	**1057460**	**0,9**	**1,9**	**1,1**
Solids	81846	79338	98645	126639	121617	130855	135286	130745	122784	1,9	2,1	1,1
Oil	535645	512185	533039	599851	580318	615114	626358	611095	588167	0,0	0,9	0,8
- Crude oil and Feedstocks	508460	494000	513725	581995	579210	616460	633238	622747	604198	0,1	1,2	0,9
- Oil products	27185	18185	19314	17856	1108	-1346	-6880	-11652	-16031	-3,4	-24,9	
Natural gas	135121	145288	192531	257366	289171	324084	341566	341952	335267	3,6	4,2	1,7
Electricity	3323	1508	1686	971	99	-613	-1684	-1781	-1867	-6,6	-24,7	
Renewable energy forms	144	279	397	1222	3384	5889	9056	11638	13109	10,7	23,9	10,3
Detailed Results												
Gross Inland Consumption	**1660159**	**1662517**	**1723099**	**1825989**	**1766735**	**1793808**	**1795298**	**1772466**	**1754215**	**0,4**	**0,3**	**0,2**
Solids	452940	364248	321007	319922	289439	283746	275219	264225	253180	-3,4	-1,0	-0,5

Oil	631058	650858	658727	676859	633216	637558	623595	598152	570317	0,4	-0,4	-0,2
Natural gas	294905	333268	393417	445998	453320	453150	453065	433679	410407	2,9	1,4	0,0
Nuclear	202589	223028	243761	257360	238917	241308	237522	244981	263509	1,9	-0,2	-0,1
Electricity	3323	1508	1686	971	99	-613	-1684	-1781	-1867	-6,6	-24,7	
Renewable energy forms	75343	89606	104501	124880	151744	178659	207581	233210	258669	3,3	3,8	3,2
as % in Gross Inland Consumption												
Solids	27,3	21,9	18,6	17,5	16,4	15,8	15,3	14,9	14,4			
Oil	38,0	39,1	38,2	37,1	35,8	35,5	34,7	33,7	32,5			
Natural gas	17,8	20,0	22,8	24,4	25,7	25,3	25,2	24,5	23,4			
Nuclear	12,2	13,4	14,1	14,1	13,5	13,5	13,2	13,8	15,0			
Renewable energy forms	4,5	5,4	6,1	6,8	8,6	10,0	11,6	13,2	14,7			
Gross Electricity Generation in GWh_e	**2562823**	**2712209**	**2991720**	**3274121**	**3306907**	**3539987**	**3763728**	**3974563**	**4154468**	**1,6**	**1,0**	**1,3**
Nuclear	794718	881662	944823	997519	926545	937067	928611	978255	1064396	1,7	-0,2	0,0
Hydro & wind	292648	330306	375545	378836	501928	633873	786086	940044	1088090	2,5	2,9	4,6
Thermal (incl. biomass)	1475456	1500241	1671352	1897765	1878434	1969047	2049031	2056264	2001982	1,3	1,2	0,9
Fuel Inputs for Thermal Power Generation	**383492**	**362334**	**382613**	**424208**	**413270**	**419274**	**427345**	**426777**	**412907**	**0,0**	**0,8**	**0,3**
Solids	263837	230040	223012	229245	219296	215528	208159	199245	190852	-1,7	-0,2	-0,5
Oil (including refinery gas)	54404	51463	39294	29780	15783	16306	15437	13965	11863	-3,2	-8,7	-0,2
Gas	56754	67806	102408	134637	138400	140574	148807	148127	132636	6,1	3,1	0,7
Biomass & Waste	5724	10033	14960	25901	34692	41639	48465	55907	61201	10,1	8,8	3,4
Geothermal heat	2774	2992	2939	4645	5098	5227	6476	9532	16355	0,6	5,7	2,4
Hydrogen - Methanol	0	0	0	0	0	0	0	0	0			

