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KPI TECHNICAL REPORT:
IMPACTS OF LINKING JI AND CDM CREDITS TO THE EUROPEAN EMISSION ALLOWANCE TRADING SCHEME (KPI-ETS)

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1 THE EUROPEAN EMISSION ALLOWANCE TRADING SCHEME: ANALYTICAL FRAMEWORK

The analysis of the impacts of linking JI and CDM to the future European Emission Allowance Trading System (ETSy) has been performed after development of an adequate version of the ASPEN-sd software. This version allows identifying two categories of sectors in Europe: the Emission Trading Sector or ETSe, which is based on the POLES model disaggregation in order to simulate sectors identified in the Directive on Emission Allowance Trading and the other sectors, identified as NTSe – non trading sectors. Likewise, and in order to identify sectors with different accessibility factors for JI or CDM projects, the ETSe and NTSe distinction has also been used for the other regions of the world that are taken into account in the simulation.

In order to identify the impacts of the linking of JI and CDM credits to the European Emission Allowance Trading Scheme, a set of simulation with ASPEN – based on updated MAC curves from the POLES model – have been performed. They correspond to a progressive opening of the trading system and allow in each case to identify the fundamentals of the allowance market: price, quantities exchanged by the different partners, domestic and total abatement cost.

Sectoral allocations in the EU have been calculated on the basis of what would be a cost-effective domestic program in each Member-State, i.e. through equalisation of MACs in the ETSe and in the NTSe.

The results presented in this study are based on the "Multi-gas" version of the POLES model described above, as resulting from the DG Research "GECS project" and thus include a set of 18 Other Greenhouse Gases (OGHG) emitting activities in industry, agriculture or waste management. However the OGHG emissions and reduction potentials that occur in the European ETSe are not accounted for in the ETSe sector, as the Directive on emission allowances does not immediately allow for the integration of these activities.

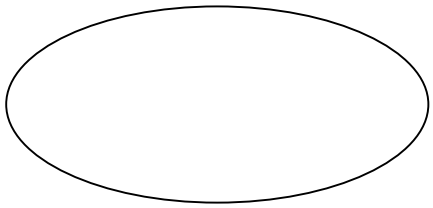
Table 1. Emissions taken into account in the KPI-ETS study

	ETS	NTS
Enlarged EU	CO2 from electricity generation CO2 from energy intensive industries	Other CO2 emissions All other GHGs emissions
Rest Annex B	CO2 from electricity generation CO2 from energy intensive industries HFC emissions (industry) PFC emissions (industry) SF6 emissions (industry, electricity)	Other CO2 emissions CH4 emissions N2O emissions
Non-Annex B	CO2 from electricity generation CO2 from industries CO2 from industrial process (cement, ..) HFC emissions (industry) PFC emissions (industry) SF6 emissions (industry, electricity)	Other CO2 emissions CH4 emissions N2O emissions

The sequence used for the economic assessment can be described as follows:

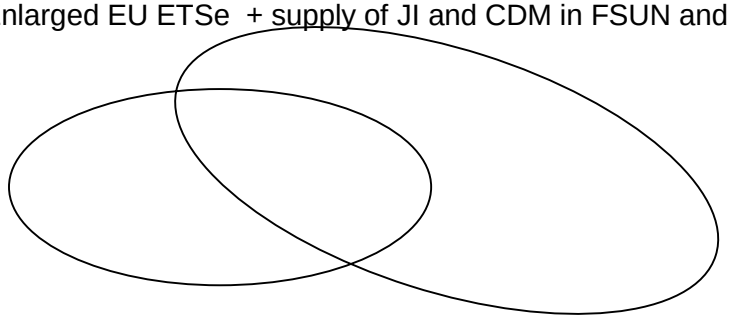
- **Stage 1: no-linking**

Enlarged EU ETSe



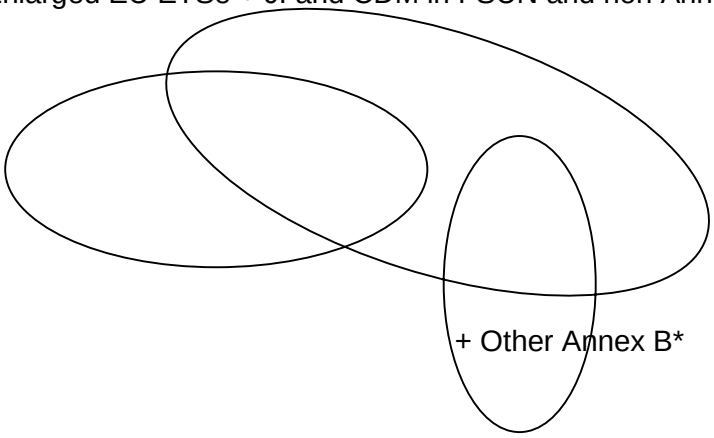
- **Stage 2: linking, no Others, no Member-States**

