ENVIROS

TODAY'S BUSINESS TOMORROW'S WORLD

Ofgem Discussion Day 22nd February

EU Emissions Trading Scheme:

Impacts on Electricity Consumers

Marginal Abatement Costs and Future Allowance Prices

Guy Turner

Enviros Consulting

guy.turner@enviros.com

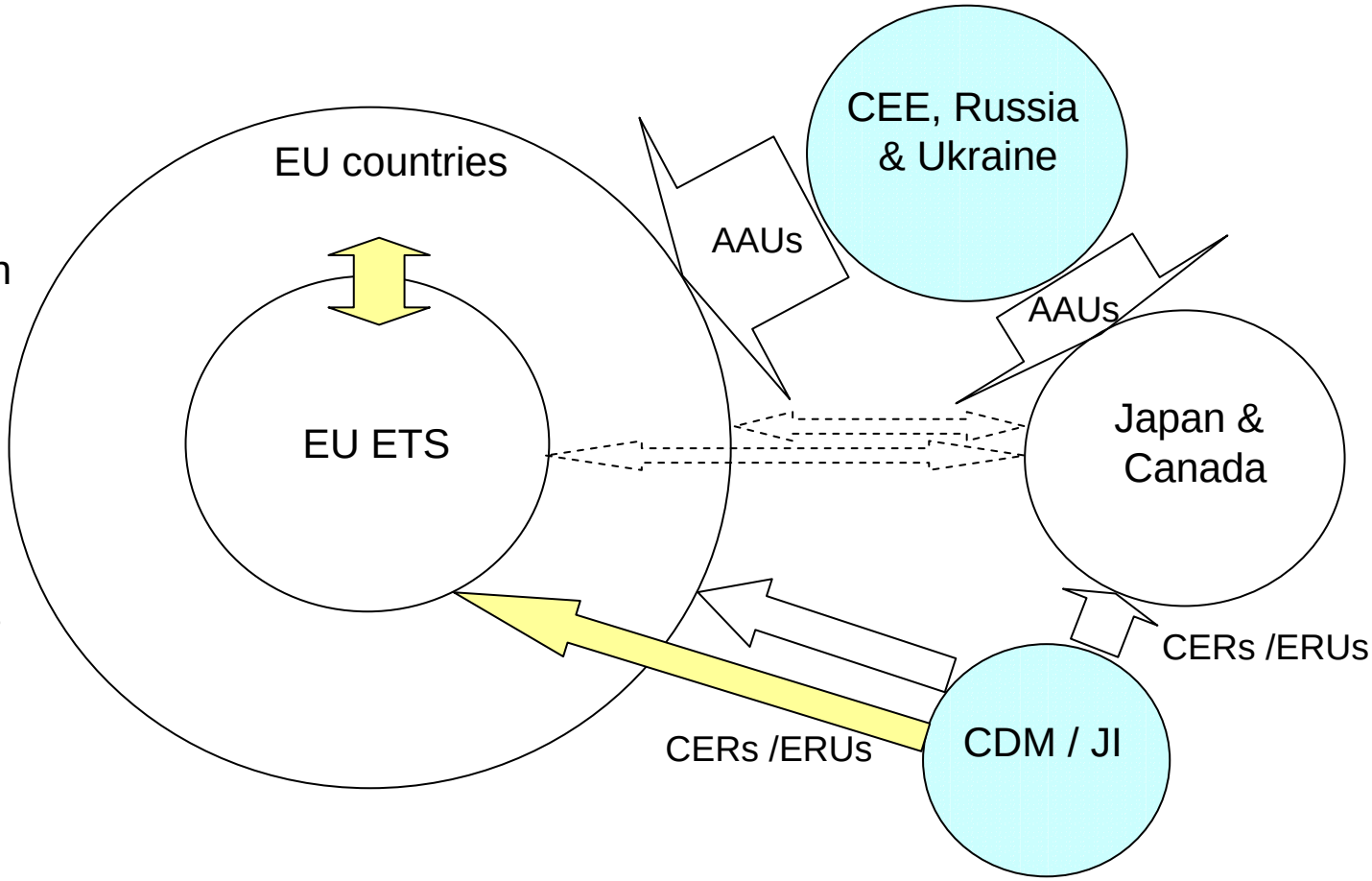
Contents

- Drivers of EU Allowances prices
- Model forecasts
- Market forward curves
- Certainty of price predictions

In the long term EU ETS prices are driven by global carbon balances

Complexity of interactions is contained within two main variables:

