Implementing climate related measures: will the Kyoto mechanisms release the demand side potential?

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Keywords
climate, Kyoto mechanisms, demand side measures

Abstract

There is a hope that the Kyoto-mechanisms that allow trade and exchange of emissions and emission rights on new markets will clear the market for GHG-emissions. There is however less discussion on incentives and decisions, on technologies to be used and by whom and why. Most of this seems to be left to the "invisible hand" of the market.

This paper tries to estimate the opportunities for GHG reduction in different countries and discuss what sort of measures the Kyoto-agreement and -mechanisms can induce. It will further discuss the possibility for different partners to be active in fulfilment of the obligations. The paper is primarily geared towards investigating possibilities on the demand side.

The first and most critical issue is to understand where, by whom and on what grounds decisions to invest in GHG-reducing measures are made. The mechanisms have to address the mind of the people who control the solutions. Secondly the outcome will depend on how countries want to "play their hand" in the game over the Kyoto-commitments. Here it is argued that the picture is far more complicated than looking on the GHG-budget deficit or surplus only. Several countries have very good opportunities to serve themselves with domestic actions but could also step on their own toes if the GHG-obligations are not correctly allocated among stakeholders within the country.

The Kyoto-obligations may add an incentive to improve market for more efficient technologies to the already existing incentive for a more efficient use of resources by an "informed demand" based on more rational decisions. The incentive is however not automatic. It will still require a decisive element from government action.

Energy, Technology and Decisions

The key to success in abatement of the GHG lies in finding out who makes the decisions, and on what grounds and then influence these. A great deal of the potential to lower GHG-emissions is in the hands of individuals for whom energy and energy economy is not the primary concern but rather usefulness and comfort that can be delivered by use of energy. The obligations in the Kyoto agreements pertain to nations. Governments have access to incentives of many sorts but normally prefer to use such that are conform with the behaviour of mature markets, i.e. taxes or subsidies which allow the actors themselves to make the choice of who should act, how and when. In the Kyoto context there is a more stern element in the allocation of responsibilities to market actors (sectors) to reduce the emission of GHG. If all actors would respond in an economically rational way to the incentives, the fulfilment of the Kyoto obligations would have been (theoretically speaking) an easy task, although there would still be some debates and discussion over the fairness in distribution of burdens. But a great deal of the decisions is beyond the control of governments or is not sincerely touched by incentives in the control of governments as indicated in Figure 1 and Table 1.

One issue for contemplation is thus to assess how big the proportions are that are touched by such incentives that are in the arsenal of governments. As a starting point, we give a rough estimate of the existing energy efficiency potentials

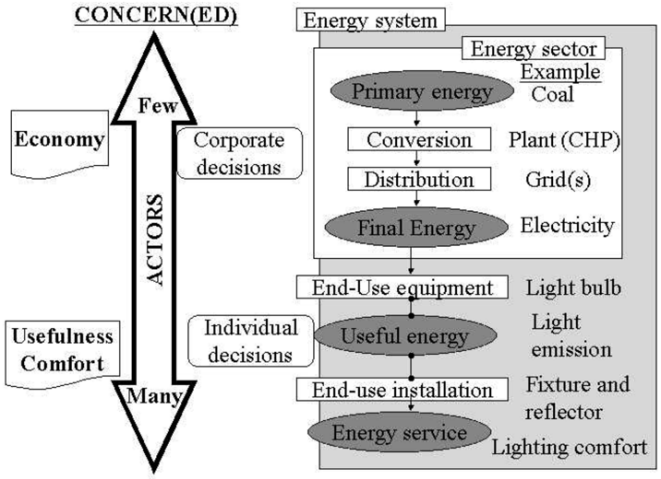

Figure 1: *Energy system hierarchy. (adapted from The World Energy assessment, WEA, chapter 6).*

and their allocation to sectors. We will use the World Energy Assessment (WEA, 2000) that has made extensive survey of calculated potential for economic savings in sectors and all over the world. The format for these estimations is somewhat different but generally show double digits percent savings in all sectors. Table 2 (estimated savings) has been deducted from the WEA and is used to indicate potentials.

By application of the above savings profile for regions with data on country emission of CO_2 from different sectors recorded by the IEA (OECD/IEA 2002), we can spot the savings potential to sectors as being "direct or indirect". The direct potential is when the actor makes the decision and note the benefit in his own activity. The indirect is when the reduction following a decision to save the energy use is booked in another sector, see Figure 2. The indirect potential is calculated by distributing the supply side proportion of CO_2 emissions to buildings and industry in the proportion these sectors have as emitters in their country's total balance. The indirect potential stems from the reduction of use of energy delivered from the energy sector to the end-users, mostly as electricity and heat. The indirect demand side savings potential can be realised in two ways, either by activities (savings) in the buildings and industry sector, which benefit the supply side without their acting, or by encouragement from utilities as e.g. DSM and Energy Services. The overall potential is almost 2/3 directly on the demand side as seen in Table 4. The biggest problem is that it is "locked in" in sectors where decisions are basically individual and mostly made with very little (if any) recognition of energy consequences of the choices. The remaining 1/3 could be realised by demand side activities and be assigned to the energy sector though the actors in that sector would probably not encourage such since it will hit their bottom line in their business.