Enlarged EU ETSe + supply of JI and CDM in FSUN and non Annex B



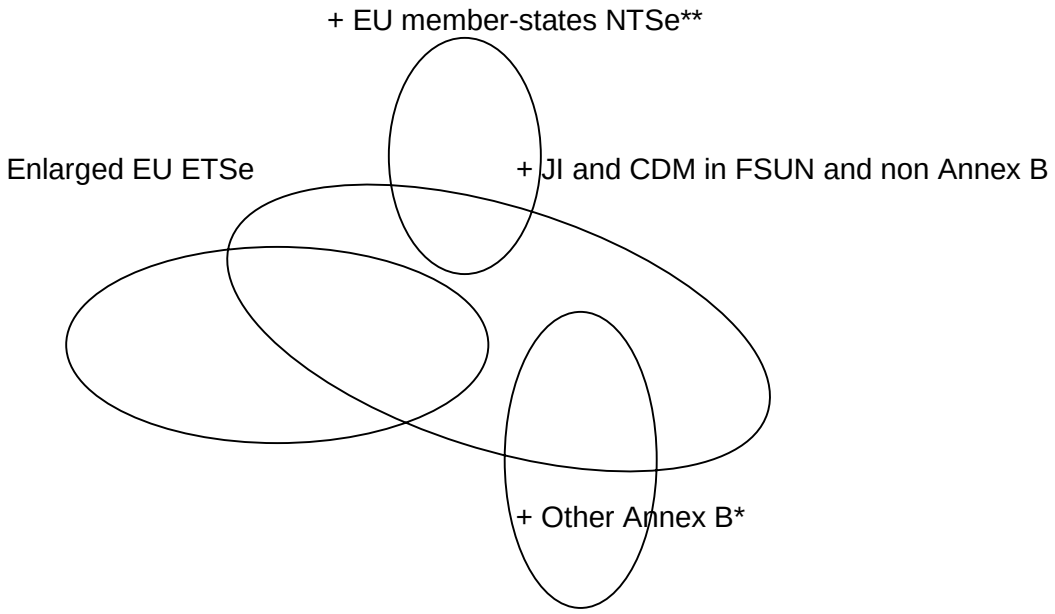
- **Stage 3: linking, with Others but no Member-States**

Enlarged EU ETSe + JI and CDM in FSUN and non Annex B



* Other Annex B (non US) participate on the basis of their national MAC curves, only if the resulting permit price is inferior to their domestic MAC (otherwise they would supply AAU permits to the extended ETSy)

- **Stage 4: linking, with Others and Member-States**



*** EU Member States participate on the basis of their NTSe MAC curves in order to avoid double counting of ETS demand/supply*

2 QUANTITATIVE ANALYSIS

Benchmark: No EU Emission Allowance Trading Scheme

A no trade situation allows identifying costs with fully domestic policies. It illustrates the diversity of costs involved by the Kyoto targets and reveals from the start the potential gains from emission trading that basically come from the reduction in the differences in actions to be undertaken.

Table 2. No EU Emissions Allowance Trading Scheme

	Reference 2010 (MtCO2eq)			**Target**[1] (MtCO2eq)	**MAC** ($/tCO2eq)	**Target**[1] (MtCO2eq)	**Abat. Cost** M$
	ETS*	NTS*	**Total**	**Total**		**ETS**	**ETS**
USA	3304	4128	7432	-	-	-	-
Canada	161	510	670	-	-	-	-
Mexico	226	415	641	-	-	-	-
R Central America	68	147	215	-	-	-	-
Brasil	296	796	1092	-	-	-	-
R South America	140	727	867	-	-	-	-
France	128	458	586	489	73	111	441
Germany	380	727	1107	1075	4	378	4
Italy	205	386	591	464	80	143	1976
UK	184	470	655	584	15	149	224
Austria	16	65	81	61	122	13	226
Belg.-Lux	36	122	158	140	33	33	36
Denmark	29	47	75	52	150	16	652
Finland	31	45	76	59	33	21	144
Ireland	23	42	66	47	99	13	415
Netherlands	72	181	253	219	39	58	237
Sweden	33	64	98	65	253	32	101
Spain	156	252	407	308	87	110	1730
Greece	72	67	138	101	45	41	547
Portugal	24	48	72	61	35	18	98
Switz. + Norway	33	97	131	-	-	-	-
Turkey	165	146	311	-	-	-	-
Egypt	80	97	177	-	-	-	-
North Africa Non OPEP	40	41	81	-	-	-	-
North Africa OPEP	49	122	171	-	-	-	-
Gulf	463	856	1319	-	-	-	-
R Middle-East	104	89	193	-	-	-	-
Sub-Saharan Africa	336	1263	1599	-	-	-	-
Pol+Hun+Czech+Slova.	292	420	712	712	0	292	0
Rest Cent. Europe (AB)	88	139	227	227	0	88	0
Rest Cent. Europe (NAB)	66	58	124	-	-	-	-
FSU (AB)	799	1019	1818	-	-	-	-
Former SU NAB	201	382	583	-	-	-	-
India	1442	1264	2706	-	-	-	-
R South Asia	103	485	588	-	-	-	-
Korea	314	303	617	-	-	-	-
R South-East Asia	763	1378	2142	-	-	-	-
China	4376	2402	6778	-	-	-	-
Japan	510	694	1204	-	-	-	-
Aust.+ NZ	228	297	525	-	-	-	-

(1) The targets do not take into account the surplus allocation to some Kyoto Annex B Parties

	Reference 2010 (MtCO2eq)			Target (MtCO2eq)		TAC M$
	ETS	NTS	Total	ETS	Total	ETS
EU15	1389	2975	4364	1135	3725	6830
EU enlarged	1768	3534	5303	1514	4664	6830

Stage 1: The Enlarged EU Emission Allowance Trading Scheme in the EU-25 ("No linking")

Taking into account the Acceding Countries in the EU trading scheme results in an allowance price of 26 €/tCO_2.

No reductions done through CDM or JI projects are imported by the enlarged EU.

Total abatement costs for the ETS sector are 2.9 billion €.

