Netherlands Environmental Assessment Agency

Co-benefits of EU CO_2-policy based on a global sectoral CGE framework

TFIAM workshop
October 7th, 2009

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Objectives

- Impacts EU air/climate policies depend on:
  - Global climate change policies (e.g. cooperation)
  - Level of emissions sensitive to basic economic variables (GDP) and policies in baseline
  - Interaction between policy arenas (climate & air quality; cap and trade & renewables)
  - Impact EU ETS on sectors!!!

Bottom Up vs. Top Down analyses

- Bottom-up models (e.g. PRIMES)
  - Focus on abatement and technology options
  - Cost estimates dependent on base line projections

- Top-down models (e.g. Worldscan; GEM E3)
  - Accounts for feedbacks
    - *Energy (carbon) prices*
    - *Macro/Sectoral location and growth*
    - *Final demand (electricity, transport)*

WorldScan & BAU

- WorldScan: flexible CGE model
  - regions & sectors = here 14 & 21
  - CO_2 only, no adjustment costs
  - To study cobenefits CH_4, N_2O, SO_2, NO_x also included

- BAU (2020):
  - Europe: PRIMES 2007 baseline
    - *energy and emissions based on GAINS databases*
    - *GDP 2010-2020: 2.4%*
  - Rest of the World: baseline OECD Env. Outlook
  - Oil price ($60 per barrel)

Simulations: EU 20/20/20 no-CDM

- ETS-EU
- No trading outside ETS
- No CDM
- Limited action outside EU
- % Renewables constant

Starting point for negiotations

Results in 2020 in EU27

Macro Impacts in 2020 in EU27
from 20/20/20 no CDM/renewables

National income (% of BAU)	-1.1 (ETS = -0.3)
Employment (% of BAU)	-0.5
ETS-price (€/tCO_2)	35
non-ETS-price (€/tCO_2)	64

