PRIMES MODEL **IMPACT ASSESSMENT OF** THE NEW POLICY **OBJECTIVES OF THE EU** By Prof. Pantelis CAPROS E3MLab/NTUA

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New energy policy of the EU

□ Head of States Decision of March 8, 2007

- GHG Emissions of the EU in 2020 : 20% (mandatory) and under world conditions 30% down from 1990
- Renewables as % of Final Energy Demand in 2020: 20%
- Biofuels in 2020 : 10% of total liquids in transport
- Energy Efficiency (-20% energy consumption) but not a binding objective
- European Commission proposed, 23-Jan-2008, legislation to enforce and distribute the targets by Member-State
 - EU ETS reinforced and based on full auctioning for power generation
 - Specific emission reduction targets by Member-State for non EU ETS sectors
 - Specific targets for Renewables binding each Member-State, trading among MS is allowed

Impact Assessment and definition of "burden sharing" with model PRIMES

- The energy model PRIMES of E3MLab has been used as the main tool in the preparation of the proposal of the European Commission
- □ The setting of targets per MS and sector considers:
 - Energy Cost and price impacts
 - Economic growth and relative prosperity of each MS
 - Structure of the energy system and potential
 - Previous effort in reducing emissions
 - Technical Potential of Renewables
- EU-ETS based entirely on auctioning of allowances; revenues being recycled by the governments in the economy

Methodology for burden sharing

- Three different objectives (-20% GHG, 20% RES, 10% biofuels) but interrelated since meeting one objective facilitates meeting the others
- The burden sharing aims at defining specific targets per Member-State and per sector (EU ETS only EU wide, non ETS by MS)
- The starting point is the "cost-efficient" burden sharing which corresponds to imposing the three targets as constraints at the EU level and let the EU-wide markets determine the allocation to countries and sectors

Cost-efficient burden sharing

- This is based on optimal allocation of abatement effort and RES deployment
- All sectors and all countries face exactly the same marginal costs corresponding to the three constraints, namely lower GHG, higher RES, higher biofuels
- Equalizing the marginal costs leads to optimal allocation of GHG abatement, incremental RES, incremental biofuels by country and by sector
- The cost-efficient Burden Sharing minimises incremental energy system cost for the EU but leads to disproportional impacts on the Member-States compared to GDP per capita



Multicriteria burden sharing

- So, afford higher total cost for the EU but use additional criteria for the burden sharing
 - GDP per capita
 - Energy Cost Impacts as % of GDP
 - Effort before 2005
- ETS remains a EU-wide market with a single market clearing price: a specific target is defined for ETS carbon abatement (-21% from 2005)
- The remaining GHG abatement is allocated to each country's Non-ETS
- RES are not allowed to trade (except biofuels) so RES target is differentiated by country
- So, non-ETS and RES do not clear at the same shadow price (marginal value)

Proposed Burden Sharing

Obligations for 2020		non EU ETS target (*)	RES target (**)
Austria	AT	-16%	34%
Belgium	ΒE	-15%	13%
Bulgaria	BG	20%	16%
Cyprus	CY	-5%	13%
Czech Republic	CZ	9%	13%
Denmark	DK	-20%	30%
Estonia	EE	11%	25%
Finland	FI	-16%	38%
France	FR	-14%	23%
Germany	DE	-14%	18%
Greece	EL	-4%	18%
Hungary	HU	10%	13%
Ireland	IE	-20%	16%
Italy	IT	-13%	17%
Latvia	LV	17%	42%
Lithuania	LT	15%	23%
Luxembourg	LU	-20%	11%
Malta	MT	5%	10%
Netherlands	NL	-16%	14%
Poland	PL	14%	15%
Portugal	ΡT	1%	31%
Romania	RO	19%	24%
Slovakia	SK	13%	14%
Slovenia	SI	4%	25%
Spain	ES	-10%	20%
Sweden	SE	-17%	49%
United Kingdom	UK	-16%	15%
Explanations:			
(*) reduction of CLIC by 2020 compared to 2005			

(*) reduction of GHG by 2020 compared to 2005

(**) Share of renewables in final energy demand by 2020

 EU ETS: 21% lower CO2 emissions in 2020 compared to 2005 – clears at EU level



GDP sorting of MS



GDP sorting of MS



PRIMES Scenarios

 A large number of scenarios constructed for the period 2010 – 2020 – 2030, starting from Baseline of November 2007

Sensitivity Analysis issues:

- Doing only GHG reduction versus both GHG and RES
- Doing only RES versus both GHG and RES
- Using JI/CDM versus not abating only in the EU
- Allowing trade of GO for RES versus not doing RES by MS
- Auctioning EU ETS versus grandfathering (as today)
- What if Baseline involved high oil and gas prices ?

Comparison of Scenarios



Comparison of Scenarios



Comparison of Scenarios

Average Marginal Costs of Meeting EU Summit 2007 Targets



ENERGY SYSTEM IMPACTS OF EC PROPOSED BURDEN-SHARING SCENARIO

PRIMES Model E3MLAB / NTUA April 2008

Baseline Trends in the EU (PRIMES)



All GHGs versus Baseline



New targets versus Baseline for EU27



Optimal allocation of CO₂ abatement



Indirect effects on Energy Intensity



Changes in Final Energy Consumption

Power Generation (TWh)

Final consumption of Oil and Gas (Mtoe)



Energy Savings needed per sector

Energy Saving Effort from Baseline Trends



Optimal Allocation of RES development



Optimal Allocation of RES development

RESelectricity in Baseline (ktoe)



Structure of Power Generation(TWh)



Fuels used in Power Generation Baseline Scenario (ktoe) Policy Scenario (ktoe) **Biomass** Gas **Biomass** Oil Oil Gas Lignite Lignite Hard coal Hard coal 2010 2015 2020 2025

New Power Generation Units



Power Generation Indicators



Change in Prices and Costs

Avg. Change in 2020-2030 from Baseline





Conclusions

- The new binding targets of the EU including the auctioning of ETS allowances imply considerable restructuring of the EU energy systems
- The implied changes concern in priority the following:
 - Energy savings in all sectors between 10 30%
 - Renewables wind incl. offshore and considerable deployment of biomass at large scale
 - Substitution of solid fuels by gas in medium term
 - After 2020, development of nuclear and CCS

Conclusions

- The allocation of effort is asymmetric: large impact on centralized systems (power sector) but also considerable energy efficiency gains by consumers
- Total direct and indirect energy system cost is around 0,70% of GDP per year
- Electricity prices will increase considerably
- Capital turnover is accelerated and the demand for new technology equipment is seen as a new growth opportunity of the EU