Fuel Input in other transformation proc.	**839073**	**814654**	**827098**	**842975**	**794488**	**805380**	**798865**	**776192**	**751812**	**-0,1**	**-0,4**	**0,1**
Refineries	679426	705954	735244	758152	716734	726162	716900	695921	672350	0,8	-0,3	0,0
Biofuels and hydrogen production	2	202	610	3129	11802	17450	22015	24357	25886	79,6	34,5	6,4
District heating	32960	23240	19323	16212	17488	15768	15126	13097	12625	-5,2	-1,0	-1,4
Others	126685	85258	71921	65482	48464	46000	44824	42818	40952	-5,5	-3,9	-0,8
Energy Branch Consumption	**82379**	**88696**	**88176**	**96033**	**92241**	**90711**	**90058**	**89584**	**89123**	**0,7**	**0,5**	**-0,2**
Non-Energy Uses	**97931**	**110541**	**112495**	**117477**	**111366**	**114981**	**117038**	**117712**	**118698**	**1,4**	**-0,1**	**0,5**
Final Energy Demand	**1068710**	**1069989**	**1112989**	**1173676**	**1168714**	**1206226**	**1213578**	**1195402**	**1178548**	**0,4**	**0,5**	**0,4**
by sector												
Industry	365650	328513	326949	326308	312942	321533	327328	329924	332479	-1,1	-0,4	0,5
- energy intensive industries	234722	214526	213112	210991	193633	195410	196003	194164	193088	-1,0	-1,0	0,1
- other industrial sectors	130928	113987	113837	115317	119310	126123	131325	135759	139391	-1,4	0,5	1,0
Residential	264307	280418	286784	308104	309189	315127	310395	298871	292450	0,8	0,8	0,0
Tertiary	158484	160442	159866	176859	176231	181468	181243	176885	174673	0,1	1,0	0,3
Transport	280269	300617	339389	362405	370352	388099	394611	389722	378946	1,9	0,9	0,6
by fuel												
Solids	125031	84977	61454	54486	44341	43910	43358	42070	39978	-6,9	-3,2	-0,2
Oil	444429	456959	478882	495857	475863	481036	471276	453252	433326	0,7	-0,1	-0,1
Gas	227902	245996	265552	283524	284994	282842	272655	252732	242098	1,5	0,7	-0,4
Electricity	184145	193367	216403	237537	240672	259000	274252	288280	299142	1,6	1,1	1,3
Heat (from CHP and District Heating) [(A)]	48610	44616	40061	44441	59097	67708	72624	77293	80628	-1,9	4,0	2,1
Other	38592	44073	50640	57832	63748	71731	79414	81775	83376	2,8	2,3	2,2

CO_2 Emissions (Mt of CO_2 - sec approach)	**4030,6**	**3800,1**	**3810,6**	**3946,6**	**3742,8**	**3724,7**	**3609,9**	**3371,4**	**3021,2**	**-0,6**	**-0,2**	**-0,4**
Power generation/District heating	1484,3	1321,2	1320,8	1381,1	1302,1	1287,2	1235,5	1113,7	867,3	-1,2	-0,1	-0,5
Energy Branch	152,2	171,0	170,2	181,6	158,4	147,3	140,1	130,0	119,5	1,1	-0,7	-1,2
Industry	781,4	678,1	623,0	581,9	496,8	485,6	477,1	454,0	441,7	-2,2	-2,2	-0,4
Residential	499,4	481,6	466,2	486,7	481,2	472,5	436,6	395,1	368,2	-0,7	0,3	-1,0
Tertiary	300,5	275,3	242,0	262,2	253,6	245,1	228,5	209,2	194,3	-2,1	0,5	-1,0
Transport	812,7	872,9	988,5	1053,1	1050,7	1087,0	1092,0	1069,4	1030,3	2,0	0,6	0,4
CO_2 Emissions Index (1990=100)	**100,0**	**94,3**	**94,5**	**97,9**	**92,9**	**92,4**	**89,6**	**83,6**	**75,0**			
CO_2 Emissions (Mt of CO_2 - ref approach)	**4172,0**	**3950,7**	**3922,7**	**4087,6**	**3812,4**	**3791,3**	**3679,7**	**3441,7**	**3092,3**	**-0,6**	**-0,3**	**-0,4**
CO_2 Emissions Index (1990=100)	**100,0**	**94,7**	**94,0**	**98,0**	**91,4**	**90,9**	**88,2**	**82,5**	**74,1**			