Allocation of the Kyoto-obligations is crucial. Basically the obligations will be allocated "upstreams" to the supply side and to the chimneys. From the perspective of decisions this could be good since measures could be undertaken fairly quickly and based on transparent calculation. The bigger, and more sustainable, potential is however directly on the demand side, which will be harder or impossible to target with allocations of responsibilities for the Kyoto-commitments.

Quite a bit of the available (reasonable) potential for energy efficiency improvements is hidden with actors who do not primarily respond to economic incentives Thus there is a need to make specific arrangements to exploit the demand side potential.

The Kyoto mechanism architecture and the forces released

The Kyoto protocol established several methods including the flexibility mechanisms that should facilitate for the developed countries (Annex B countries) to find lower costs to meet their national emission targets (Nielsen and Rose Olsen, 2000; Vrolijk and Grubb, 2000; OECD/IEA 1997). Some of these mechanisms are deliberately formed to target projects and smaller scale solutions, the CDM and the JI. Thus use of these could be a way to release some of the huge demand side potential.

There is a veritable buffet for activities based on the idea that the most cost-efficient solutions should be reached by means of trading and global exchange. Thus there is a platform for technology exchange and building of new experi-

Table 1: Relation between technology (type and size) and decision strategies (Nilsson and Wene, 2002).

Decisions characteristics				**Corresponding Technology characteristics**	
Frequency of Change	*Basis for choice of replacement*	*Energy-savings as objective*	*Decision strategy*	*Unit size*	*End-Use Activity Type*
Often	Habit	Never	Mainly along Heuristic rules (if not purely by habit and tradition)	Very small (20-100 W)	Household lamps
Regular	Routine	Occurs		Small (100-1000 W)	Small appliances
Normal	Planned	Important		Small (1-10 kW)	Commercial maintenance, (e.g. motors)
Not often	Calculated	Important	Rational within delegated responsibilities	Big by unit size or aggregation (10-5000 kW)	Industrial & Commercial. Retrofit (e.g. lighting)
Seldom	Investment	Depends	Rational in context of purpose	Huge (> 2 MW)	Production and process technology (e.g. casting)

ences. Since the instruments are still in development it is still too early to tell the outcome and there is a great need to try to pick some possible useful trends to develop further. The first step is to analyse what could be on the mind of the actors on the scene by looking into their positions. Are the countries concerned likely and able to release such activities that will realise the full potential that their commitment to the Kyoto-agreement could?

In this paper we will primarily observe the OECD-countries that are members of the IEA and those countries who participate in the work within the Energy Charter Treaty, since within these frameworks there is also provided a system of collaboration on technologies and implementation of technologies.

If all the countries concerned would have ratified the Kyoto-protocol there would have been a balance in supply and demand to fulfil the common obligations but we already know that the US will not (yet) participate and it is not yet known if the Russian Federation will. If also the Russian Federation stays out the protocol will not be legally binding but there are still so many other countries committed legally and morally to the obligations that it seems likely that some sort of "Kyotoish" activity will take place. There seem to be a certain surplus in demand for buying available "hot air" which would likely drive up prices on a market for Assigned Amounts (AA).

A first conclusion could be that those who will act as buyers would like to take some control on an early stage by widening of their opportunities. This could happen by:

a) use of domestic resources,

b) developing of CDM (since that will widen the supply of options), and/or

c) making use of JI (since that will give a more detailed control over costs).

Table 2: Estimated potential energy savings (final energy consumption), based on WEA (2000), Chapter 6.

Region	Potential for economic savings in sector (%)		
	Industry	Buildings	Transport
Western Europe	15	20	20
North America	10	30	15
Japan and Australia	15	20	10

Table 3: Overview of CO_s-emissions distribution (% of total) in sectors in the IEA-countries.

	Energy sector	Industry	Buildings	Transport
Average CO_2-percentage	35.4	22.4	15	27.2
Range	1-57	11-37	3-40	11-59

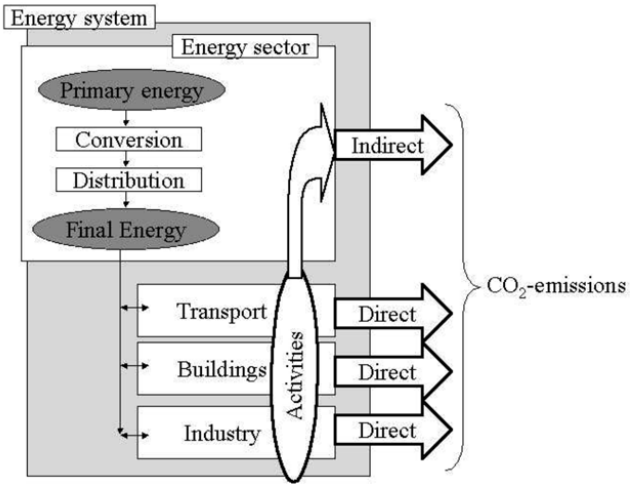

Figure 2: *Demand Side Activities impact on CO_2-emission.*

Will the countries play the game?

The likelihood for countries to act in a certain fashion should however not be judged on their CO_2-budget surplus or deficit (their account) only. Their conduct could be characterised also by their position as regards how their society and technological platform is performing in terms of CO_2-intensity (their ability). If countries are sorted on these two parameters we will get a more detailed view:

a) Those who have a deficit and at the same time a high intensity will have good opportunities to find technologies and to undertake domestic actions. This is group: **DO** it yourself (with domestic resources);

Table 4: Indication of savings potential (% of total CO2-emissions) and correlation to structure for decisions to realise the potential.