Table 3. Stage 1: Enlarged EU ETS only

	Target (MtCO2eq)	**Emissions** (MtCO2eq)			**Dom AC** (M$)	**Trade** (MtCO2eq)			**Trade Cost** (M$)	**TAC** (M$)
		ETS	NTS	**Total**	**ETS**	ETS	NTS	**Total**	**ETS**	**ETS**
USA	-	-	-	-	-	-	-	-	-	-
Canada	-	-	-	-	-	-	-	-	-	-
Mexico	-	-	-	-	-	-	-	-	-	-
R Central America	-	-	-	-	-	-	-	-	-	-
Brasil	-	-	-	-	-	-	-	-	-	-
R South America	-	-	-	-	-	-	-	-	-	-
France	489	118	378	496	105	7	-	7	187	292
Germany	1075	370	698	1068	106	-8	-	-8	-199	-94
Italy	464	175	321	496	363	32	-	32	852	1214
UK	584	135	435	570	513	-14	-	-14	-377	135
Austria	61	15	48	64	10	3	-	3	74	84
Belg.-Lux	140	34	107	141	25	0	-	0	10	35
Denmark	52	24	35	59	56	8	-	8	201	258
Finland	59	22	38	60	102	1	-	1	37	139
Ireland	47	19	35	53	62	6	-	6	162	224
Netherlands	219	61	161	222	127	3	-	3	90	217
Sweden	65	33	33	66	5	1	-	1	21	26
Spain	308	137	198	335	219	28	-	28	726	945
Greece	101	49	61	110	255	8	-	8	219	474
Portugal	61	19	43	62	60	1	-	1	33	93
Switz. + Norway	-	-	-	-	-	-	-	-	-	-
Turkey	-	-	-	-	-	-	-	-	-	-
Egypt	-	-	-	-	-	-	-	-	-	-
North Africa Non OPEP	-	-	-	-	-	-	-	-	-	-
North Africa OPEP	-	-	-	-	-	-	-	-	-	-
Gulf	-	-	-	-	-	-	-	-	-	-
R Middle-East	-	-	-	-	-	-	-	-	-	-
Sub-Saharan Africa	-	-	-	-	-	-	-	-	-	-
Pol+Hun+Czech+Slova.	712	234	420	654	694	-58	-	-58	-1530	-836
Rest Cent. Europe (AB)	227	68	139	207	228	-19	-	-19	-506	-278
Rest Cent. Europe (NAB)	-	-	-	-	-	-	-	-	-	-
FSU (AB)	-	-	-	-	-	-	-	-	-	-
Former SU NAB	-	-	-	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-	-
R South Asia	-	-	-	-	-	-	-	-	-	-
Korea	-	-	-	-	-	-	-	-	-	-
R South-East Asia	-	-	-	-	-	-	-	-	-	-
China	-	-	-	-	-	-	-	-	-	-
Japan	-	-	-	-	-	-	-	-	-	-
Aust.+ NZ	-	-	-	-	-	-	-	-	-	-

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	Total	ETS	ETS	NTS	Total	ETS	ETS
EU enlarged	4664	1514	3150	4664	2930	0	-	0	0	2930
FSU AB	-	-	-	-	-	-	-	-	-	-
Rest Annex B	-	-	-	-	-	-	-	-	-	-
USA	-	-	-	-	-	-	-	-	-	-
Non-Annex B	-	-	-	-	-	-	-	-	-	-

Stage 2: The Enlarged EU Emission Trading Scheme plus JI and CDM credits ("Linking, no others, no MS")

This stage corresponds to the opening of the Emission Allowance Trading Scheme to JI and CDM credits.

The impact of linking JI and CDM on the market equilibrium is significant, as the allowance price drops to 4.8 €/tCO_2e. Total ETS cost is in that case drastically reduced as it is brought down to only 1.1 billion €.

However, the amount of imported credits from JI and CDM is relatively limited when compared with the ETSe allocations, as their share represents 12.7 % of the initial allocation to the ETSe (192 MtCO_2e imported from JI and CDM vs. 1515 MtCO_2e allocated).

Table 4. Stage 2: The Enlarged EU Emission Trading Scheme plus JI and CDM credits

ETS market price : 4.8

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	**Total**	**ETS**	ETS	NTS	**Total**	**ETS**	**ETS**
USA	-	-	-	-	-	-	-	-	-	-
Canada	-	-	-	-	-	-	-	-	-	-
Mexico	-	225	413	638	4	-2	-2	-3	-45	-4
R Central America	-	67	146	214	1	0	0	-1	-11	-1
Brasil	-	294	795	1088	6	-2	-1	-4	-49	-6
R South America	-	140	725	865	1	0	-2	-2	-30	-1
France	489	125	378	504	7	14	-	14	69	75
Germany	1075	377	698	1075	6	-1	-	-1	-3	3
Italy	464	198	321	519	16	56	-	56	267	282
UK	584	170	435	604	35	20	-	20	97	131
Austria	61	16	48	64	0	3	-	3	17	17
Belg.-Lux	140	35	107	142	1	2	-	2	10	11
Denmark	52	28	35	63	2	11	-	11	55	57
Finland	59	29	38	67	5	8	-	8	39	44
Ireland	47	23	35	57	2	10	-	10	48	50
Netherlands	219	69	161	230	6	12	-	12	56	62
Sweden	65	33	33	66	0	1	-	1	5	5
Spain	308	151	198	350	11	42	-	42	200	211
Greece	101	66	61	126	14	25	-	25	121	135
Portugal	61	23	43	66	3	5	-	5	24	27
Switz. + Norway	-	-	-	-	-	-	-	-	-	-
Turkey	-	164	145	309	4	-2	0	-2	-28	-4
Egypt	-	79	97	176	1	0	0	-1	-11	-1
North Africa Non OPEP	-	40	41	81	1	0	0	-1	-7	-1
North Africa OPEP	-	49	121	170	1	0	-1	-1	-15	-1
Gulf	-	460	850	1309	9	-4	-7	-10	-135	-9
R Middle-East	-	104	88	192	2	-1	0	-1	-15	-2
Sub-Saharan Africa	-	330	1258	1588	13	-6	-5	-11	-153	-13
Pol+Hun+Czech+Slova.	712	278	420	698	32	-13	-	-13	-64	-32
Rest Cent. Europe (AB)	227	83	139	222	11	-4	-	-4	-21	-11
Rest Cent. Europe (NAB)	-	66	57	123	1	-1	0	-1	-12	-1
FSU (AB)	1818	781	1019	1800	12	-18	-5	-23	-88	-76
Former SU NAB	-	199	378	577	6	-2	-4	-6	-85	-6
India	-	1429	1258	2687	31	-13	-6	-19	-275	-31
R South Asia	-	103	483	585	2	-1	-2	-3	-38	-2
Korea	-	313	302	615	3	-1	0	-2	-26	-3
R South-East Asia	-	756	1372	2128	17	-7	-6	-13	-182	-17
China	-	4310	2381	6690	159	-66	-22	-88	-1242	-159
Japan	-	-	-	-	-	-	-	-	-	-
Aust.+ NZ	-	-	-	-	-	-	-	-	-	-

