Assessment and Improvement of Methodologies used for GHG Projections

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Etsap workshop 3 July 2008
Paris

Who is using Markal and how

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Outline of the Presentation

- Objective and organisation of the project
- Overview of the models used by MS
- Evaluation of Policies and Measures
- Quality assessment of the projections

Background

- Regular submissions of GHG projections for
  - UNFCCC (National communications)
  - EU (Monitoring mechanism)
- Raising questions on the quality of these projections
  - Comparisons with Primes scenario's
  - Deviating trends between member states

Objective of the project ?

- Capacity building in MS aibility to develeop GHG projections
- Will EU reach the Kyoto target ?
- Quantification of effect of (CC) Policies and Measures ?
  - EU-ETS; renewables directive; CHP directive; directive on the improvement of end use energy efficiency; ACEA; biofuels directive; Energy performance of buildings

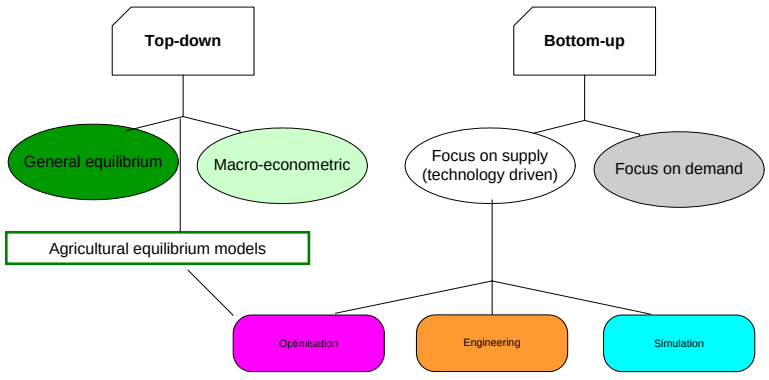
Organisation of the project

- October 2006 – October 2008
- Öko institute: statistical and policy related assumptions, country visits
- VITO: properties of different models, sensitivity and uncertainty analysis of current projection
- IEEP: Practical organisation of workshops
  - 26-27 june 2008
  - October 2008

Model requirements

1. The model's ability or usefulness in developing accurate GHG scenario's
2. The model's usefulness in developing and evaluating PAM's
   - Rebound effects
   - Overlapping effects
   - Immediate and long term evaluation of cost-effectiveness

Model types



Model types : methodological differences

- Focus : economic aspects ⇔ engineering aspects
- Type economic relationship: micro ⇔ macro
- Technology representation: explicit ⇔ general assumptions
- Number of variables : detailed ⇔ aggregated
- Nature of economic drivers: output ⇔ input
- Empirical verification parameters:
  lab data ⇔ regression ⇔ literature and expert judgement
- Mathematical formulation: nxn = ⇔ n x m <,>,=

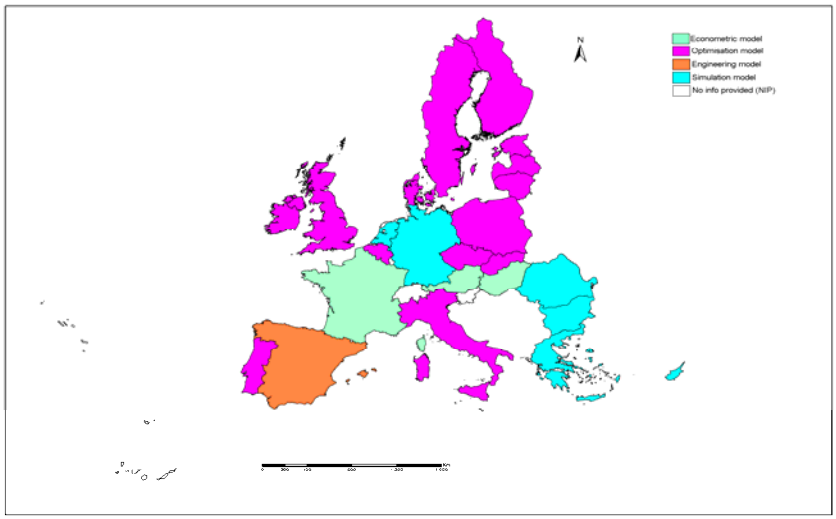
Model types : methodological differences

	focus	micro-macro	technology representation	number of variables	economic drivers	empirical verification parameters	mathematics
Top down models							
General equilibrium models	economic aspects	micro-macro	implicit	aggregated	output	expert judgement	non-linear equations
Econometric models	economic aspects	macro	implicit	aggregated	output	statistical tests	nxn = (log linear)
Bottom up models							
Optimisation	engineering	micro	explicit	detailed	input	lab/ expert judgement	LP, nxm <>=,
Engineering	engineering		explicit	detailed	input	lab	recursive
Simulation	engineering	micro	explicit	aggregated	input	lab/ expert judgement	recursive
Bottom up - Demand							
End-use demand			implicit	aggregated	input	expert judgement	recursive