	Demand Side indirect (benefiting the Supply side)	Demand Side (direct)			SUM
	Energy Prod.	Industry	Buildings	Transport	
Range	0-9	1-6	1-8	2-12	13-19
Median	6	3	3	4	18
Arithmetic Average	6	3	3	5	17
Decisions type in sector	Corporate, Political	Formalised Corporate	Operational, Individual, Comfort	Individual	
"Societal concern" in decision	High	Important	Some	Little	

Table 5: Overview of the Kyoto-mechanisms and their applicability.

Instrument		Character		Comments
Flexible Mechanisms	Clean Development Mechanism, **CDM** (article 12)	Project based trading	With non-Annex B countries from 2000 Delivers "Certified Emission Reductions" **(CER)**	Use of these mechanisms shall be **"supplementary"** to domestic actions. The project- achieved reductions shall be **"additional"** to those that would otherwise occur, i.e. compared to the **"baseline".**
	Joint Implementation, **JI** (article 6)		Between Annex I countries From 2008 Delivers "Emission Reduction Units" **(ERU)**	
	Emission Trading, **ET** (article 17)	Between Annex B countries From 2008 Trade(part of) "Assigned Amounts" of emission **(AA)**		
Forming of bubbles (article 4)		Burden sharing between countries.		
Banking and borrowing (article 3.13)		Banking allowed for subsequent commitment periods. Borrowing only within the period.		
Activities Implemented Jointly, **AIJ** (Conference of the Parties Decision 5/CP.1)		Pilot Programme to test and analyse methods for future JI and CDM		Have been recognised as an opportunity for "learning by doing"

b) Those with a surplus and with a high intensity will be in a good position to **SELL** since they both have "hot air" and good opportunities to replace existing technology. They will be interesting as suppliers of JI-projects (and in cases when applicable also CDM);

c) Those with a deficit but with a low intensity are limited in their opportunity for domestic actions and will primarily be directed towards **BUY**ing to cover their debts;

d) Those with a surplus and with low intensity will be in the target area and would prefer to **REMAIN** there.

Based on this simple overview it seems reasonable to anticipate that some countries would be more active than others in exploitation of the demand side potential. In Table 6 this has been noted by statement on such incentives. A simple categorisation of countries according to their standing in terms of commitments and their present technology would however be unrealistic since there is also an ongoing development and there is a will both to use and drive technological development in several countries. The CO_2 intensity of their energy system will give some clues on how they can cope with their commitments as shown in Table 6 but also within the groups thus identified is necessary to look closer on how they could use technological dynamics and/or use their situation for playing the game on the market. We will then continue to see if the dynamics of development, either by will or by trend, will give us more ideas on the usefulness of the Kyoto-mechanisms.

Table 6: Position analysis of possible country attitudes to their Kyoto-commitments.

CO_2 Position						
CO_2-emissions Rel. target (Account)	CO_2-intensity in energy supply (Ability)	STRATEGY based on position	Countries In position category[a]	CO_2-emission rel. target (Mton)	% of relevant demand	Incentive for demand side action
ABOVE	HIGH	**DO** it yourself. The country has good opportunities to serve themselves.	(Australia), Denmark, Germany, Ireland, Italy, Netherlands, (United States)	+192 (+1156.4)[b]	35%[A] (75%[B])	YES
	LOW	**BUY.** The opportunities for domestic actions are limited	Austria, Belgium, Canada, Finland, France, Japan, Luxembourg, New Zealand, Norway, Spain, Switzerland	+349	65%[A] (25%[B])	HARDLY
BELOW		**REMAIN.** This is where everybody wants to be	Bulgaria, Hungary, Iceland. Latvia, Lithuania, Slovakia, Sweden, (Ukraine), United Kingdom	-112 (-501)	21%[A] (30%[B])	SOME
	HIGH	**SELL.** The country has "hot air" and probably good opportunities to identify projects for JI and (where applicable) CDM.	Czech Republic, Estonia, Greece, Poland, Portugal, Romania, (Russian Federation),	-120 (-1373.1)	22%[A] (90%[B])	STRATEGIC

a. Countries that has not ratified the Kyoto-protocol are put in italics and brackets.
b. Within brackets the amounts related to all signatories ratifying the agreement.
A of 531 (see Table 5).
B of 1529 (see Table 5).

Table 7: Overview of countries positions as regards the Kyoto framework and its targets.