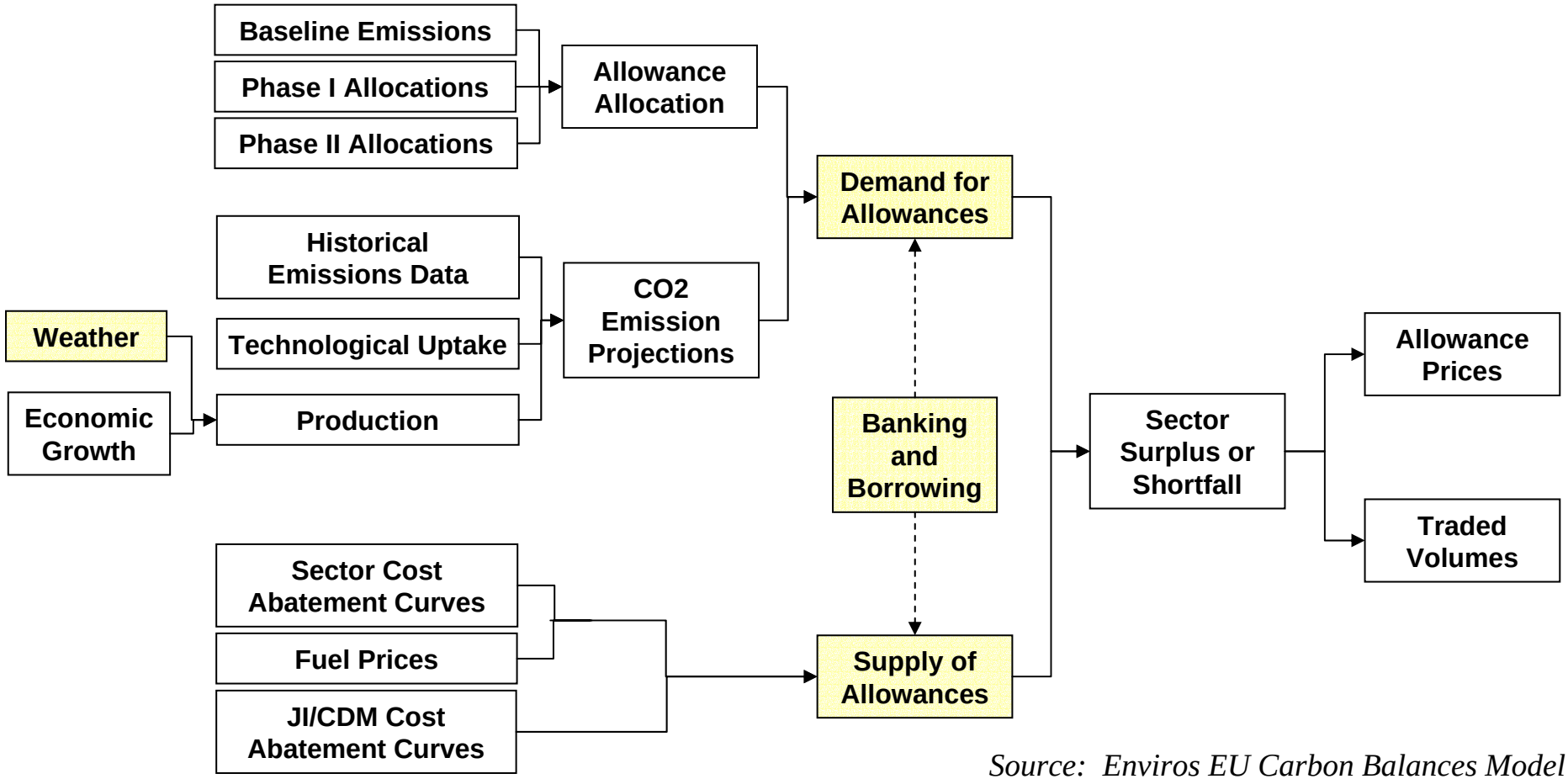
- EU ETS allocations
- Price of CERs / ERUs



In the short term allowance prices are driven by three categories of variables:

EU ETS allocations Growth in economic activity (and emissions)	Demand
Abatement opportunities and costs	Supply
Weather Market Behaviour	Variation