General Overview of Models Used by MS

	Energy - supply	Industry	Transport	Residential	Tertiary	Industrial processes	F-Gases
Austria	Prometeus		AUTRAF /GLOBEMI	Prometeus		IPCC	ATP
Belgium	Markal	Markal/EPM	EPM/ TEMAT	EPM/ ATP		NIP	NIP
Bulgaria	ENPEP / WASP / BALANCE	ENPEP/ MACRO-DEMAND-BALANCE-IMPACT				NIP	NIP
Cyprus	ENPEP - Balance					IPCC	NIP
Czech Republic	EFOM/ENV	EFOM/ENV ATP				IPCC	NIP
Denmark	RAMSES/ ADAM /EMMA	ADAM /EMMA	COPERT 3	ADAM /EMMA		NIP	NIP
Estonia	Markal					NIP	NIP
Finland	Times/ EV-Model (combines engineering model and key industrial sectors to a CGE model)					covers also industrial energy emissions	NIP
France	Poles	MED-PRO				PAMs reduction of voluntary agreement calculated and then included in the projections	PAMs reduction of voluntary agreement calculated and then included in the projections. For refrigeration model from the école des mines (European model? Possibly figures for all MS)
Germany	Elias	Separate module	Astra	Model from University Julich		Activity data from industry sub-module	NIP
Greece	BALANCE	BALANCE/ATP	MAED			ATP	ATP
Hungary	Anonymous					similar to industry - energy	NIP
Ireland	IPM	Hermes/ESRI				consultations with industry	consultations with industry
Italy	Markal					ATP	ATP
Latvia	Markal		Copert III	Markal		NIP	NIP
Lithuania	Message	MAED				NIP	NIP
Luxembourg							
Malta							
Netherlands	Powers/Selpe /SERUM	Athena /SAVE-powers		Athena /SAVE		unclear	unclear
Poland	MESSAGE/WASP	MAED / BALANCE				ATP	ATP
Portugal	Times ?	detailed sector accounting model	separate model	simulation model	simulation model	ATP	
Romania	ENPEP		NIP	ENPEP			Extrapolation of historical data
Slovakia	MESSAGE	BALANCE				ATP	ATP
Slovenia	MESAP / REESLO		Copert III			NIP	NIP
Spain	SEP	SEP	SEP	SEP	SEP	ATP	ATP
Sweden	Markal/EMEC (CGE)	ATP	Sampers - Samgods	DoS	DoS	ATP	ATP
United Kingdom	Lia PGM	DTI				NIP	NIP

Models used for electricity sector



Evaluation of CCPMs
PAMS considered for electricity production

- Renewable energy directive
  - quantified national targets for renewable electricity consumption
  - reduce obstacles to increase production form renewable energy
- CHP directive
  - framework for promotion of high efficiency co-generation
  - No hard targets
  - MS specific implementation
- EU-ETS
  - National cap and allocation plan
  - Linking directive

Evaluation of CCPMs
theory and practice: RENEWABLES

	type of model	RENEW directive	
		theory	*reported*
Austria	Econometric model	Input	*yes*
Belgium	Optimisation model	Output	*yes*
Bulgaria	Simulation model	Input	*no*
Cyprus	Simulation model	Input	*partly*
Czech Republic	Optimisation model	Output	*no*
Denmark	Optimisation model	Output	*yes*
Estonia	Optimisation model	Output	*partly*
Finland	Optimisation model	Output	*yes*
France	Poles	Output	*yes*
Germany	Engineering type	Input	*partly*
Greece	Simulation model	Input	*no*
Hungary	Econometric model	Input	*unclear*
Ireland	Optimisation model	Output	*yes*
Italy	Optimisation model	Output	*no*
Latvia	Optimisation model	Output	*yes*
Lithuania	Optimisation model	Output	*yes*
Netherlands	Simulation model	Input	*yes*
Poland	Optimisation model	Output	*no*
Portugal	Optimisation model	Output	*yes*
Romania	Simulation model	Input	*unclear*
Slovakia	Optimisation model	Output	***no***
Slovenia		?	*yes*
Spain	Engineering type	Input	*yes*
Sweden	Optimisation model	Output	*yes*
United Kingdom	Optimisation model	Output	*yes*

