Cost-effective and environmentally safe GHG emissions trading and abatement under uncertainties

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Global environmental problems: International integrity of the goals

- Environment is a common good
- Global environmental problems – need for coordinated robust solutions
- Transboundary problems require appropriate models for negotiation, verification and certification of commitments to manage shared resources effectively in a fair and mutually beneficial way
- Large often unresolvable uncertainties, asymmetric information

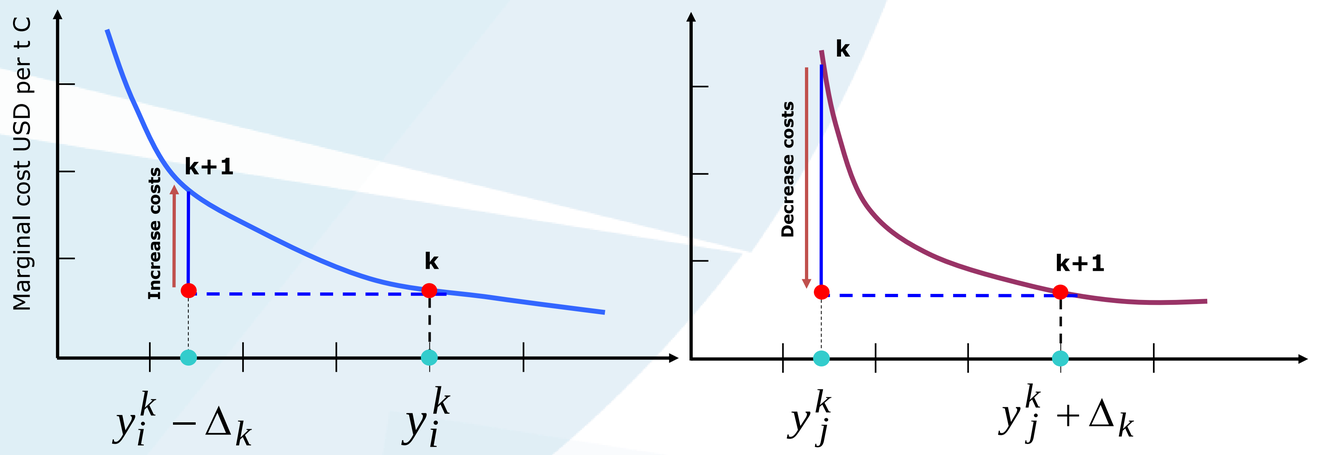
IIASA Integrated model for robust emission trading and abatement under uncertainties

- Recent IIASA studies (ESM, ASA, MAG programs) analyze the role of uncertainties in emissions trading and abatement
- Studies include major countries: USA, Australia, Canada, EU27, Japan, Russia, China, …
- Underlying problem - Minimize total costs of participants: **Cost = Cost1 + Cost2 + …+ Costn**
- Fulfill environmental goals under Under assymetric information, uncertainties about emissions, market uncertainties, cost functions (current and future) including increasing returns

The role of emission trading

- Companies or groups of emitting entities are required to hold emission allowances which represent their right to emit specific amounts
- Companies that need to increase their emission allowance must buy credits from those who pollute less. The transfer is referred to as trade
- Main challenge – major uncertainties around emissions: natural, monitoring, conversion factors, accounting, reporting, asymmetric info, market shocks, …
- Phase 1: 2005 – 2007 :
  - After the first year of trading, prices collapsed when the market determined that too many allowances had been allocated
- Phase 2: from 2008 :
  - Prices collapsed again due economic downturn and demand decrease
  - Companies holding the permits and traders started selling out heavily
  - Low prices - fewer incentives to move to less GHG intensive fuels
  - Heavy emitters may now have too many permits