Country[a,b,c] Annex I and B countries to left in the box (Annex I but not B bracketed and underlined) Annex B but not I in middle Non-annex I countries to the right in the box	Quantified emission limitation according to Annex B from Kyoto (% of base year 1990)[d]	1998 CO_2 emission level (% of base year 1990)[e]	Relation to target (%-units)	Relation to target 1998 (Mton CO_2)[f]	CO_2 intensity (CO_2 per TPES, tCO_2 per toe)[g]	Signatory to ECT Energy Efficiency – Protocol[h]	IEA member
Albania					1.86	X	
Armenia					1.73	X	
Australia	108	121	+13	(37.0)	2.99	x	X
Austria	(92) 87	107	+20	12.6	2.20	X	X
Azerbaijan					2.41	X	
(**Belarus**)	-				2.28	x	
Belgium	(92) 92.5	107	+14.5	14.8	2.03	X	X
Bosnia and Herzegovina					3.53	x	
Bulgaria	92	53	-39	-40.4	2.27	X	
Canada	94	114	+20	86.9	2.10		X
Croatia	95				2.28	X	
Cyprus					2.61	X	
Czech Republic	92	78	-14	-24.0	2.94	X	X
Denmark	(92) 79	114	+35	18.3	2.57	X	X
Estonia	92	51	-39	-15.6	3.09	X	
Finland	(92) 100	105	+5	3.1	1.65	X	X
France	(92) 100	107	+7	25.3	1.45	X	X
Germany	(92) 79	87	+8	84.7	2.45	X	X
Greece	(92) 125	118	-7	-6.1	3.15	X	X
Hungary	94	69	-25	-21.1	2.23	X	X
Iceland	110	106	-4	-0.1	0.63	x	
Ireland	(92) 113	127	+14	4.3	2.82	X	X
Italy	(92) 93.5	106	+12.5	55.0	2.48	X	X
Japan	94	109	+15	173.8	2.20	x	X
Kazakhstan					3.14	X	
Kyrgyzstan					1.88	X	
Latvia	92	33	-59	-14.5	1.79	X	
Liechtenstein	92					X	
Lithuania	92	42	-50	*(-19.6)*	1.57	X	
Luxembourg	(92) 72	74	+2	0.3	2.18	X	X
Malta					2.80	x	
Moldova					2.22	X	
Monaco	92	128	+36	*(0.04)*			
Mongolia						X	
Netherlands	(92) 94	112	+18	29.7	2.34	X	X
FYR Macedonia					3.05	X	
New Zealand	100	114	+14	3.5	1.70		X
Norway	101	119	+18	6.2	1.31	x	X

a. Annex I countries with bold text
b. Country in transition to market economy according to Annex I in italics.
c. Annex II countries in shaded box
d. Values for EU countries with burden sharing.
e. According to UNFCCC database http://ghg.unfccc.int/
f. Data for country that has not ratified the Kyoto protocol is in italics and within brackets.
g. IEA Statistics for the year 2000. Figure to the left is below, and to the right above, World average, which is 2.32.
h. X=Parties that have deposited instrument of ratification. x=Charter signatories which have not yet deposited instrument of ratification.

Table 7 [continued]: Overview of countries positions as regards the Kyoto framework and its targets.

Country[a,b,c] Annex I and B countries to left in the box (Annex I but not B bracketed and underlined) Annex B but not I in middle Non-annex I countries to the right in the box	Quantified emission limitation according to Annex B from Kyoto (% of base year 1990)[d]	1998 CO_2 emission level (% of base year 1990)[e]	Relation to target (%-units)	Relation to target 1998 (Mton CO_2)[f]	CO_2 intensity (CO_2 per TPES, tCO_2 per toe)[g]	Signatory to ECT Energy Efficiency – Protocol[h]	IEA member
Poland	94	89	-5	-20.4	3.25	x	
Portugal	(92) 127	125	-2	-0.8	2.42	X	X
Romania	92	64	-28	-53.6	2.38	X	
Russian Federation	100	63	-37	*(-876.4)*	2.45	x	
Slovakia	92	70	-22	-13.4	2.17	X	
Slovenia	92				2.21	X	
Spain	(92) 115	120	+5	12,4	2.28	X	X
Sweden	(92) 104	103	-1	-0.6	1.09	X	X
Switzerland	92	101	+9	*(4.0)*	1.57	X	X
Tajikistan					1.52	X	
(**Turkey**)	-				2.65	x	X
Turkmenistan					2.47	X	
Ukraine	100	45	-55	*(-389.4)*	2.16	X	
United Kingdom	(92) 94	94	-0	-2.7	2.28	X	X
USA	92	111	+19	*(957.1)*	2.46		X
Uzbekistan					2.29	X	
				TOTAL:	2.32[i]	50	25
				Supply	Demand		
TOTAL				-1499	+1529		
				+30		(2% surplus in demand)	
TOTAL (except not yet ratifying countries)				-233	+531		
				+298		(56% surplus in demand)	

a. Annex I countries with bold text.
b. Country in transition to market economy according to Annex I in italics.
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d. Values for EU countries with burden sharing.
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f. Data for country that has not ratified the Kyoto protocol is in italics and within brackets.
g. IEA Statistics for the year 2000. Figure to the left is below, and to the right above, World average, which is 2.32.
h. X=Parties that have deposited instrument of ratification. x=Charter signatories which have not yet deposited instrument of ratification.
i. World Average.

A GAME WITH FOUR TEAMS

A closer look on all the categories and discussion more in detail how they possibly could use their own resources and what weight they carry to the market of emissions trading, could reveal more. In Tables 8-11 their commitment (demand for CO_2 emission rights) or their possible supply of such, is recorded as a sign of the relative importance for the country and for the market. But more important is that countries have a chance to act to improve their technology, which will show in an improvement of the CO_2 intensity. We will assume that if a country faces improvements greater than 25% in their domestic resources they will also be active to exploit them. We will also anticipate that they will be seen as small, medium or large players on the emissions rights market depending on their present balance with the addition they could get from domestic actions and assume that all countries will be able to improve domestically.