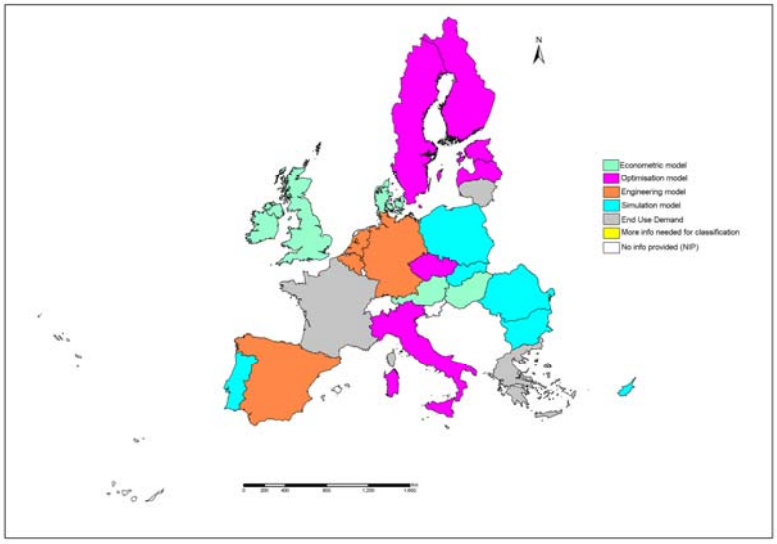
Evaluation of CCPMs theory and practice: CHP

	type of model	CHP directive	
		theory	*reported*
Austria	Econometric model		*partly*
Belgium	Optimisation model	Output	*yes*
Bulgaria	Simulation model		*no*
Cyprus	Simulation model		*no*
Czech Republic	Optimisation model	Output	*no*
Denmark	Optimisation model	Output	*yes*
Estonia	Optimisation model	Output	*partly*
Finland	Optimisation model	Output	*yes*
France	Poles		*yes*
Germany	Engineering type	Input	*partly*
Greece	Simulation model		*no*
Hungary	Econometric model		*unclear*
Ireland	Optimisation model	Output	*yes*
Italy	Optimisation model	Output	*yes*
Latvia	Optimisation model	Output	*yes*
Lithuania	Optimisation model	Output	*yes*
Netherlands	Simulation model	Input	*yes*
Poland	Optimisation model	Output	*no*
Portugal	Optimisation model	Output	*no*
Romania	Simulation model		*unclear*
Slovakia	Optimisation model	Output	*no*
Slovenia		?	*yes*
Spain	Engineering type		*yes*
Sweden	Optimisation model	Output	*yes*
United Kingdom	Optimisation model	Output	*no*

Evaluation of CCPMs theory and practice: EU-ETS

	type of model	EU ETS	
		theory	*reported*
Austria	Econometric model	Input	*yes*
Belgium	Optimisation model	Input	*yes*
Bulgaria	Simulation model	Input	*no*
Cyprus	Simulation model	Input	*no*
Czech Republic	Optimisation model	Input	*yes*
Denmark	Optimisation model	Input	*yes*
Estonia	Optimisation model	Input	*unclear*
Finland	Optimisation model	Input	*no*
France	Poles	Output	*yes*
Germany	Engineering type	Input	*yes*
Greece	Simulation model	Input	*no*
Hungary	Econometric model	Input	*unclear*
Ireland	Optimisation model	Input	*yes*
Italy	Optimisation model	Input	*yes*
Latvia	Optimisation model	Input	*unclear*
Lithuania	Optimisation model	Input	*yes*
Netherlands	Simulation model	?	*yes*
Poland	Optimisation model	Input	*no*
Portugal	Optimisation model	Input	*no*
Romania	Simulation model	Input	*unclear*
Slovakia	Optimisation model	Input	*no*
Slovenia		?	*no*
Spain	Engineering type	Input	*yes*
Sweden	Optimisation model	Input	*yes*
United Kingdom	Optimisation model	Input	*no*