- Non-ETS dominates macro impact, but ….
  CDM and renewables also crucial

Results in 2020 in EU27

- Large impacts on fossil fuel inputs …
  in particular coal

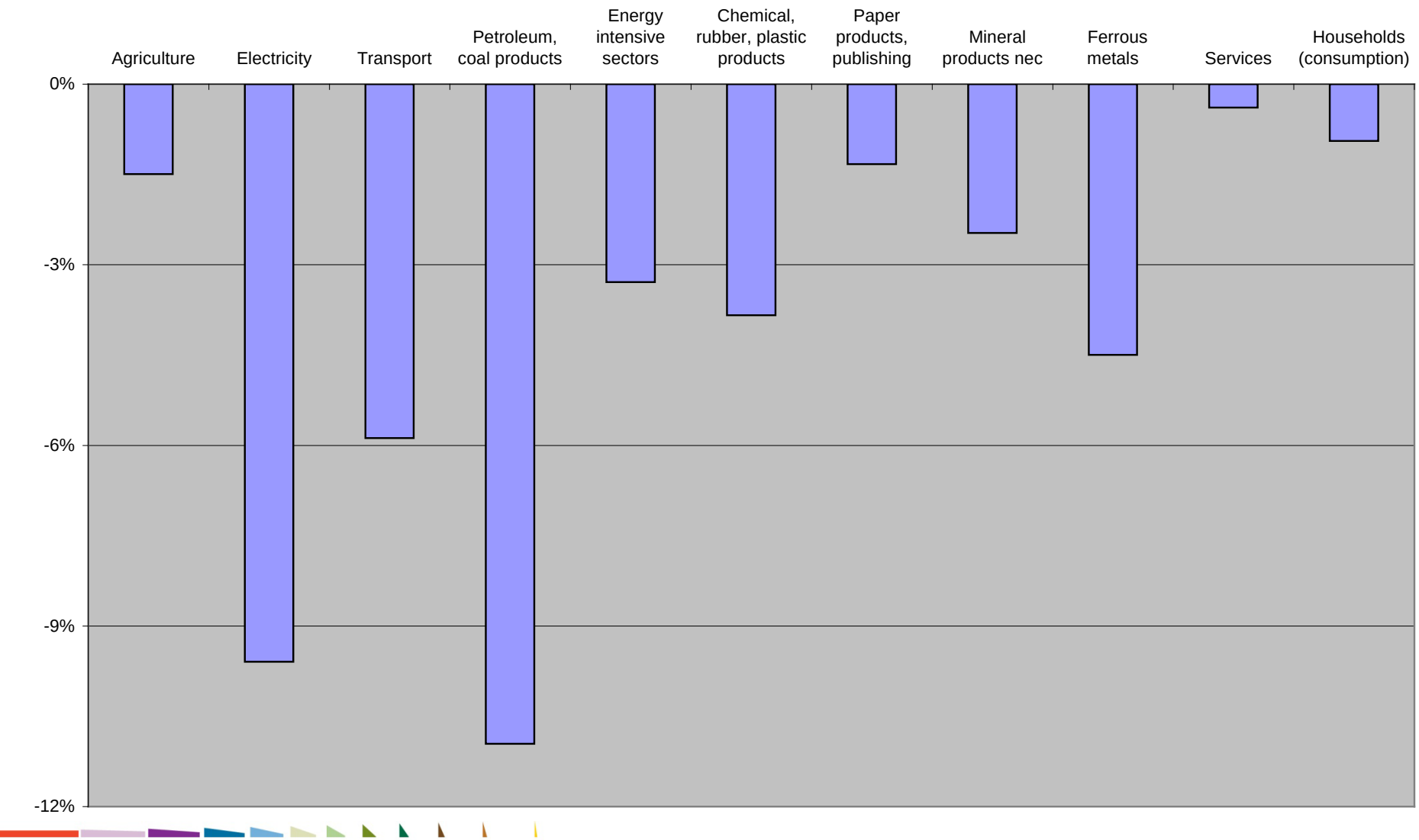
Energy (%)	
Coal	-41.5
Petroleum, coal products	-10.5
Natural gas	-17.2
Electricity	-7.8