Category DO: This group represents a demand of 192 Mton CO_2 but could also, just by aligning their technologies to the world average in intensity, deliver more than 80 Mton domestically. It is worth to notice that Ireland thereby would potentially be a seller on the market, that Germany and Italy could supply half of their obligations themselves, and that Denmark and Netherlands probably will have to turn outwards to find the necessary remedy for their deficit. Still the remaining deficit for both Germany and Italy is considerable and will easily justify vivid outward actions to make use of the trading opportunities.

The category DO was basically anticipated be interested in using their domestic resources but it seems as if Netherlands could be less so.

Table 8: Assessment of opportunities for countries in the DO-group.

Country	Intensity ton CO_2/toe	Commitment, C (Mton)	Potential for additional domestic measures,	Relative importance		Remaining commitment after domestic measures, RC (Mton)	Possible country position as actor domestically (A=active)[a] and on the international market (S=small, M=medium, L=Large)	
				P/C %	C/Σ C %		Domestic	Buyer on int. market
Denmark	2.57	18.3	4.9	30	10	13.4	A	S
Germany	2.45	84.7	44.2	50	45	40.5	A	L
Ireland	2.82	4.3	7.3	170	2	(-3.0)	A	-
Italy	2.48	55.0	27.5	50	28	27.5	A	M
Netherlands	2.34	29.7	1.5	10	15	28.2	-	M
SUM (Σ)		192	85.3	60		109.7		

a. Active if P/C% > 25%; Small if remaining demand is 10-25Mton, Medium 25-40 Mton, Large >40 Mton.

Table 9: Assessment of opportunities for countries in the SELL-group.

Country	Intensity ton CO_2/toe	Supply opp. (hot air), C (Mton)	Potential for additional domestic measures, P (Mton)	Relative importance		Resulting available supply after domestic measures, RC (Mton)	Possible country position as actor domestically (A=active) and on the international market (S=small, M=medium, L=Large)	
				P/C %	C/Σ C %		Domestic	Seller on int. market
Czech Republic	2.94	24.0	25.0	104	20	49.0	AA	L
Estonia	3.09	15.6	3.5	22.6	13	19.1	-	S
Greece	3.15	6.1	23.1	380	5	29.2	AAA	M
Poland	3.25	20.4	83.7	410	17	104.1	AAA	XL
Portugal	2.42	0.8	2.5	310	1	3.3	AAA	-
Romania	2.38	53.6	2.2	4.1	44	55.8	-	L
SUM (Σ)		120.5	139.9	116		260.4		

Table 10: Assessment of opportunities for countries in the BUY-group.

Country	Intensity ton CO_2/toe	Committment C (Mton)	Potential for additional domestic measures, P (Mton)	Relative importance		Resulting demand after domestic measures, RC (Mton)	Possible country position as actor domestically (A=active) and on the international market (S=small, M=medium, L=Large)	
				P/C %	C/Σ C %		Domestic[a]	Buyer on int. market
Austria	2.20	12.6	8.2	65	2	4.4	-	S
Belgium	2.03	14.8	15.6	105	4	-0.8	-	S
Canada	2,10	86.9	68.5	79	20	18.4	-	L
Finland	1.65	3.1	7.1	230	2	-4	A	-
France	1.45	25.3	48.5	192	14	-23.2	A	- (seller?)
Japan	2.20	173.8	150.1	86	43	23.7	-	XL
Luxembourg	2.18	0.3	1.0	330	-	-0.7	A	-
New Zealand	1.70	3.5	4.1	117	1	-0.6	-	-
Norway	1.31	6.2	4.4	70	1	1.8	-	-
Spain	2.28	12.4	37.0	298	10	-24.6	A	- (seller?)
Switzerland	1.57	4.0	5.4	135	1	-1.4	A	-
SUM (Σ)		342.9	349.9	102		-7		

a. Active if the P/C % is significantly above the average for the group.

Table 11: Assessment of opportunities for countries in the REMAIN-group.

Country	Intensity ton CO_2/toe	Surplus C (Mton)	Potential for additional domestic measures,[a] P (Mton)	Relative importance		Resulting available supply after domestic measures, RC (Mton)	Possible country position as actor domestically (A=active) and on the international market (S=small, M=medium, L=Large)	
				P/C %	C/Σ C %		Domestic[b]	Buyer on int. market
Bulgaria	2.27	40.4	2.8	7	36	43.2	-	L
Hungary	2.23	24.7	3.6	15	22	28.3	-	M
Iceland	0.63	0.1	0.1	100	-	0.2	A	-
Latvia	1.79	14.5	0.4	3	13	14.9	-	S
Lithuania	1.57	19.6	0.7	4	17	20.3	-	S
Slovakia	2.17	13.4	2.5	19	12	15.9	-	S
Sweden	1.09	0.6	3.4	565	-	4	A	-
United Kingdom	2.28	2.7	34.5	>1000	2	37.2	A	M
SUM (Σ)		112.4	48.0	43		160.4		

a. If the country lowers it's intensity to the world average.
b. Active if the P/C % is significantly above the average for the group.

Category SELL: This group represents a supply of 120 Mton of CO_2 but if the same countries should align their technology to the world average in intensity they could deliver 140 Mton more. Even then this total amount will be if dwarfed Ukraine or the Russian Federation would join the system. It would otherwise be reasonable to assume that the countries in this category would be prime suppliers of JI-projects, especially Czech Republic and Poland but also Greece. Portugal is rather insignificant in this group. Romania and Estonia could be anticipated to be suppliers of "hot air", though Romania would be less active as regards to domestic actions.