Model types used for industry



Evaluation of CCPMs theory-practice

	type of model	EU ETS		Energy efficiency		CDM/JI linking	
		theory	reported	theory	reported	theory	reported
Austria	Econometric model	partial	yes		0		no
Belgium	Engineering type		yes		yes		yes
Bulgaria	End use demand		no		0		no
Cyprus	Simulation model	partial	unclear		0		no
Czech Republic	Optimisation model	CO2 tax	0		0		0
Denmark	Econometric model	partial	yes		0		yes
Estonia	Optimisation model	CO2 tax	unclear		0		yes
Finland	Optimisation model	CO2 tax	yes		0		no
France	End use demand		yes		0		0
Germany	Engineering type		yes		0		no
Greece	Simulation model	partial	no		0		0
Hungary	Econometric model	partial	unclear		0		0
Ireland	Engineering type		no		0		no
Italy	Optimisation model	CO2 tax	no		0		no
Latvia	Optimisation model	CO2 tax	unclear		0		unclear
Lithuania	End use demand		yes		0		no
Netherlands	Engineering type		yes		0		0
Poland	Simulation model	partial	0		0		0
Portugal			yes		0		no
Romania	Simulation model	partial	unclear		0		unclear
Slovakia	Simulation model	partial	yes		0		no
Slovenia			unclear		0		unclear
Spain	Engineering type		yes		0		NA
Sweden	Engineering type		yes		0		0
United Kingdom	Econometric model	partial	yes		0		no

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Discussion: recommendations

- Optimisation model – integrated in the power sector

  WHY

  – Detailed (energy – intensive separately)

  – Evaluation/integration of PAMs possible (CHP, CO_2 tax/price)

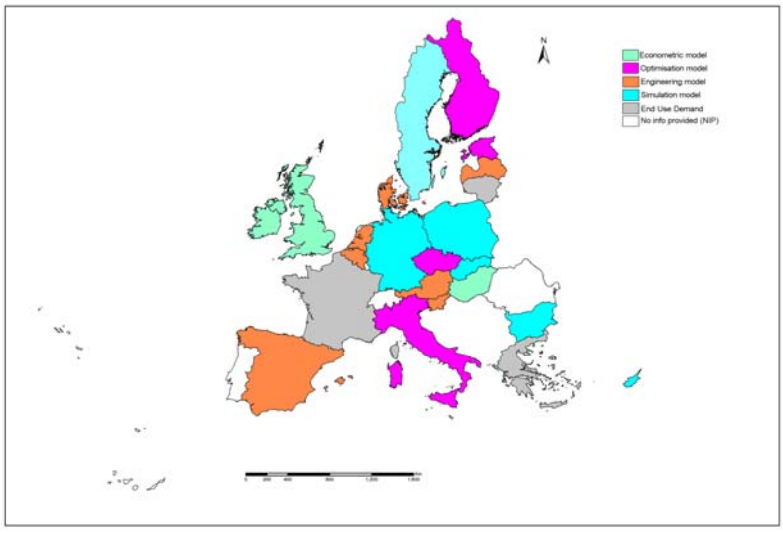
  – Cost minimisation reflects real market behaviour

  NEEDED IS

  – Activity scenario

  = *key variable*

Model (types) used by MS: transport sector



Evaluation of CCPMs theory-practice

	type of model	ACEA agreement		biofuels directive	
		theory	*reported*	theory	*reported*
Austria	Engineering type	input	yes		yes
Belgium	Engineering type	input	yes		yes
Bulgaria	Simulation model				
Cyprus	Simulation model		**yes**		
Czech Republic	Optimisation model	input			yes
Denmark	Econometric model	?	**yes**		yes
Estonia	Optimisation model	input			
Finland	Optimisation model	input	yes		
France	End use demand		**yes**		yes
Germany	Optimisation model	input	yes		
Greece	End use demand		**yes**		yes
Hungary	Econometric model	?			
Ireland	Engineering type	input	yes		yes
Italy	Engineering type	input	yes		yes
Latvia	Engineering type	input			yes
Lithuania	End use demand				
Netherlands	Engineering type	input			yes
Poland	Simulation model				yes
Portugal			**yes**		
Romania					
Slovakia	Simulation model				
Slovenia	Engineering type	input			
Spain	Engineering type	input	yes		yes
Sweden	Optimisation model	input	yes		yes
United Kingdom	Econometric model	?	**yes**		yes