SUMMARY ENERGY BALANCE AND INDICATORS (B)

	1990	1995	2000	2005	2010	2015	2020	2025	2030	'90-'00	'00-'10	'10-'20
										Annual % Change		
Main Energy System Indicators												
Population (Million)	470,388	477,010	481,072	489,211	499,389	507,727	513,838	517,811	519,942	0,2	0,4	0,3
GDP (in 000 MEuro'05)	8142,7	8748,4	10107,2	11063,1	11385,6	12750,3	14164,0	15503,7	16824,7	2,2	1,2	2,2
Gross Inl. Cons./GDP (toe/MEuro'05)	203,9	190,0	170,5	165,1	155,2	140,7	126,8	114,3	104,3	-1,8	-0,9	-2,0
Gross Inl. Cons./Capita (toe/inhabitant)	3,53	3,49	3,58	3,73	3,54	3,53	3,49	3,42	3,37	0,1	-0,1	-0,1
Electricity Generated/Capita (kWh gross/inhabitant)	5448	5686	6219	6693	6622	6972	7325	7676	7990	1,3	0,6	1,0
Carbon intensity (t of CO2/toe of GIC)	2,43	2,29	2,21	2,16	2,12	2,08	2,01	1,90	1,72	-0,9	-0,4	-0,5
CO2 Emissions/Capita (t of CO2/inhabitant)	8,57	7,97	7,92	8,07	7,49	7,34	7,03	6,51	5,81	-0,8	-0,6	-0,6
CO2 Emissions to GDP (t of CO2/MEuro'05)	495,0	434,4	377,0	356,7	328,7	292,1	254,9	217,5	179,6	-2,7	-1,4	-2,5
Import Dependency %	44,6	43,5	46,8	52,5	54,7	58,3	60,1	59,9	58,4			
Energy intensity indicators (2000=100)												
Industry (Energy on Value added)	130,3	115,2	100,0	95,1	90,4	84,2	77,6	71,9	67,4	-2,6	-1,0	-1,5
Residential (Energy on Private Income)	114,4	113,2	100,0	97,5	97,2	88,0	78,4	69,7	63,4	-1,3	-0,3	-2,1
Tertiary (Energy on Value added)	126,5	117,0	100,0	99,4	95,3	86,8	77,8	69,0	62,5	-2,3	-0,5	-2,0
Transport (Energy on GDP)	102,5	102,3	100,0	97,6	96,9	90,6	83,0	74,9	67,1	-0,2	-0,3	-1,5
Carbon Intensity indicators												
Electricity and Steam production (t of CO2/MWh)	0,46	0,40	0,37	0,35	0,31	0,28	0,26	0,22	0,16	-2,1	-1,8	-2,0
Final energy demand (t of CO2/toe)	2,24	2,16	2,08	2,03	1,95	1,90	1,84	1,78	1,73	-0,7	-0,6	-0,6
Industry	2,14	2,06	1,91	1,78	1,59	1,51	1,46	1,38	1,33	-1,1	-1,8	-0,8