Results in 2020 in EU27

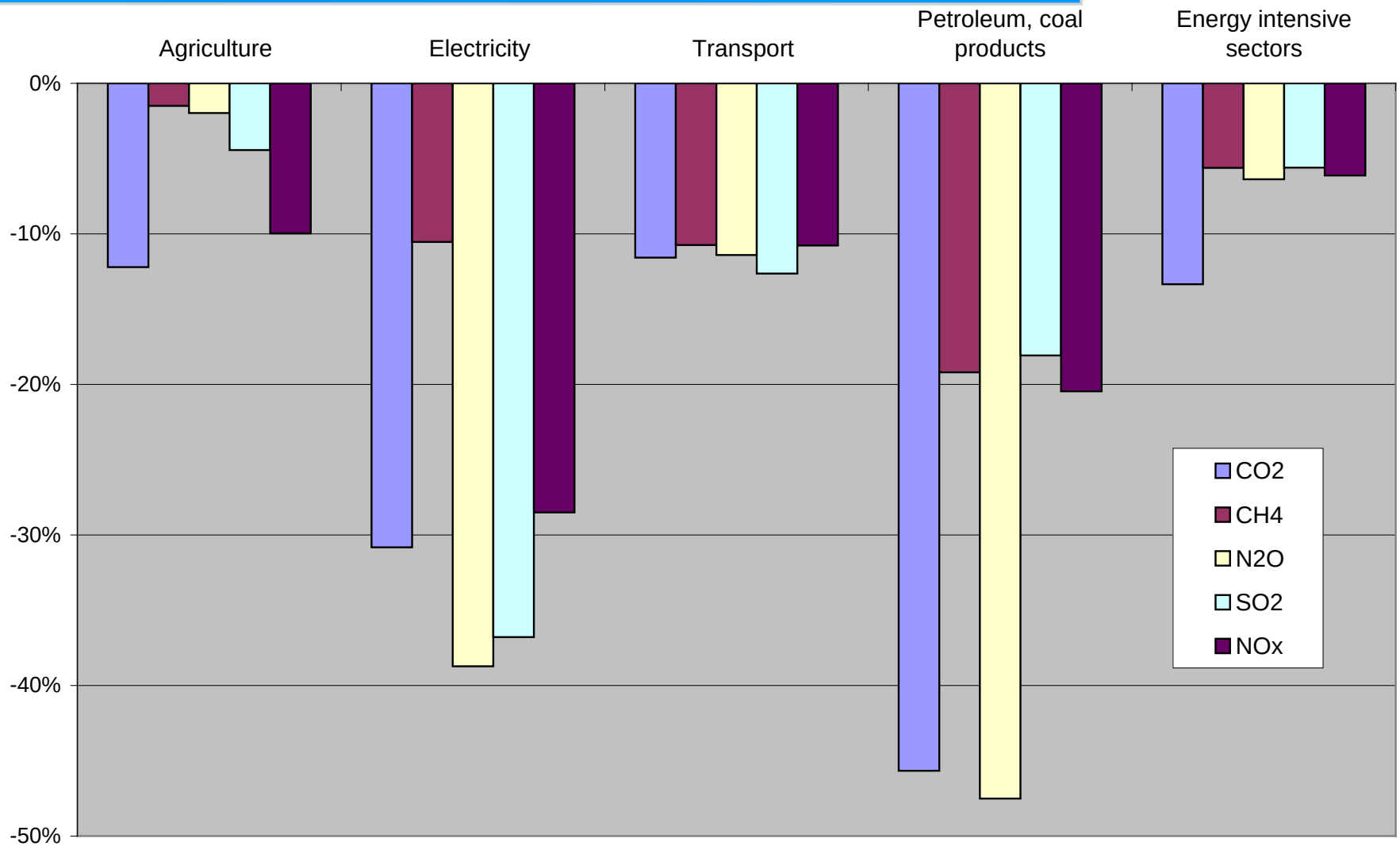
- Co-benefits EU27:
  - energy savings NO_x/SO_x
  - production losses agriculture CH_4/N_2O

Emissions	Mton/kton	Mton/kton	%
CO_2 (Mton)	4361	-921	-21
CH_4 (kton)	17096	-524	-3
N_2O (kton)	1458	-119	-8
SO_2 (kton)	3187	-612	-19
NO_2 (kton)	5961	-878	-15