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	Total	ETS	ETS	NTS	Total	ETS	ETS
EU enlarged	4664	1706	3150	4855	150	192	-	192	919	1069
FSU AB	1818	781	1019	1800	12	-18	-5	-23	-88	-76
Rest Annex B	-	-	-	-	-	-	-	-	-	-
USA	-	-	-	-	-	-	-	-	-	-
Non-Annex B	-	9126	10910	20036.28	260	-109	-60	-168	-2359	-260

Stage 3: Competition for JI and CDM credits ("Linking, no MS")

This case is developed in order to account for potential competition from other Annex B countries (except EU and US) on the project credits market. A condition ensures that these countries intervene on the market only when their domestic costs are superior to the market price for credits. For them to be suppliers to the ETSe would necessitate the conclusion of a bilateral agreement between the EU and the respective country in accordance with the Article 24 in the forthcoming EU Directive.

Both the allowance price and the total costs are affected, with a price of 10.5 €/tCO_2e and a total cost at 2.0 billion € for participants in the enlarged EU ETSe. Consequently the share of acquired JI and CDM credits in relation to the initial allocation is lower than in the preceding case, at 8% (128 MtCO_2e vs 1515 MtCO_2e allocated).

Table 5. Stage 3: Competition for JI and CDM credits

ETS market price : **10.5**

	Target (MtCO2eq)	**Emissions** (MtCO2eq)			**Dom AC** (M$)	**Trade** (MtCO2eq)			**Trade Cost** (M$)	**TAC** (M$)
		ETS	NTS	**Total**	**ETS**	ETS	NTS	**Total**	**ETS**	**ETS**
USA	-	-	-	-	-	-	-	-	-	-
Canada	494	146	451	597	68	22	81	103	228	296
Mexico	-	223	412	635	17	-3	-3	-6.1	-91	-17
R Central America	-	67	146	213	3	-1	-1	-1.4	-20	-5
Brasil	-	291	794	1085	25	-5	-2	-6.7	-97	-26
R South America	-	139	724	863	5	-1	-3	-4.0	-56	-5
France	489	123	378	501	28	12	-	12	122	150
Germany	1075	375	698	1072	25	-3	-	-3	-32	-7
Italy	464	191	321	512	69	49	-	49	512	581
UK	584	157	435	591	132	7	-	7	77	209
Austria	61	16	48	64	2	3	-	3	34	36
Belg.-Lux	140	35	107	142	5	1	-	1	16	21
Denmark	52	26	35	62	12	10	-	10	107	119
Finland	59	27	38	65	22	6	-	6	62	84
Ireland	47	22	35	56	10	9	-	9	95	104
Netherlands	219	67	161	228	26	9	-	9	95	121
Sweden	65	33	33	66	1	1	-	1	11	12
Spain	308	147	198	345	47	37	-	37	390	437
Greece	101	60	61	121	58	19	-	19	204	262
Portugal	61	22	43	65	11	4	-	4	41	53
Switz. + Norway	97	31	93	124	14	11	16	27	113	127
Turkey	-	162	145	307	17	-3	-1	-4	-58	-18
Egypt	-	79	97	176	4	-1	-1	-1	-22	-4
North Africa Non OPEP	-	40	41	80	3	0	0	-1	-14	-3
North Africa OPEP	-	48	120	169	3	-1	-1	-2	-29	-4
Gulf	-	456	845	1301	35	-7	-11	-18	-259	-39
R Middle-East	-	103	88	191	7	-1	-1	-2	-30	-8
Sub-Saharan Africa	-	324	1254	1578	65	-12	-9	-21	-303	-64
Pol+Hun+Czech+Slova.	712	265	420	685	138	-27	-	-27	-287	-149
Rest Cent. Europe (AB)	227	78	139	218	46	-9	-	-9	-95	-49
Rest Cent. Europe (NAB)	-	65	57	122	6	-1	-1	-2	-24	-6
FSU (AB)	1818	761	1019	1781	76	-38	-11	-49	-397	-321
Former SU NAB	-	196	376	572	25	-5	-7	-11	-163	-26
India	-	1415	1253	2668	141	-27	-11	-38	-559	-146
R South Asia	-	102	481	583	7	-1	-4	-5	-73	-8
Korea	-	312	302	614	14	-3	-1	-4	-53	-15
R South-East Asia	-	749	1368	2117	77	-15	-10	-25	-364	-79
China	-	4244	2364	6608	661	-132	-39	-170	-2494	-723
Japan	1071	469	670	1139	192	38	29	67	401	593
Aust.+ NZ	418	197	266	462	166	29	16	44	302	467

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	Total	ETS	ETS	NTS	Total	ETS	ETS
EU enlarged	4664	1642	3150	4792	631	128	-	128	1352	1983
FSU AB	1818	761	1019	1781	76	-38	-11	-49	-397	-321
Rest Annex B	2136	842	1483	2325	440	99	143	242	2548	1484
USA	-	-	-	-	-	-	-	-	-	-
Non-Annex B	-	9015	10868	19882.51	1115	-219	-103	-322	-4708	-1195

Stage 4: More competition – EU Member States acting as buyers of JI and CDM credits ("Linking")

This last case provides an assessment of the impacts of potential competition between ETSe entities and EU Member States, representing their NTSe sectors.