The category SELL was basically anticipated be interested in using their domestic resources strategically but for Estonia and Romania it could be that they are too small to be of real value.

Category BUY: This group has an aggregated demand of 343 Mton CO_2 and an intensity, which in some cases is down to almost 50% of the world average. The reason is in many cases supply of CO_2-free electricity (nuclear and hydro), which is exploited to the limit of reasonable capacity. Under the assumption that all countries still can improve in some other sectors they could reduce their "buying needs" with more than their commitments and even turn into sellers.[1] The only sure buyers of significance would be Canada and Japan especially if they do not undertake their domestic opportunities. Two countries could even turn into potential sellers (France and Spain) though the French opportunities for improvement are in the transport sector. Given the importance of French industrial tradition in transportation it seems to be an interesting niche.

For the groups DO and SELL it was assumed that they could reduce their intensity to the world average, which will on the average would be 16% improvement (in a range from 1-30%). The countries with low intensity are here assumed to be able to make the same improvement percentage-wise.

The category BUY was basically anticipated HARDLY to be interested in using their domestic resources. Some could still be if they could find ways to exploit improvements in sectors with a very high demand for energy. It seems reasonable that several of these countries are not in an immediate need for buying to honour their commitments, nevertheless they could be powerful players on the market since quite a bit of their possible domestic measures will not be in the power sector but in the more fragmented end-use.

Category REMAIN: This group has an aggregated surplus of 112 Mton and are not in a pressing position except that their relatively low intensity do not allow them to improve their technology stock as easily for the same reason as the category BUY. They could however add to their surplus by domestic measures another 50 Mton even if their improvement in intensity is only half of that in the group SELL. Several of these countries could be large players on the international market though for different reasons. Hungary and Bulgaria for the reasons anticipated, having a great amount of hot air, but also United Kingdom. UK seem to be in a good position to act very strongly for domestic measures, which could put them in a favourable position also to be a seller!

THE GAME CONCLUDED

The exercise made here was based on the idea that most of the present analysis of how Kyoto-mechanisms could work to provide markets for GHG-abatement is made with static assumptions regarding primarily the countries balance-sheet for CO_2, their account. Also their ability to make domestic changes counts however and is here analysed from their CO_2 intensity. Also such a study would however only give a position of the countries and not really tell about their actions.

1. The countries with low intensity only have to improve by 13% on the average to wipe out their debt.

Table 12: Moving between combinations of policy states.

Moving from/to	Corresponds to	Effect on Result	Comment
A to B (C to B1) (C1 to D)	Releasing of the existing economic potential and acting directly on the demand side c.f. WEA assessments	10-20% (see table 2)	Conventional demand side measures stops at B (or B1)
B to B1 A to C	Releasing of potentials connected to removal of subsidies of the supply side.	Not known, but could be estimated as the reduction rate in the Kyoto-commitments	Subsidies to supply side must be removed. Otherwise fulfilment of the Kyoto-obligations will only serve as a remedy for a policy failure.
C to C1	The Kyoto commitments themselves are a way of internalising external costs that supply has in emitting GHGs.		Conventional supply side measures stops at C
A to D	Simultaneous effect of adjusting both supply side and demand side markets to true conditions.	Should in consequence be more than 20%	

Thus we have here also added a discussion about opportunities to improve technologically, which is possible for practically all countries though their intensities vary tremendously. The reasons for the variations often depends on historically motivated comparative advantages shown by use of certain technologies in energy and industry sectors whereas buildings and transport sector mostly allow great improvements. In Figure 3 there is a comparison of intensities in the "groups" and the projected improvements in the analysis. This illustrates that the brief analysis made is not too far out. The cardinal problem is rather that a lot of these improvements will have to be made in sectors where decisions are not always easy for governments to influence (see Tables 1 and 4).

Several countries have excellent opportunities to improve their situation in terms of GHG-efficiency and more careful analysis is necessary than to look on their GHG-budget balance only. Regardless of their initial situation they will have considerable opportunities to play a game that turns out in their favour. Such games could of course include not acting (at least not act quickly) to improve their GHG-budget.

The instruments that governments could use

The new climate mechanisms are designed to give support to the economic incentives for improving systems. They could add to those measures and instruments already in governments hands by reinforcing them as they are or as a complement. The CDM and the JI for instance will encourage a search for projects and to some extent there are provision made for facilitate the exploitation of small projects. The Fast track CDM is such a recognition of the potential hidden in small projects.

Today's use of energy is partly based on subsidised supply and uninformed demand which ought to be changed to a situation that is based on full cost supply; by inclusion of externalities, and informed demand.

There are two ways towards D in Figure 4, via B or via C. With single-sided measures there will be a halt half-way towards the full potential for GHG-reductions, either at B or at C. The Kyoto-mechanisms could add another pulling effect towards a more correctly working market since the intention is to internalise the externalities related to global warming. Thus the policy state will move along the line A-C-C1. But if countries continue subsidising supply side use of fossil fuels even the fulfilment of the Kyoto-obligations will only serve as a "pain-killer" for a policy failure. The other route (A-)B-B1-D is parallel and builds on that demand is "informed" rather than uninformed and that users of energy roughly behaves economically rationally.