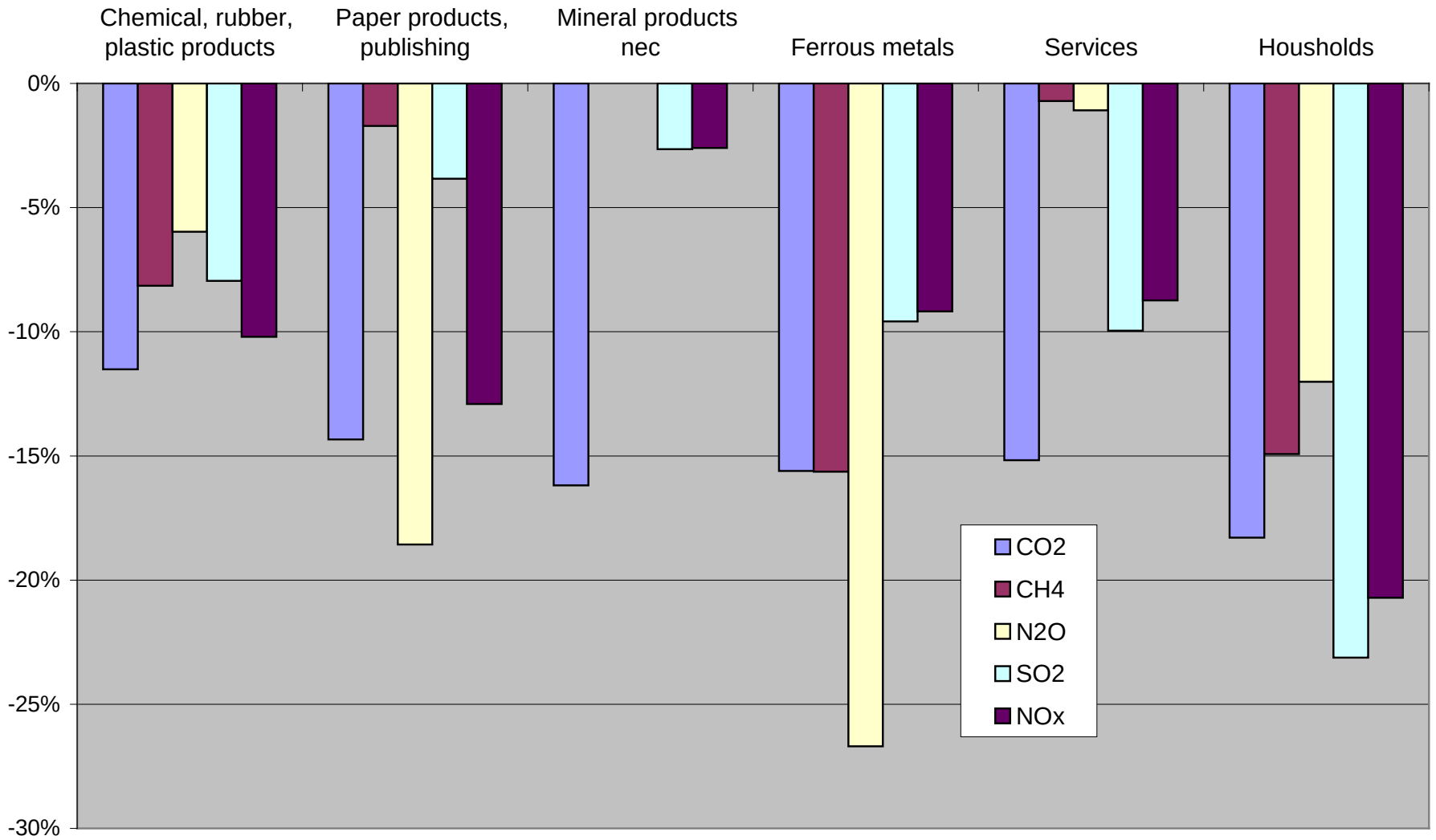
Production by sector



Emissions by sector (EU27)



Emissions by sector (EU27)



Results: - 40% SO_2 from top-down adjustments

Sector	Emissions SO_2			Production	Δprod /Δemis
	baseline	reductions	Δemis (%)	Δprod (%)	
Agriculture	6	0	-4	-2	0.34
Electricity	905	333	-37	-10	0.26
Transport	36	5	-13	-6	0.47
Services	239	24	-10	-0	0.04
Petroleum, coal products	841	152	-18	-11	0.61
Energy intensive sectors	840	47	-6	-3	0.59
Households (consumption)	217	50	-23	-1	0.04
Total EU27	3187	612	-19		0.4

Results: and - 40% NO_x in addition

Sector	Emissions NO_x			Production	Δprod /Δemis
	baseline	reductions	Δemis (%)	Δprod (%)	
Agriculture	374	37	-10	-2	0.1
Electricity	1171	334	-29	-10	0.3
Transport	1876	202	-11	-6	0.5
Services	634	55	-9	-0	0.0
Petroleum, coal products	467	96	-20	-11	0.5
Energy intensive sectors	892	55	-6	-3	0.5
Households (consumption)	434	90	-21	-1	0.0
Total EU27	5961	878	-15		0.4

Synergies CO2 ⇔ SO_2 & NO_x

- contribution Δ production levels in total reduction:

- TD adjustments in economy →

  reduction of 240 kton SO_2 and 340 kton NO_x

- against €1/kg SO_2 and €2/kg NO_x →
  - Estimated avoided end-of-pipe costs = 920*10^6 €!

Future plans

- Abatement cost CH_4, N_2O, NO_x, SO_2
- Particulate matter
- EU country detail
- Interactions renewables targets
- Policy instruments for NEC