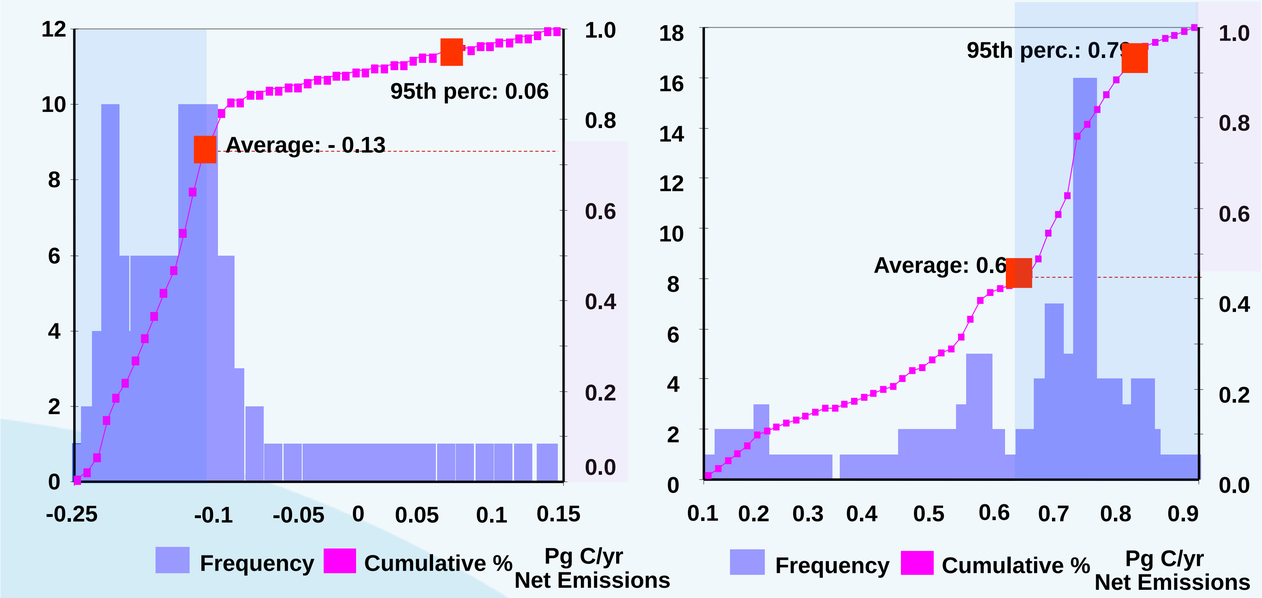
Bilateral emissions trading



Trades without uncertainties – not robust

	USA	Austr	Can	EU27	Japan	Rus	Ukr
Em opt (MtC)	5017	397	643	4401	1274	1900	340
Unc opt	0	0	0	0	0	0	0
Trades opt	202	133	210	80	188	-474	-340
Marginal cost (€ per tC)	13	13	13	13	13	13	13
Costs after trades (Million €)							
Em reduction	11091	261	650	2969	392	1270	200
Unc reduction	0	0	0	0	0	0	0
Trades	2596	1637	2540	958	2231	-5739	-4046
Total (core)	13687	1898	3190	3927	2622	-4469	-3845
Costs before trades (Million €)							
Em reduction	13839	16992	29341	4221	23959	0	0
Unc reduction	0	0	0	0	0	0	0
Total	13839	16992	29341	4221	23959	0	0
Profits due to trades	152	15095	26152	294	21336	4469	3845
Total profits							71342

Representation of uncertainties matters !



Trades with uncertainties – increase of profits

	USA	Austr	Can	EU27	Japan	Rus	Ukr
Em opt	3519	385	606	4138	1229	1803	327
Unc opt	249	37	59	988	150	331	153
Trades opt	-1047	157	232	805	293	-240	-200
Marginal cost (€ per tC)	25	25	25	25	25	25	25
Costs after trades (Million €)							
Em reduction	38735	666	1733	9157	1259	3686	500
Unc reduction	5031	344	626	2704	558	207	142
Trades	-25181	3782	5579	19360	6645	-5772	-4219
Total (core)	18586	4792	7939	31221	8462	-2293	-3577
Costs before trades (Million €)							
Em reduction	21712	30087	59560	37598	90418	0	0
Unc reduction	2925	4756	8204	8587	13354	71	0
Total	24637	34843	67764	46185	103772	0	0
Profits due to trades	6051	30051	59825	14965	95310	2325	3577
Total profits							212104