Three cases of linking have been analysed.

The *case 4.*a imposes a 6% limit on the import of credits done by the enlarged EU ETSe (meaning that 6% of the requested objective can be fulfilled by such credits obtained through JI and CDM). The *case 4.b* imposes a tighter constraint on imports (3%) while the *case 4.c* on the contrary allows for an unrestricted use of imports.

The increased competition results in a further increase in the international allowance price, to 12 €/tCO_2e, even though the import of credits by the enlarged EU ETSe limits the demand. The limit on imports imposes an higher allowance price in the ETSe market:14.5 €/tCO2e. The total costs for participants in the Emission Allowance Trading Scheme is 2.4 billion €, while the ratio of acquired JI and CDM credits is brought down to 91 MtCO_2e.

The overall JI and CDM credits purchased by the enlarged EU (ETSe + NTSe) amounts to 208 MtCO_2e (91 for ETSe and 117 for NTSe), which represents around a third of its 2010 reduction objective, and 4% of its total 1990 emissions.

In the case 4.b, the imports of JI and CDM credits are limited to 3%. Because of the consequently lower demand for international allowances, the obtained international allowance price decreases by about 6% compared to case 4.a, to 11.3 €/tCO_2e. On the other hand, this more restricted access to JI and CDM credits leads to a 37% increase of the price of allowances in the enlarged EU ETSe market compared to case 4.a. The price now reaches 20 €/tCO_2e.

The overall purchase of credits amounts to 171 MtCO_2e only (45 MtCO_2e for ETSe and 126 for MtCO_2e for NTSe). It represents 3.3% of the enlarged EU 1990 emissions. The annual compliance cost for the enlarged EU ETS amounts in this case to 2.8 b€

The case 4.c, on the contrary, does not set any limit on the use of CDM and JI credits. The international market then leads to a permit price of 12.4 €/tCO_2e and a volume of acquired credits of 224 MtCO_2e (111 MtCO_2e for ETSe and 113 MtCO_2e for NTSe). The annual compliance cost decreases to 2.2 b€, still higher than in case 3.

However, compared to stage 3, the introduction of the NTSe, through Member States purchases, reduces the total Kyoto compliance cost for Enlarged EU. If only ETSe participants can purchase project credits, Member States would forego the opportunity to reduce the costs for other sectors.

Table 6. Stage 4.a: EU MS acting as buyers of JI and CDM credits, Imports = 6%

International Market Price : **12.0**

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	**Total**	**ETS**	ETS	NTS	**Total**	**ETS**	**ETS**
USA	-	-	-	-	-	-	-	-	-	-
Canada	494	145	445	589	84	20	75	95.6	244	328
Mexico	-	222	412	634	24	-4	-3	-7.1	-47	-22
R Central America	-	67	146	213	4	-1	-1	-1.5	-10	-6
Brasil	-	290	794	1084	33	-6	-2	-7.6	-68	-34
R South America	-	139	724	863	6	-1	-3	-4.5	-13	-7
France	489	121	432	553	48	10	53	63.4	144	192
Germany	1075	373	664	1038	42	-4	-33	-37.8	-63	-21
Italy	464	187	367	554	125	44	46	89.7	639	764
UK	584	150	439	589	218	0	4	4.6	6	224
Austria	61	16	61	77	4	3	13	15.9	46	49
Belg.-Lux	140	35	115	149	9	1	8	9.1	17	26
Denmark	52	26	45	71	21	9	9	18.8	136	157
Finland	59	26	41	67	39	5	4	8.1	66	105
Ireland	47	21	40	61	19	8	5	13.5	120	139
Netherlands	219	65	172	237	46	7	11	18.5	108	154
Sweden	65	33	60	93	2	1	27	27.8	14	15
Spain	308	144	236	380	80	34	38	72.0	499	579
Greece	101	57	64	121	100	16	4	19.6	232	333
Portugal	61	21	46	67	20	3	3	6.0	46	67
Switz. + Norway	97	30	93	123	17	10	16	26.6	46	143
Turkey	-	161	145	306	24	-4	-1	-4.5	-47	-23
Egypt	-	79	97	175	6	-1	-1	-1.7	-11	-5
North Africa Non OPEP	-	39	40	80	4	-1	-1	-1.1	-7	-3
North Africa OPEP	-	48	120	168	5	-1	-2	-2.3	-10	-5
Gulf	-	455	844	1299	48	-8	-12	-20.5	-99	-50
R Middle-East	-	103	88	191	10	-2	-1	-2.3	-20	-10
Sub-Saharan Africa	-	322	1253	1575	88	-14	-10	-23.9	-173	-85
Pol+Hun+Czech+Slova.	712	256	360	616	246	-36	-60	-95.9	-521	-274
Rest Cent. Europe (AB)	227	76	125	201	83	-12	-14	-25.7	-174	-91
Rest Cent. Europe (NAB)	-	65	57	122	8	-1	-1	-1.9	-16	-8
FSU (AB)	1818	754	1019	1774	272	-45	-13	-57.6	-538	-266
Former SU NAB	-	196	375	571	34	-6	-7	-12.9	-69	-34
India	-	1410	1252	2662	196	-32	-12	-44.0	-387	-191
R South Asia	-	102	481	582	10	-2	-4	-5.8	-21	-11
Korea	-	311	302	613	20	-3	-1	-4.2	-40	-19
R South-East Asia	-	746	1367	2113	108	-18	-11	-28.7	-212	-104
China	-	4223	2359	6582	902	-153	-43	-196.3	-1841	-940
Japan	1071	465	667	1133	235	34	27	61.0	414	648
Aust.+ NZ	418	192	263	455	217	24	13	37.1	290	508

The corresponding MAC for enlarged EU ETS is **14.5 €/tCO$_2$e**.