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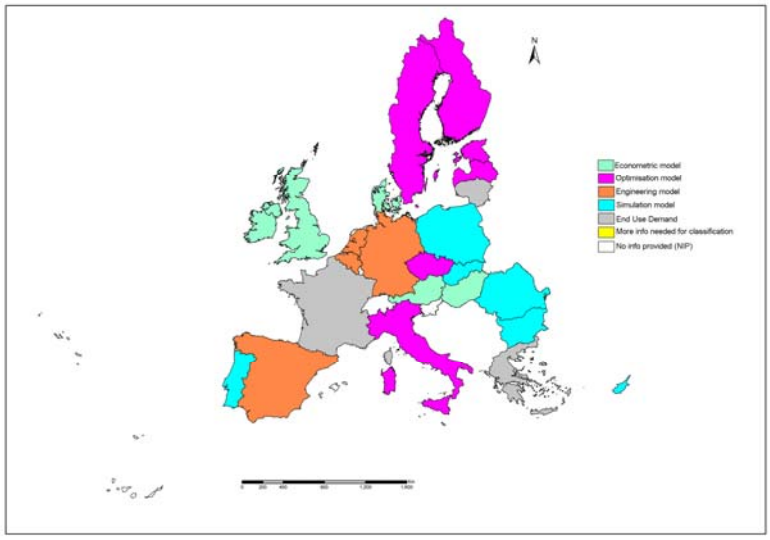
Model (types) used by MS: residential sector



Evaluation of CCPMs theory-practice

	type of model	E performance of buildings	
		theory	*reported*
Austria	Econometric model		**partly**
Belgium	Engineering type	input	yes
Bulgaria	Simulation model	output	no
Cyprus	Simulation model	output	yes
Czech Republic	Optimisation model	input	yes
Denmark	Econometric model		**yes**
Estonia	Optimisation model	input	no
Finland	Optimisation model	input	no
France	End use demand		**yes**
Germany	Optimisation model	input	unclear
Greece	End use demand		**yes**
Hungary	Econometric model		no
Ireland	Engineering type	input	yes
Italy	End use demand		**partly**
Latvia	Optimisation model	input	yes
Lithuania	End use demand		**yes**
Luxembourg			
Malta			
Netherlands	Engineering type	input	yes
Poland	Simulation model	output	no
Portugal	Simulation model	output	yes
Romania	Simulation model	output	unclear
Slovakia	Simulation model	output	no
Slovenia			yes
Spain	Engineering type	input	yes
Sweden	Simulation model	output	yes
United Kingdom	Econometric model		**yes**

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Conclusions from discussions on workshop 26-27 may

- Almost general consensus that Markal types of models are useful for
  - Electricity sector
  - Industry
- No general consensus for residential (flip flap)
- Some doubts for transport
- Increasing interest in Markal-Times : Greece, Portugal, Italy, Luxembourg, Spain

