

International Energy Workshop 2008  
30 June – 2 July 008, International Energy Agency, Paris, France

## **Supra-European Emissions Trading Schemes: An Efficiency and International Trade Analysis**

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## Agenda

- Background on global ETS developments
- Simulation model
- Policy scenarios
- Simulation results
- Conclusions

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## Background: EU emissions trading scheme

- EU Emissions Trading Scheme (EU ETS) ⇔ installation-based scheme entering its second phase in 2008:
  - Exclusive coverage of energy-intensive industries (electricity, iron and steel, paper and pulp, chemicals, non-ferrous metals, aviation)
  - Not covered: services, agriculture, transport, household, small emitters
  - Allocation of emission allowances to covered installations (grandfathering) ⇔ National Allocation Plans (NAPs), NAP III
  - Access to project-based emissions crediting: CDM and JI
- European Council (2007): increasing cost efficiency by linking EU ETS to compatible mandatory schemes

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## Background: Non-EU emissions trading schemes

- International Carbon Action Partnership (2007) ⇔ intergovernmental expert forum on potential linkage of emissions trading schemes:
  - Norway and Switzerland designing schemes closely to the EU ETS
  - Canada: promoting “Large Final Emitter System”
  - Japan: Voluntary “Pilot Project of Domestic Emissions Trading Scheme”
  - Australia: “New South Wales Greenhouse Gas Abatement Scheme” already operating at the state level
  - USA: “Regional Greenhouse Gas Initiative” promoted by 10 Northeast and Mid-Atlantic states and “Western Climate Initiative” by 6 Western states
  - Russia: ratified the Kyoto Protocol => incentives to link up to EU

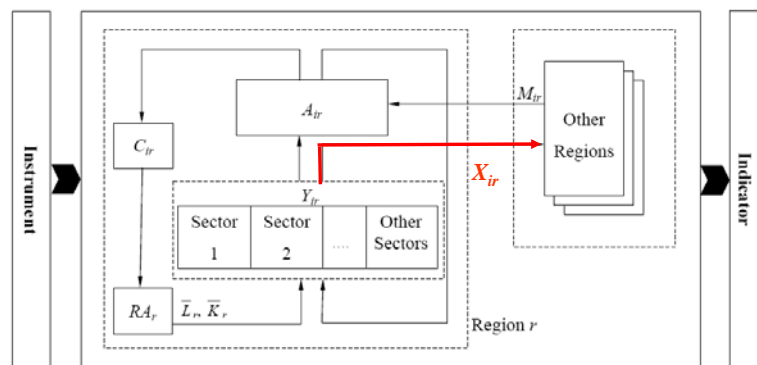
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## Simulation Model

- PACE model: Policy Assessment based on Computable Equilibrium (Böhringer and Lange, 2005)
- Large-scale computable general equilibrium (CGE) model of international trade and global energy use in 2020
- GTAP-6 database (87 regions, 57 sectors, 5 factors): baseyear 2001
- Forward calibration to 2020 employing EiE (EU, 2005) and DoE (US Department of Energy, 2005) projections

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## Stylized Model Structure



Key:  $i$ : sector index;  $r$ : region index  
 $\bar{L}_r$ : labor;  $\bar{K}_r$ : capital  
 $Y_{ir}$ : production;  $A_{ir}$ : Armington aggregate;  $M_{ir}$ : import composite,  $C_{ir}$ : consumption  
 $RA_r$ : income of representative agent (household)

## Regional policy scenarios

Regional scenario	Regions participating in emissions trading	CDM regions
<i>EU</i>	EU-27	China India Brazil Mexico Korea Rest of World
<i>EU*</i>	EU-27 Canada Japan	
<i>EU**</i>	EU-27 Canada Japan Russian Federation	
<i>EU***</i>	EU-27 Canada Japan Russian Federation Australia United States	

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## Institutional policy scenarios

Assumption: allocation modus in emerging ETS similar to "blueprint" EU

Policy scenario	Reference year	EU CO <sub>2</sub> regulation		CDM access	
		<i>DIR</i>	<i>NDIR</i>	<i>DIR</i>	<i>NDIR</i>
<i>Sectors</i>					
<i>EU</i>	2020	<i>Permits (NAP III allocation)</i>	<i>Tax</i>	<i>No</i>	<i>No</i>
<i>EU*</i>				<i>No</i>	<i>No</i>
<i>EU**</i>				<i>No</i>	<i>No</i>
<i>EU***</i>				<i>No</i>	<i>No</i>
<i>EU_CDM_DIR</i>				<i>Yes</i>	<i>No</i>
<i>EU*_CDM_DIR</i>				<i>Yes</i>	<i>No</i>
<i>EU**_CDM_DIR</i>				<i>Yes</i>	<i>No</i>
<i>EU***_CDM_DIR</i>				<i>Yes</i>	<i>No</i>