Typical structure of a fundamental emissions market model



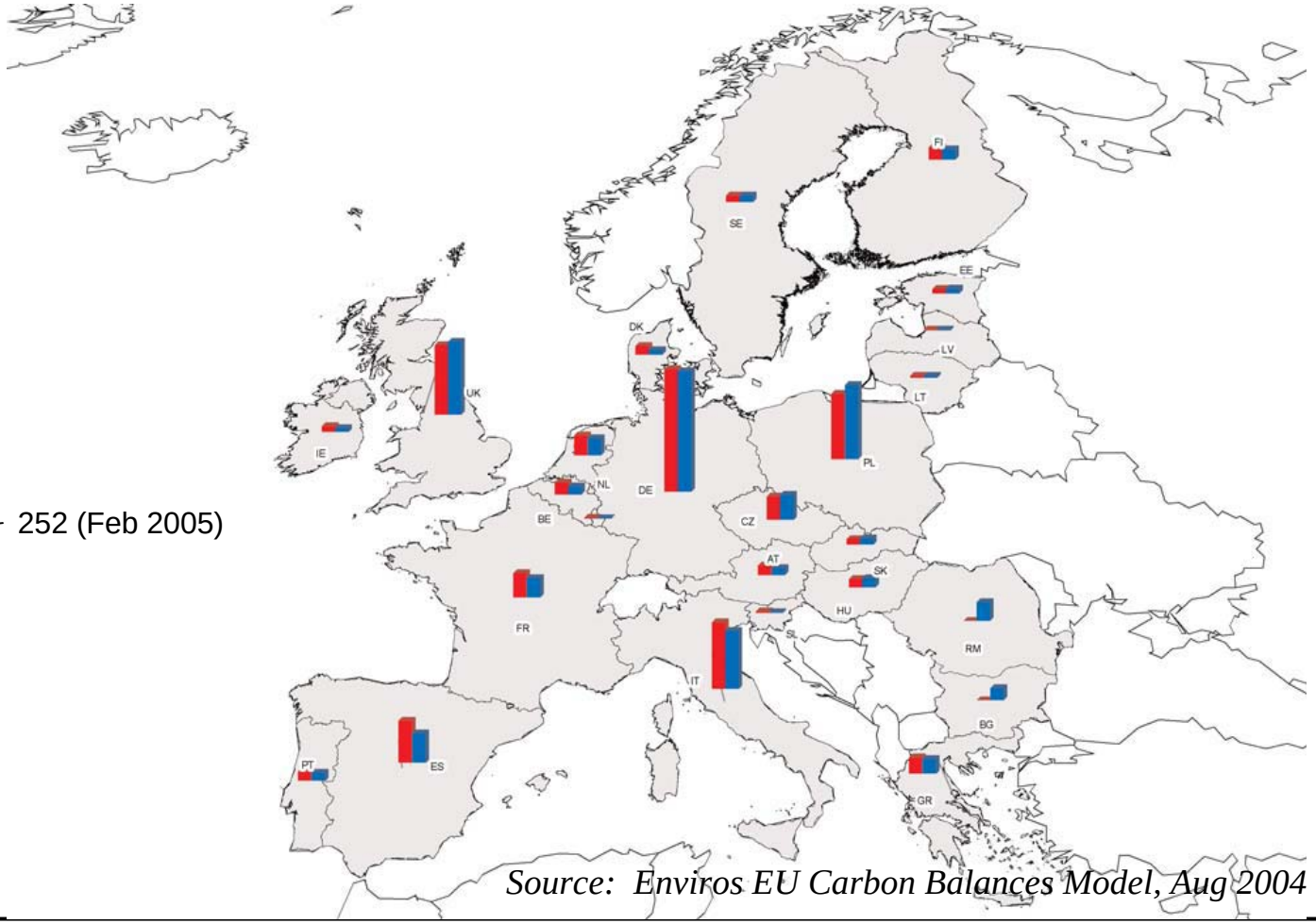
Source: Enviros EU Carbon Balances Model