The move A-B (or C-B1 or C1-D) corresponds to releasing of the economic potential as described in WEA 2000. The Kyoto-mechanisms could add also to this transversal move especially by use of the project-focused instruments CDM and JI (and also AIJ). Such movements would naturally be more likely if the projects and the methods to release them

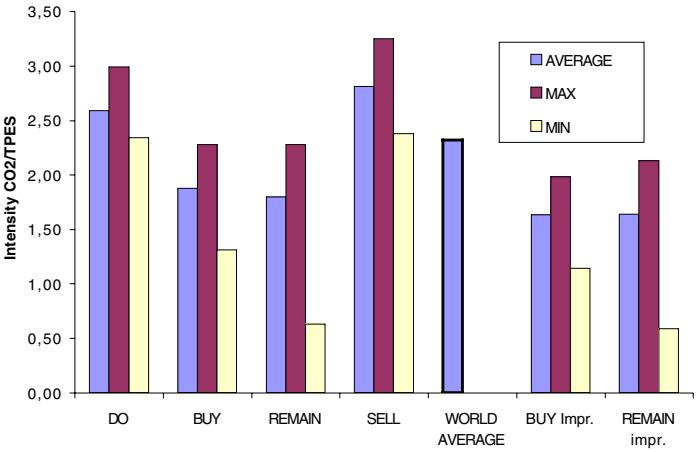

Figure 3: *Intensity statistics for each of the groups and some possible changes towards the average or beyond.*

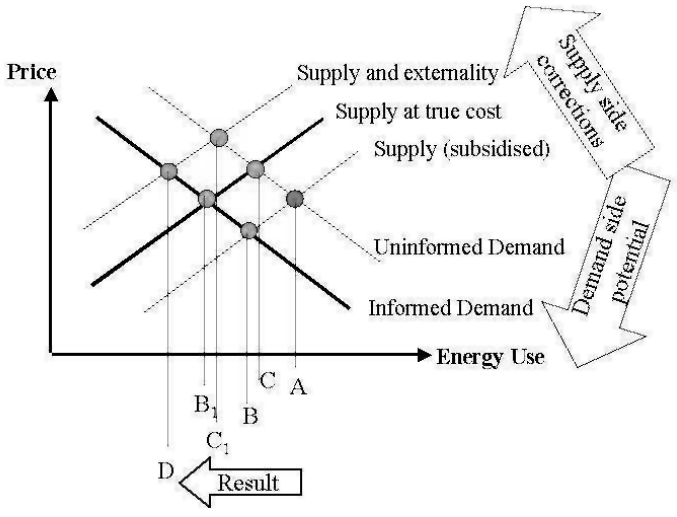

Figure 4: *Possible combinations of policy states.*

Table 13: Policy instruments addressing certain behaviours and the possible measures/activities released.

		Row	Behavioural aspect (driver)		
			Calculation, profit	Routine, Plan	Habit
Instrument	Rational (taxes, levies)	1	Profit on own money	Service, Value by assistance (ESCO?)	
	Perception	2	Methods, praxis	Orientation, catalogues	Labels etc
	Command	3	Standards	Mandatory Quality declarations	Codes
Climate Instrument	Trading	4	Adding value to aggregated actions and to certain actors	Intermediaries aggregates value?	
	Project (techn)	5	Brokers interest?	Certain technologies (sizes) are favoured	
Other promotional Schemes (certificates, quota)		6	Green certificates	White certificates, DSM	
Technologies concerned		7	Large scale and Supply Side	Medium size, Site adapted Demand and Supply Side	Small size, Demand Side

are also in harmony with other measures used to improve energy efficiency and renewable fuels (carbon lean technologies). In Table 13 there is an attempt to map out how policies and measures for different purposes could interplay. The driver for action with the user is either fully rational and based on calculations, or subject to plans and routines, or based on habits without much consideration about energy consequences [see columns].

- The traditional instruments/policies are either using the economically rational argument (prices, taxes), or the perception of the actor to facilitate the decision, or is a form of command [rows 1-3].
- The new elements from the climate mechanisms are either based on trading per se or have a complement in giving advantage to certain technologies/sizes, e.g. fast track CDM [rows 4-5].
- New sets of trading mechanisms have also been developed based on a combination of economic rationality and command in order to support green (or white) improvements [row 6].
- The issue in context of this study is to what extent these instruments work together and if one can trace a connection to certain technologies and types of technologies [row 7].

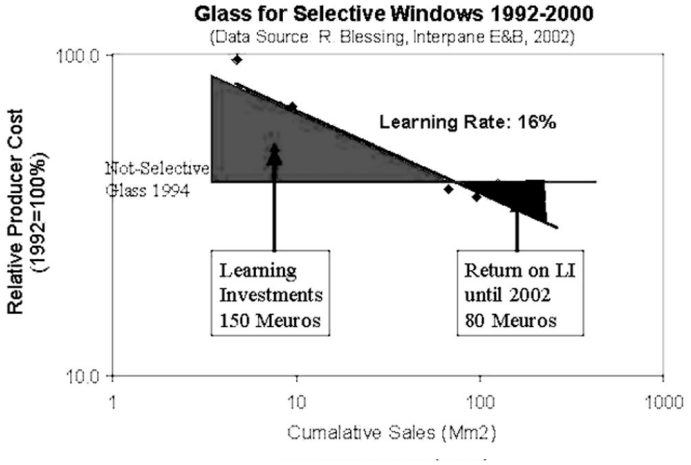

Figure 5: *Learning Curve and learning investments for selective windows on the German market (source Clas-Otto Wene).*

With this view one could conclude that there is not much added from the Climate Instruments to address the potential of the energy demand that is guided by peoples habits. There could be room for some innovations such as brokers and other intermediaries that could aggregate value from trading or from projects, but very little has been seen yet.