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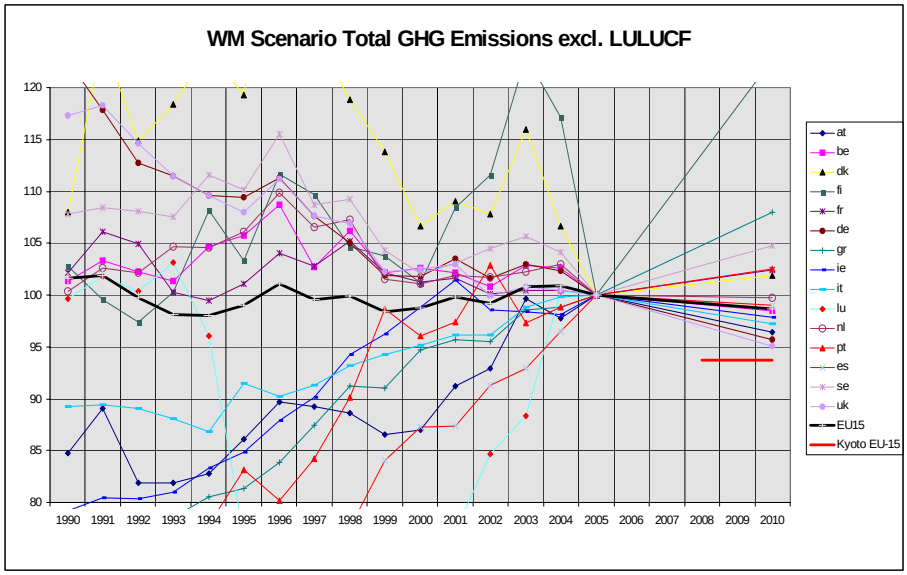
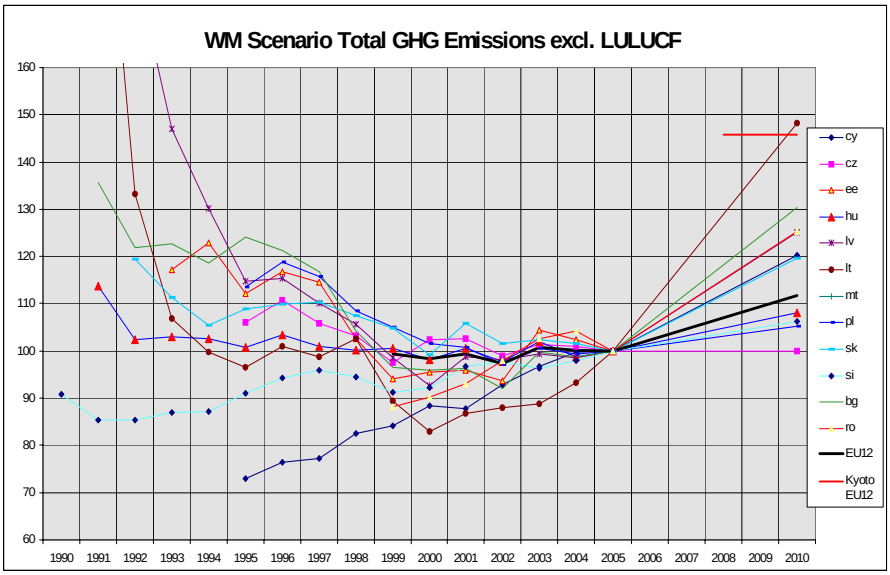
Results of projections under MM – EU15

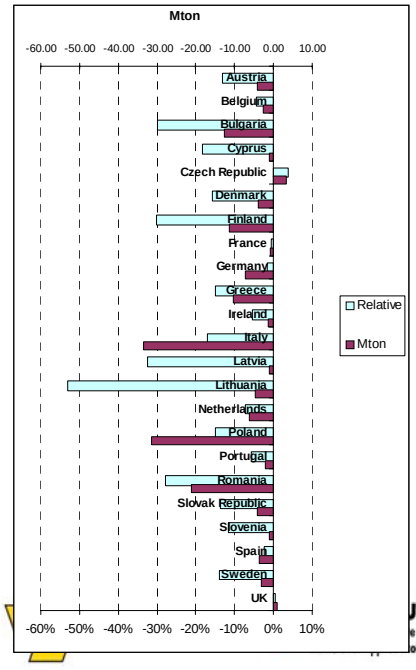


Results of projections under MM – EU12



Quality assessment of projections (EU level)

- Sectors covered by EU-ETS : alternative projection = Cap + new projection for small industries
- Transport sector : alternative projection (historical relations)
- Residential sector: logical ? Trends in projections