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	Total	ETS	ETS	NTS	Total	ETS	ETS
EU enlarged	4664	1605	3267	4872	1102	91	117	208	1316	2418
FSU AB	1818	754	1019	1774	272	-45	-13	-58	-538	-266
Rest Annex B	2136	841	1482	2323	553	89	75	220	20	1628
USA	-	-	-	-	-	-	-	-	-	-
Non-Annex B	-	9017	10868	19885	1531	-256	-114	-371	-3088	-1558

Table 7. Stage 4.b: EU MS acting as buyers of JI and CDM credits, Imports = 3%

International Market Price : **11.3**

	Target (MtCO2eq)	**Emissions** (MtCO2eq)			**Dom AC** (M$)	**Trade** (MtCO2eq)			**Trade Cost** (M$)	**TAC** (M$)
		ETS	NTS	**Total**	**ETS**	ETS	NTS	**Total**	**ETS**	**ETS**
USA	-	-	-	-	-	-	-	-	-	-
Canada	494	145	448	593	77	21	78	99.0	237	314
Mexico	-	223	412	635	21	-4	-3	-6.7	-41	-20
R Central America	-	67	146	213	4	-1	-1	-1.5	-9	-5
Brasil	-	291	794	1085	29	-5	-2	-7.2	-60	-31
R South America	-	139	724	863	5	-1	-3	-4.3	-11	-6
France	489	120	433	552	73	9	54	62.8	170	242
Germany	1075	372	666	1038	71	-6	-32	-37.6	-121	-50
Italy	464	181	368	549	225	38	46	84.7	764	989
UK	584	142	440	582	351	-7	5	-2.0	-146	205
Austria	61	16	61	77	6	3	13	15.9	60	66
Belg.-Lux	140	34	115	149	16	1	8	9.0	16	31
Denmark	52	25	45	70	36	9	9	18.0	170	206
Finland	59	24	41	65	66	3	4	6.7	59	125
Ireland	47	20	40	60	35	7	5	12.6	146	181
Netherlands	219	63	172	236	80	5	11	16.9	109	189
Sweden	65	33	60	93	3	1	27	27.9	18	20
Spain	308	141	236	377	137	31	38	69.2	621	757
Greece	101	53	65	117	168	12	4	15.8	241	409
Portugal	61	20	46	66	36	2	3	5.2	45	82
Switz. + Norway	97	30	93	124	15	11	16	26.9	45	136
Turkey	-	162	145	307	20	-4	-1	-4.2	-41	-21
Egypt	-	79	97	175	5	-1	-1	-1.6	-9	-5
North Africa Non OPEP	-	40	40	80	3	-1	-1	-1.0	-6	-3
North Africa OPEP	-	48	120	169	4	-1	-1	-2.2	-8	-4
Gulf	-	455	845	1300	42	-8	-12	-19.4	-87	-45
R Middle-East	-	103	88	191	9	-2	-1	-2.2	-17	-9
Sub-Saharan Africa	-	323	1254	1576	77	-13	-9	-22.5	-152	-75
Pol+Hun+Czech+Slova.	712	245	362	607	434	-47	-58	-105.1	-933	-500
Rest Cent. Europe (AB)	227	72	126	198	145	-16	-13	-29.0	-311	-166
Rest Cent. Europe (NAB)	-	65	57	122	7	-1	-1	-1.8	-14	-7
FSU (AB)	1818	757	1019	1777	235	-41	-12	-53.4	-470	-236
Former SU NAB	-	196	375	571	30	-5	-7	-12.2	-60	-31
India	-	1412	1253	2665	170	-30	-11	-41.1	-339	-169
R South Asia	-	102	481	583	9	-2	-4	-5.5	-18	-9
Korea	-	311	302	613	18	-3	-1	-3.9	-35	-17
R South-East Asia	-	747	1368	2115	93	-16	-11	-26.9	-185	-92
China	-	4233	2361	6594	786	-143	-41	-184.1	-1621	-835
Japan	1071	467	669	1135	214	36	28	64.0	409	624
Aust.+ NZ	418	194	264	459	193	26	14	40.5	297	490

The corresponding MAC for enlarged EU ETS is **20 €/tCO_2e**.

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	Total	ETS	ETS	NTS	Total	ETS	ETS
EU enlarged	4664	1559	3276	4835	1882	45	126	171	906	2788
FSU AB	1818	757	1019	1777	235	-41	-12	-53	-470	-236
Rest Annex B	2136	841	1482	2323	499	94	78	230	21	1563
USA	-	-	-	-	-	-	-	-	-	-
Non-Annex B	-	9017	10868	19885	1331	-239	-109	-348	-2714	-1383

Table 8. Stage 4.c: EU MS acting as buyers of JI and CDM credits, no constraint on imports