Residential	1,89	1,72	1,63	1,58	1,56	1,50	1,41	1,32	1,26	-1,5	-0,4	-1,0
Tertiary	1,90	1,72	1,51	1,48	1,44	1,35	1,26	1,18	1,11	-2,2	-0,5	-1,3
Transport	2,90	2,90	2,91	2,91	2,84	2,80	2,77	2,74	2,72	0,0	-0,3	-0,2
Electricity and steam generation												
Net Generation Capacity in MW_e			**654125**	**715734**	**813322**	**901412**	**942378**	**1009278**	**1099158**		**2,2**	**1,5**
Nuclear energy			133923	134409	127038	126752	123223	121792	132165		-0,5	-0,3
Renewable energy			112878	147262	206951	264849	325615	385402	444137		6,2	4,6
Hydro (pumping excluded)			99714	104505	107334	110498	113598	114930	116206		0,7	0,6
Wind			12793	40584	84096	126032	171490	217761	261956		20,7	7,4
Solar			371	2172	15272	27744	38885	49718	61081		45,0	9,8
Other renewables (tidal etc.)			0	1	249	575	1642	2993	4894			20,8
Thermal power			407324	434063	479334	509810	493540	502083	522855		1,6	0,3
of which cogeneration units			77070	84892	98907	114270	122982	132928	141688		2,5	2,2
of which CCS units			0	0	0	0	5394	13859	36740			
Solids fired			194165	186620	182756	185037	166094	153525	163732		-0,6	-1,0
Gas fired			129444	167173	215977	245307	246098	261964	269649		5,3	1,3
Oil fired			71058	62082	55837	48518	44147	42138	38539		-2,4	-2,3
Biomass-waste fired			12051	17502	24036	30209	36321	43187	48760		7,1	4,2
Fuel Cells			0	0	0	0	0	0	0			
Geothermal heat			605	686	727	738	880	1270	2175		1,9	1,9
Load factor for net electric capacities (%)			49,1	49,1	44,2	42,8	43,4	42,6	40,5			
Indicators for gross electricity production												
Efficiency for thermal electricity production (%)			37,6	38,5	39,1	40,4	41,2	41,4	41,7			
CHP indicator (% of el. from CHP)			11,4	11,7	14,8	18,5	19,3	19,9	20,3			

CCS indicator (% of electricity from CCS)			0,0	0,0	0,0	0,0	1,5	3,7	9,1		
Non fossil fuels in electricity generation (%)			45,8	44,8	47,2	49,3	50,9	54,2	58,2		
- nuclear			31,6	30,5	28,0	26,5	24,7	24,6	25,6		
- renewable energy forms and industrial waste			14,2	14,3	19,2	22,8	26,2	29,5	32,6		
Indicators for renewables (excluding industrial waste) (%) [(B)]											
RES in gross final energy demand (%)			7,6	8,6	10,9	12,8	14,9	16,9	18,7		
RES in transport (%)			0,5	1,4	4,2	5,9	7,4	8,4	9,3		
Transport sector											
Passenger transport activity (Gpkm)	**4880,7**	**5307,7**	**5892,2**	**6240,3**	**6511,3**	**7134,7**	**7596,4**	**8015,4**	**8421,6**	**1,9**	**1,0**	**1,6**
Public road transport	544,0	504,0	517,6	526,0	545,0	574,9	602,2	624,6	643,0	-0,5	0,5	1,0
Private cars and motorcycles	3501,1	3986,3	4428,1	4686,5	4866,1	5300,8	5576,3	5809,6	6041,2	2,4	0,9	1,4
Rail	472,5	421,7	447,9	461,0	482,5	522,4	563,5	603,5	641,4	-0,5	0,7	1,6
Aviation	317,3	351,3	456,9	527,3	576,9	694,1	810,6	932,7	1049,7	3,7	2,4	3,5
Inland navigation	45,8	44,4	41,7	39,5	40,8	42,4	43,8	45,1	46,3	-0,9	-0,2	0,7
Travel per person (km per capita)	10376	11127	12248	12756	13039	14052	14784	15479	16197	1,7	0,6	1,3
Freight transport activity (Gtkm)	**1848,4**	**1942,4**	**2195,7**	**2494,6**	**2662,6**	**2964,9**	**3149,3**	**3311,1**	**3459,9**	**1,7**	**1,9**	**1,7**
Trucks	1060,4	1288,7	1518,7	1800,3	1940,3	2178,6	2308,6	2426,1	2538,2	3,7	2,5	1,8
Rail	526,3	386,1	403,7	414,1	440,5	487,7	524,9	554,3	578,8	-2,6	0,9	1,8
Inland navigation	261,6	267,6	273,3	280,2	281,9	298,6	315,7	330,7	342,9	0,4	0,3	1,1
Freight activity per unit of GDP (tkm/000 Euro'05)	227	222	217	225	234	233	222	214	206	-0,4	0,7	-0,5
Energy demand in transport (ktoe)	**280269**	**300617**	**339389**	**362405**	**370352**	**388099**	**394611**	**389722**	**378946**	**1,9**	**0,9**	**0,6**
Public road transport	5197	4732	4914	5039	5179	5318	5306	5215	5086	-0,6	0,5	0,2