ETS sectors

E U 15 - 89 Mton

= 2 % GHG emissions

= 5 % verified emissions

EU 12 -74 Mton

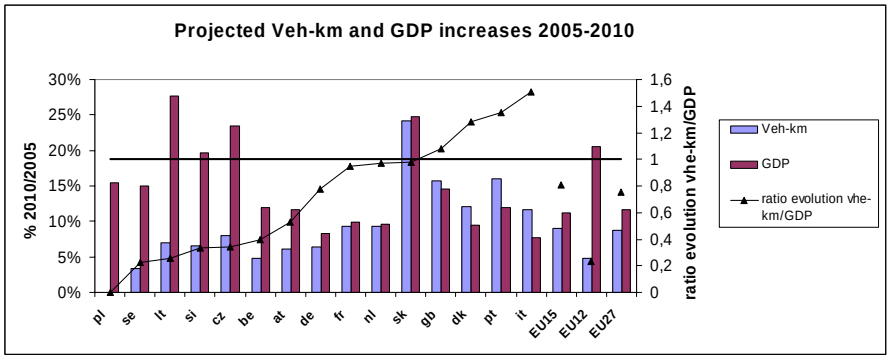
= 8 % GHG emissions

= 16 % verified emissions

Relative = % cap

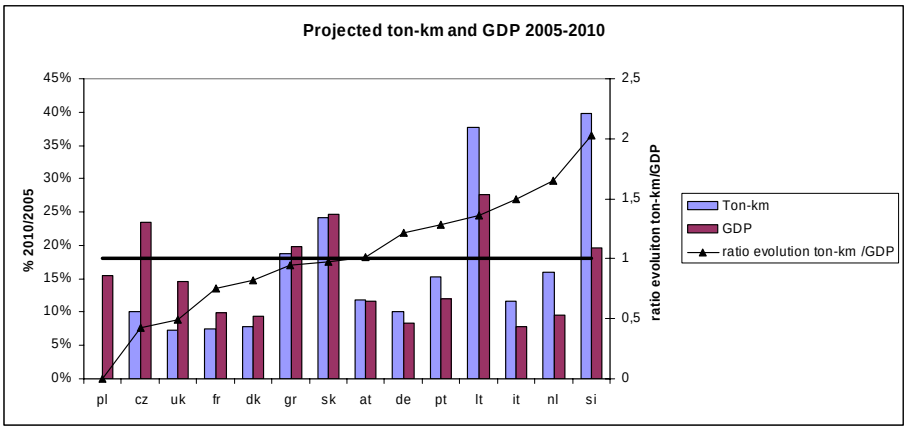
PERSONS: Relation change Veh-km – GDP in MS projections

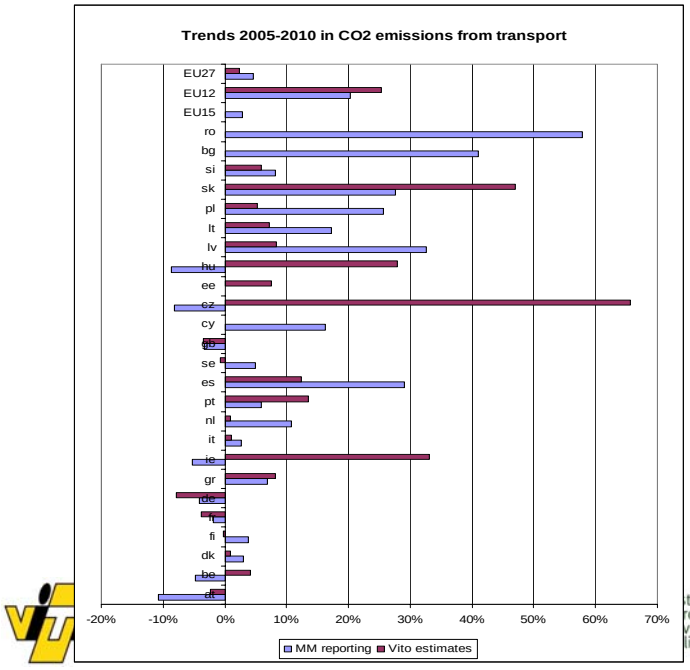
(based on Veh-km and GDP reported for MM)



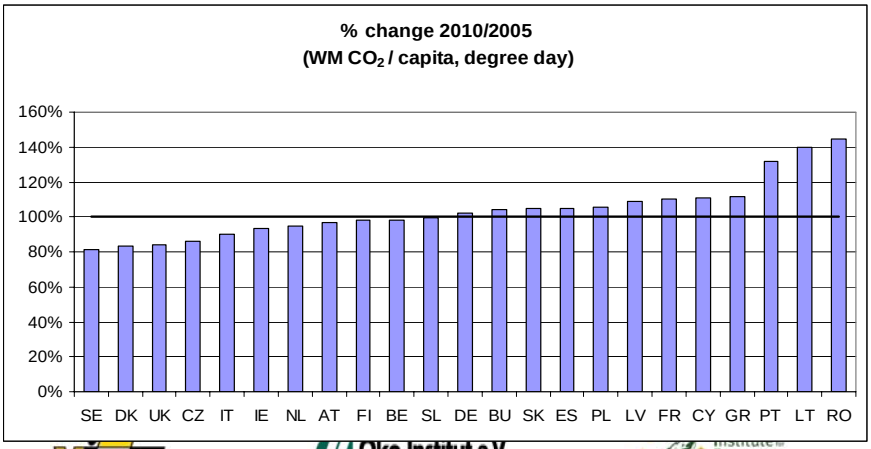
FREIGHT: Relation change ton-km – GDP in MS projections

(based on ton-km and GDP reported for MM)





Residential sector



Thank you for your attention