International Market Price : **12.4**

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	**Total**	**ETS**	ETS	NTS	**Total**	**ETS**	**ETS**
USA	-	-	-	-	-	-	-	-	-	-
Canada	494	144	444	588	88	20	74	94.1	247	335
Mexico	-	222	412	634	26	-4	-3	-7.3	-49	-24
R Central America	-	67	146	213	4	-1	-1	-1.6	-10	-6
Brasil	-	290	794	1084	35	-6	-2	-7.8	-71	-36
R South America	-	139	724	863	7	-1	-3	-4.6	-14	-7
France	489	122	431	553	37	11	53	63.8	134	170
Germany	1075	374	663	1038	32	-4	-34	-37.9	-45	-13
Italy	464	189	366	556	93	47	45	91.8	575	668
UK	584	154	438	592	168	4	4	7.9	51	220
Austria	61	16	61	77	3	3	13	16.0	40	42
Belg.-Lux	140	35	115	150	7	1	8	9.1	17	23
Denmark	52	26	45	71	16	10	9	19.2	121	137
Finland	59	26	41	67	29	5	3	8.8	66	94
Ireland	47	21	40	61	13	9	5	13.8	107	121
Netherlands	219	66	172	238	34	8	11	19.2	103	137
Sweden	65	33	60	93	1	1	27	27.8	12	13
Spain	308	145	236	381	61	36	37	73.2	443	504
Greece	101	58	64	123	76	18	4	21.4	221	297
Portugal	61	21	46	67	15	4	3	6.4	44	60
Switz. + Norway	97	30	93	123	18	10	16	26.4	44	147
Turkey	-	161	145	306	25	-4	-1	-4.7	-49	-24
Egypt	-	79	97	175	6	-1	-1	-1.7	-11	-6
North Africa Non OPEP	-	39	40	80	4	-1	-1	-1.1	-7	-4
North Africa OPEP	-	48	120	168	5	-1	-2	-2.4	-10	-5
Gulf	-	455	844	1298	51	-8	-12	-20.9	-104	-53
R Middle-East	-	103	88	191	10	-2	-1	-2.4	-21	-11
Sub-Saharan Africa	-	321	1253	1574	93	-15	-10	-24.5	-182	-89
Pol+Hun+Czech+Slova.	712	261	359	620	184	-31	-61	-91.9	-387	-203
Rest Cent. Europe (AB)	227	77	125	202	62	-10	-14	-24.3	-129	-67
Rest Cent. Europe (NAB)	-	65	57	122	9	-1	-1	-2.0	-17	-8
FSU (AB)	1818	753	1019	1772	289	-46	-13	-59.4	-569	-280
Former SU NAB	-	195	375	570	36	-6	-7	-13.2	-73	-36
India	-	1409	1252	2661	209	-33	-12	-45.2	-410	-201
R South Asia	-	102	481	582	11	-2	-4	-5.9	-22	-11
Korea	-	311	302	613	22	-3	-1	-4.3	-42	-20
R South-East Asia	-	745	1367	2112	115	-18	-11	-29.5	-224	-109
China	-	4219	2358	6577	955	-157	-44	-201.7	-1944	-988
Japan	1071	464	667	1131	244	34	26	59.7	415	659
Aust.+ NZ	418	191	263	454	229	23	12	35.6	286	515

The corresponding MAC for enlarged EU ETS is of course also of 12.4 €/tCO2e, as no restriction to trade is imposed.

	Target (MtCO2eq)	Emissions (MtCO2eq)			Dom AC (M$)	Trade (MtCO2eq)			Trade Cost (M$)	TAC (M$)
		ETS	NTS	Total	ETS	ETS	NTS	Total	ETS	ETS
EU enlarged	4664	1625	3263	4888	830	111	113	224	1373	2203
FSU AB	1818	753	1019	1772	289	-46	-13	-59	-569	-280
Rest Annex B	2136	841	1482	2323	579	87	74	216	20	1655
USA	-	-	-	-	-	-	-	-	-	-
Non-Annex B	-	9017	10868	19885	1623	-264	-117	-381	-3263	-1639

Caveats

- First of all, the authors underline the fact that the scope of such an analysis and the conclusions that can be drawn should be qualified by the inherent difficulty of analysing project mechanisms due to the uncertainty regarding reductions projects feasibility (the accessibility factor), transaction costs or institutional infrastructure.
- In order to simulate the impacts of JI and CDM credits, assumptions had thus to be introduced on transaction costs for JI and CDM projects (20 %) but more significantly on the "accessibility" of theoretical abatement potentials in Former Soviet Union and in Non-Annex B countries to the implementation of JI or CDM projects. This accessibility has been considered to be higher in FSUN than in Non-Annex B and higher in the ETSe (electricity sector and industry) than in the NTSe sectors (Transport, Residential, Tertiary). The "accessibility factors" considered here are 40 % and 20 % respectively in FSUN ETSe and NTSe, and 20 % and 10 %, respectively in Non-Annex B ETSe and NTSe.
- There is no use of FSUN surplus allocation for trading.
- The time horizon of this study is on first Kyoto period, represented by the year 2010. Although no analysis of the first period of the EU trading scheme 2005 to 2007 is performed, it may be expected that the allowance price will be lower.
- The analysis focuses only on economic impacts and assumes implicitly that baselines for projects are perfect. Carbon sinks are not taken into account.
- No nuclear projects are taken into account for the mere reason that no nuclear development is possible within the considered time-frame due to leadtime necessary for construction.
- Due to technical constraints in the model the geographics of the "enlarged EU" are not perfect.
- It is assumed that the USA stays out of the Kyoto Protocol and that, consequently, it does not take part to the allowance exchanges.
- The surplus of acceding countries under the Kyoto Protocol is not considered in this study: these countries do allocate this surplus to companies covered by the EU ETS. The "targets" reported in the results tables are drawn up on the basis that acceding countries allocate at business at usual levels.
- The analysis is based on the Marginal Abatement Cost (MAC) curves produced by the POLES model. The preliminary stage consists in assessing for each country the MAC associated with the Kyoto Target. The reduction requirement is then distributed among sectors according to the equalization of the sectoral marginal costs. For a given sector, the reduction objective thus obtained and the corresponding MAC curve allow to compute the total abatement cost. This cost is a "domestic" cost as it represents the cost of reaching the sectoral target through policies that rely only on national measures and schemes and not on allowance trading.
- Sectoral objectives and abatement costs depend on projected 2010 sectoral emissions and on the curves produced by the POLES model.

3 SUMMARY

The volume of credits obtained through JI and CDM projects by the enlarged EU Emission Allowance Trading Scheme, as well as the magnitude of cost savings and allowance price impacts will crucially depend on how much competition there will be from EU Member States and other countries in JI and CDM credits.

The first result is that allowing project credits into the EU trading scheme lowers allowances prices and costs for ETS compliance.