*DIR* = sectors covered by EU-ETS directive, *NDIR* = remaining sectors

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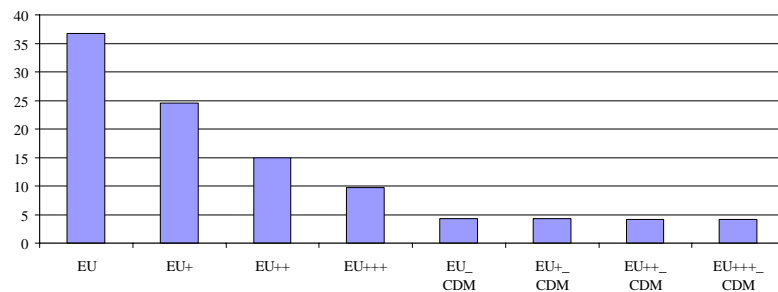
## Emission reduction targets

Region	Year	Baseline CO <sub>2</sub> Emissions (Mt of CO <sub>2</sub> )			Emissions reduction target (% vs. 1990)		Emissions reduction target (% vs. BAU)	
		1990	2010	2020	2010	2020	2010	2020
EU-15		3082.1	3204.7	3443.9	8.0	30.0	11.5	37.4
EU-12		964.6	691.4	756.5	8.0	30.0	-28.4	10.7
EU-27		4046.7	3896.1	4200.4	8.0	30.0	4.4	<b>32.5</b>
Canada		473.0	681.0	757.0	6.0	-20.0	34.7	<b>25.0</b>
Japan		990.0	1211.0	1240	6.0	6.0	23.2	<b>25.0</b>
Russian Fed.		2347.0	1732.0	1971.0	0.0	16.0	-35.5	<b>0.0</b>
Australia		294.0	520.0	582.0	-8.0	-58.4	38.9	<b>20.0</b>
United States		4989.0	6561.0	7461.0	7.0	-19.6	29.3	<b>20.0</b>

Sources: EU (2003): *European Energy and Transport Trends to 2030*; US Department of Energy (2005): *International Energy Outlook*; own calculations

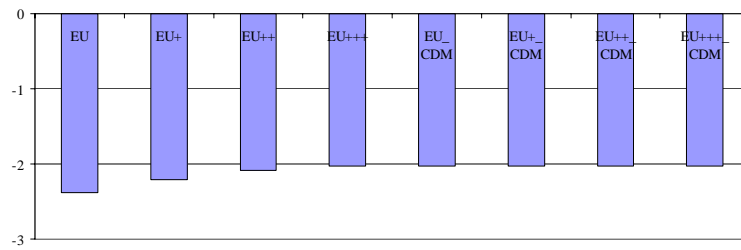
## International CO<sub>2</sub> permit price (US\$/t CO<sub>2</sub>)

CO<sub>2</sub> value in EU DIR sectors (in \$US per ton of CO<sub>2</sub>)



## Welfare effects: EU

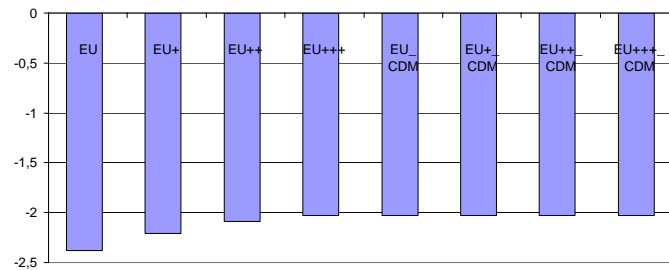
Welfare impact (in % of HEV)



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## Economy-wide competitiveness effects (ToT): EU

Terms of Trade impact (in % vs. BaU)

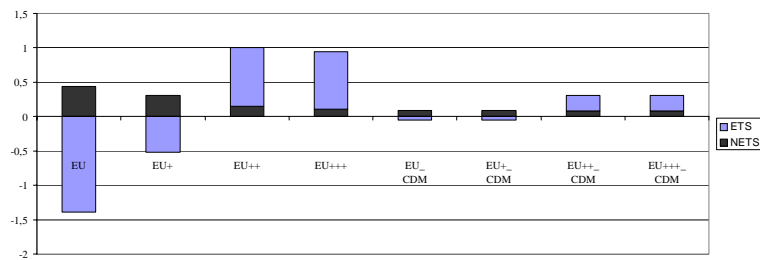


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## Sectoral competitiveness effects (RWS): EU

$$RWS_{ij} = \frac{P_{ij}^x X_{ij} / \sum_i P_{ij}^x X_{ij}}{\sum_j P_{ij}^x X_{ij} / \sum_i \sum_j P_{ij}^x X_{ij}}$$

Relative World Trade Shares – RWS (in % vs BAU)



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## General Conclusions & Remarks

- Linking the EU ETS to emerging schemes decreases international permit price but welfare impacts for the EU are rather limited
- Efficiency gains from an international linkage are exclusively attributed to the energy-intensive sectors
- Linking the EU ETS does not substantially affect economy-wide EU competitiveness (ToT) but sectoral trade-based competitiveness effects crucially depend on the linking constellation

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## Incentives to linking up

- All non-EU regions export carbon permits to Europe due to a relatively stringent allowance allocation in the EU
- Linking ETS diminishes welfare losses from emissions regulation of both permit-importing EU member states and permit-exporting non-EU regions
- Opposite trade-based incentives of linking up: EU member states improves ToTs, while non-EU regions face deterioration of ToTs
- ⇔ For non-EU regions, attractiveness of supra-European ETS is a matter of priorities for efficiency or international competitiveness
- ⇔ More efficient design of domestic ETS can boost the overall prospective for establishing supra-European emission trading scheme

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