Private cars and motorcycles	154395	166321	182974	187736	186470	185223	182700	174680	164739	1,7	0,2	-0,2
Trucks	74969	79037	90951	105104	111593	123875	127520	129191	128901	2,0	2,1	1,3
Rail	9560	9452	9600	9436	9653	10183	10052	9692	8520	0,0	0,1	0,4
Aviation	29038	34112	45395	49703	51992	57812	63078	64740	65315	4,6	1,4	2,0
Inland navigation	7110	6963	5555	5386	5466	5688	5954	6203	6385	-2,4	-0,2	0,9
Efficiency indicator (activity related)												
Passenger transport (toe/Mpkm)	39,6	39,5	40,3	39,5	38,0	35,4	33,6	31,0	28,4	0,2	-0,6	-1,2
Freight transport (toe/Mtkm)	47,1	46,8	46,3	46,5	46,1	45,8	44,3	42,6	40,3	-0,2	-0,1	-0,4

Source: PRIMES

Explanations:

(A) *Regarding heat from CHP, there is a break in the series between 2005 and 2010. This is related to the practice of Eurostat to report the fuel consumption of on site CHP under the final demand categories of the individual fuels, even if the fuel is in reality used in industrial CHP. In order to keep comparability with Eurostat statistics, the fuel consumption data for the statistical years are presented in a Eurostat compatible format. For the projection period from 2010 onwards the modeling allocates the fuel consumption for new CHP plants to the CHP part of the power generation sector while the corresponding heat and steam is shown under industrial energy demand. Comparisons concerning steam in industry should therefore start only from 2010 onwards. Except for the knock-on effect on total steam, this break in the heat series does not affect other comparisons in PRIMES that can start from 2005 or earlier years.*

(B) *PRIMES does not report separately on industrial waste. In order to ensure a consistent breakdown of supply and demand quanties, industrial waste is shown as part of total waste and of renewables. Given that only biodegradable waste counts towards the renewables targets, the indicators on the share of RES in gross final energy demand have been adjusted to exclude industrial waste. RES indicators have been calculated on the basis of the methodology developed by EUROSTAT, i.e. taking into account normalised hydro and wind production, increased weight for renewable electricity in road transport and aviation cap for gross final energy demand.*

Disclaimer: *Energy and transport statistics reported in this publication and used for the modelling are taken mainly from EUROSTAT and from the publication "EU Energy and Transport in Figures" of the Directorate General for Energy and Transport. Energy and transport statistical concepts have developed differently in the past according to their individual purposes. Energy demand in transport reflects usually sales of fuels at the point of refuelling, which can differ from the region of consumption. This is particularly relevant for airplanes and trucks. Transport statistics deal with the transport activity within a country but may not always fully include transit shipments. These differences should be borne in mind when comparing energy and transport figures. This applies in particular to transport activity ratios, such as energy efficiency in freight transport, which is measured in tonnes of oil equivalent per million tonne-km.*

Abbreviations

GIC: Gross Inland Consumption
CHP: combined heat and power

Geographical regions

EU27: EU15 Member States + NM12 Member States
EU15: EU15 Member States (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, Sweden, United Kingdom)
NM12: New Member States (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, *Romania*, Slovakia, Slovenia)

Units
toe: tonne of oil equivalent, or *107 kilocalories, or 41.86 GJ (Gigajoule)*
Mtoe: million toe
GW: Gigawatt or 109 watt
kWh: kilowatt-hour or 103 watt-hour
MWh: megawatt-hour or 106 watt-hour
TWh: Terawatt-hour or 1012 watt-hour
t: metric tonnes, or 1000 kilogrammes
Mt: Million metric tonnes
km: kilometre
pkm: passenger-kilometre (one passenger transported a distance of one kilometre)
tkm: tonne-kilometre (one tonne transported a distance of one kilometre)
Gpkm: Giga passeng*er-kilometre, or 109 passenger-kilometre*
Gtkm: Giga tonn