As expected, the lower the level of competition for JI and CDM credits, the greater the volume of credits purchased by the enlarged EU ETS and the lower the price of the corresponding allowances.

Without any competition from the European NTS sector and the other Annex B countries on the JI and CDM credits market, the allowance price collapses from 26€/tCO_2e (Case 1) to less than 5 €/tCO_2e (Case 2) with linking. The annual compliance cost for the ETS sector is reduced by about 60% from 2.9 b€ to some 1.1 b€. The reductions acquired by the enlarged EU ETSe through JI and CDM represent in this case 12,7 % of the initial allocation to ETS participants.

However, it seems reasonable to expect that other participating Annex B countries will also carry out JI and CDM projects in order to generate project credits. The taking account of this competition on the ETS market entails more than a doubling of the allowance price to 10.5 €/tCO_2e, and almost doubles the annual compliance cost for the enlarged EU ETSe to 2 b€.

The restricted linking of the enlarged EU NTSe to the market, via Member State credit purchases, have noticeable impacts. While the 6% limit leads to a comparable allowance price to case 3, and an annual compliance cost for the ETS sector 20% higher, 2.4 b€, the 3% limit case gets close to the “No linking” situation, with an allowance price for enlarged EU ETSe of 20 €/tCO_2e (the international allowance price reaches 11 €/tCO_2e) and an annual compliance cost for the ETS sector of 2.8 b€. In the case of unlimited linking, the permit price falls to 12.4 €/tCO_2e and the compliance cost to 2.2 b€, the allowances obtained by the enlarged EU ETSe through projects represent in this case 7% of its objectives.

Figure 1. International (Kyoto) market price

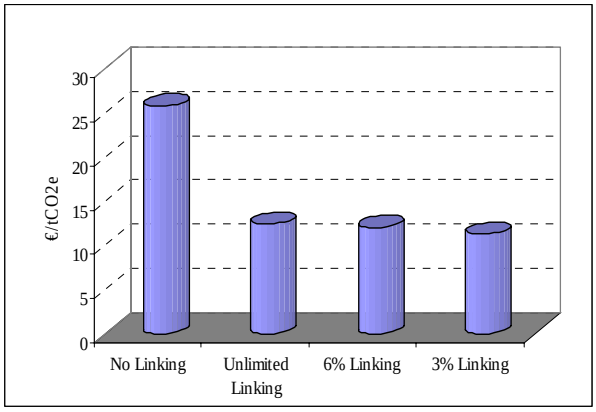
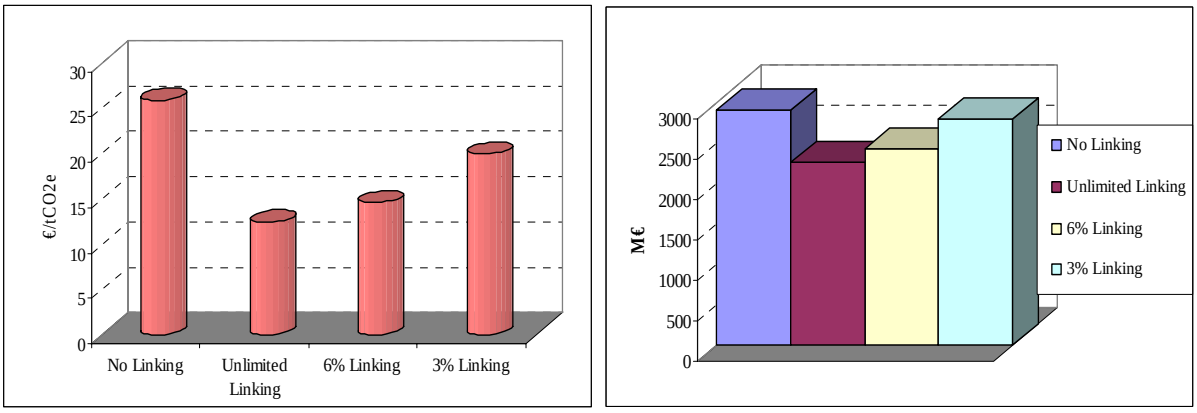


Figure 2a and 2b. Enlarged EU ETSe allowance price (€/tCO$_2$e) and annual compliance cost (M€)



In all cases, China is expected to be the greatest credits supplier (around 47% of the total – JI included, 55% of CDM only). The second most important region for project-based emission reductions is the Former Soviet Union with around 14% of the total, followed by India, with around 11% of the reductions done through CDM and JI (12% of CDM only). The Rest of Asia represents 9%, Africa-Middle East-Turkey 14%. Latin America comes last with around 5% only of the reductions (2% for Brazil alone).

Figure 3. Supply of CDM and JI credits

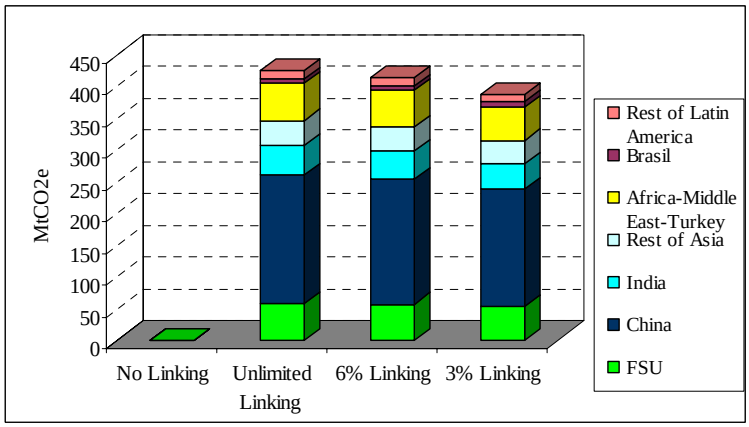


Figure 4. Shares of credit supply (case 4.c)