The use of the CDM and JI mechanisms could in principle boost technology development for several areas of application. This is especially the case if a technology could "travel down the learning curve", which could be possible e.g. for, Fuel cells, Small scale CHP, Photovoltaic applications, Lighting applications, Heat pumps, Trigeneration units, etc., (OECD/IEA 2000; OECD/IEA 2003).

Such new "challenging technologies" can develop very fast from being too expensive to compete to being the most profitable and cost-efficient solution if learning investments could be gathered. The example in **Figure 5** is from the European market fro Energy efficient "Selective windows" where a niche-market has been identified and put up 150 Meuro investments which the year 2000 has yielded

Table 14: CDM-eligible countries record in the UN-FCCC list of Technology Transfer projects.

Country	Intensity ton CO_2/toe	TPES (Mtoe)	Potential for additional domestic measures[a], P (Mton)	Records in the UNFCCC registry of Technology Transfer Projects
Albania,	Lower than world average	Low		Renewable energy projects Swiss Hydro and power loss projects Balkans Energy Efficiency Program (IFC)
Armenia,				NC[b] notes interest in: Solar energy Heating and cooling Heat Pumps
Kyrgyzstan				No records
Tajikistan				No records
Azerbaijan	2.41	11.7	1.8	Canadian Hydro power project NC notes interest in Power generation
Bosnia and Herzegovina	3.53	4.36	1,0	No records
Kazakhstan	3.14	39.06	8,0	1, National Project preparations for wind power (5 MW) and small run-of-the-river hydro power (≈1 MW) 2. NC notes interest in: District Heating savings Heating pilot projects Small hydro, wind, solar Modernisation of power plants
Malta	2.80	Low		No records
Moldova	2.87	Low		No records
FYR Macedonia	3.05	Low		No records
Turkmenistan	2.47	13.88	2.2	Mostly projects on framework issues such as market reforms, training centers etc, with some support form US and Canada
Uzbekistan	Lower than World Average	50.15		NC[b] notes interest in: Hydro power Electric power supply Fossil fuel industry

a. With an average improvement of 6.5 % in the intensity.
b. NC: National Communication to UNFCCC.

a return of 80 million Euro. Since these windows are now the more economic choice for the user the profit will of course grow.

The Kyoto flexible mechanisms seem to be a brilliant opportunity to gather learning investments by use of CDM and JI in niche-market applications, but for this to happen there is an obvious need for much stronger commitment to make use of the opportunities that the climate instruments provide.

Kyoto and the Energy Charter

The use of the Kyotomechanisms are still under exploration and development and it might be to early to tell if it is possible to create a harmony between the instruments to such an extent that there will be a boost or a real pulling force towards carbon lean economies. We will however make a try to look at announced activities in CDM-projects in countries adhering to the Energy Charter.

Several of the countries in the Energy Charter group could spearhead the use of the Kyoto-mechanisms by use of the CDM that is under development. Since the CDM-mechanism will especially favour small projects they could be anticipated to also favour energy efficiency.[2] A search of registered projects show that there are some interesting prospects but also that most of the interest that has been put on record is related to energy supply technologies. Another possible fact of importance could be that "donor" countries seem to act according to their anticipated skill. Both Canada and Switzerland are recorded for activities on hydro-power. Again we see glimpses of interest towards the potentials hidden in small scale projects and that are guided by less rational behaviour in households, transport and industry. We also see possible connections to other instruments such as codes, labels and standards but mostly on a pilot base and from countries whose impact as leaders for new applications and market transformation could be assumed to be low.

Conclusion

There is not much evidence that the Kyoto-mechanisms will significantly change the scene for energy efficiency and renewable fuels since they are still applied in isolation by countries and they are based on a hope that markets will just

2. Small is:
a) less than 15 GWh/year in reduction or
b) renewable energy projects with a maximum capacity of 15 MW or
c) reduce anthropogenic emissions by source and directly emits less than 15 kton of CO_2-equivalent gas.

simply clear the situation. The mechanisms will however not address the issues that already today keeps a large potential for improvements idle. There is a need to get away from the myopia of supply side action and of cost-efficiency based on performance of present technologies. The Kyoto-mechanism could be turned into a forceful instrument to promote new and better technologies that is given the chance to "ride down the learning curve".

More consistent acting and more pooling of resources is needed. There has been developed a fairly consistent set of advice for their stakeholders in the Energy Efficiency Initiative were the applications and the applicability analysed (OECD/IEA 1998 (EEI)). Under the Energy Charter Energy Efficiency Protocol, countries are required to formulate strategies to improve energy efficiency and thereby reduce the environmental impact of the energy cycle. Countries are required to develop, implement and regularly update energy efficiency programmes best suited to their circumstances. Such would be a natural base for pooling of resources and targeting of technologies as well as policy measures that will give make the declarations regarding climate to lift from the paper and move into reality.

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