Demand side variables

UK, Germany, Poland, Italy and Spain dominate allocations

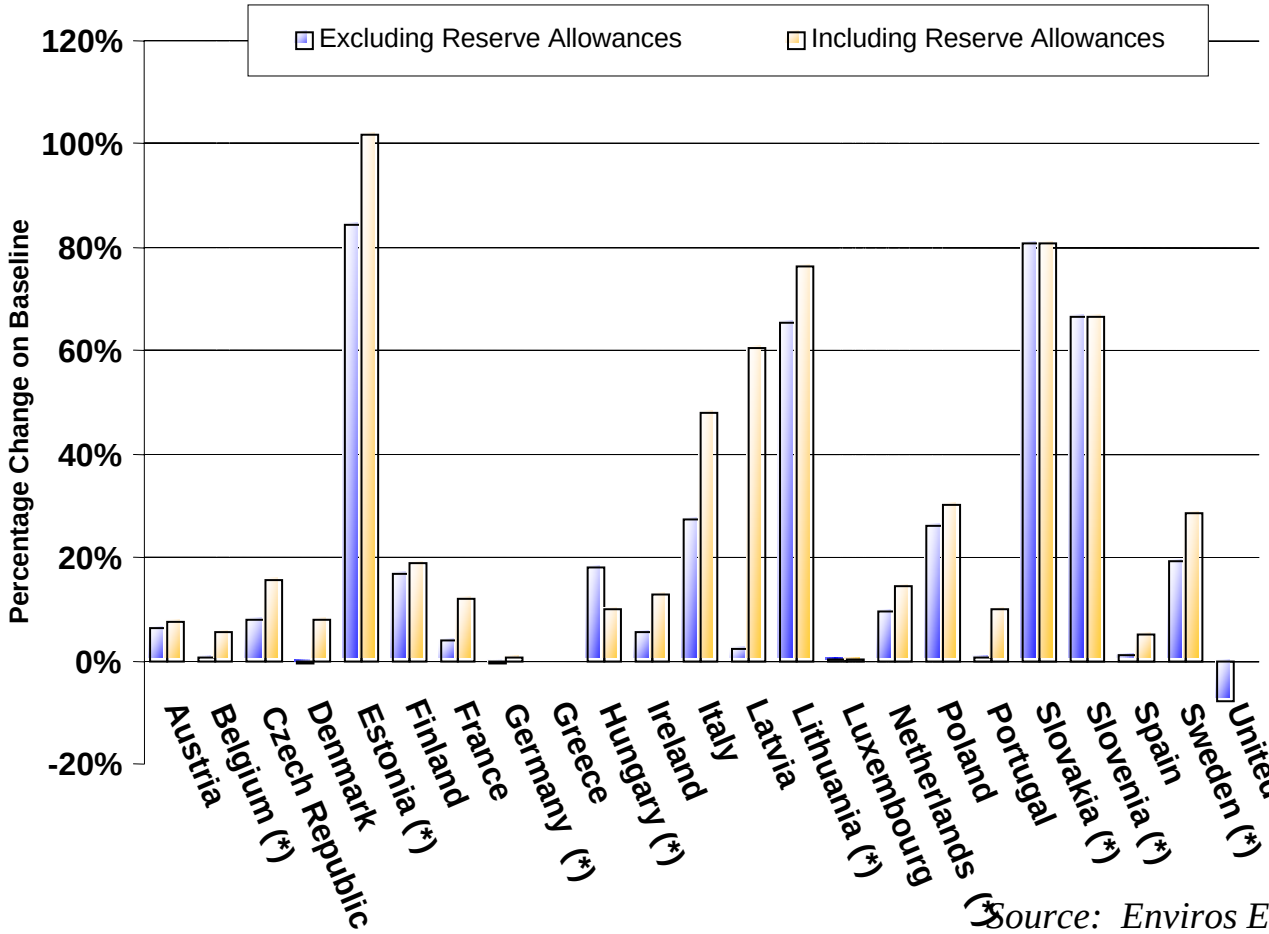
(mtCO2/yr)	Phase I	Phase II
Austria	37	26
Belgium	47	32
Denmark	34	18
Finland	49	41
France	94	74
Germany	471	462
Greece	64	57
Ireland	23	16
Italy	256	222
Luxembourg	3	3
Netherlands	77	67
Portugal	36	32
Spain	163	114
Sweden	26	25
UK	267	281
Bulgaria	-	47
Czech Republic	90	97
Estonia	17	19
Hungary	33	37
Latvia	4	4
Lithuania	8	9
Poland	252	285
Romania	-	73
Slovakia	22	23
Slovenia	6	3

252 (Feb 2005)



Source: Enviros EU Carbon Balances Model, Aug 2004

New Entrant Reserves have a major bearing on allocations



EU Average Change in Emissions from Baseline:

Excluding Reserve Allowances: **+8%**

Including Reserve Allowances **+14%**

(105mtCO2/yr)

(*) Countries have had their baseline estimated from data given in their NAP or from IEA/UNFCCC Data

Source: Enviros EU Carbon Balances Model, Aug 2004

Estimating allocations in Phase II is an art at this stage

- Impact of AAU transfers and stringency of targets
- Possible inclusion of other gases:
  - Possible additions of Methane (CH_4), Fluorinated Gases (HFCs & PFCs), Nitrous Oxide (N_2O) and Sulphur Hexafluoride (SF_6)
- Possible inclusion of other sectors:
    - Chemical Sector:
    - Aluminium Sector:
    - Transport Sector:
- Possible inclusion of other states:
  - Countries expected to have completed the accession process by 2008 are:
    - Romania
    - Bulgaria

  Turkey is not expected to have completed the accession process by this date.

Given this uncertainty we have to make a number of assumptions..

EU-ETS Entry:

- The 23 EU Countries with a Kyoto Commitment are entered into Phase I and Phase II of the EU ETS
- Bulgaria and Romania are entered into Phase II.
- Malta and Cyprus are not to be included in either Phase I or Phase II
- Aluminium and Chemical Industries are included in Phase II of the EU-ETS
- The EU ETS only covers CO_2 emissions in both Phase I and Phase II (CO_2 emissions from combustion and process emissions).

Allocation:

- Phase I allocations are determined by each countries NAP. Where necessary sectors have been subdivided according to UNFCCC/IEA data.
- ***Phase II Allocation is determined as 50% of each nation's remaining distance to target in 2006.***

Market Behaviour:

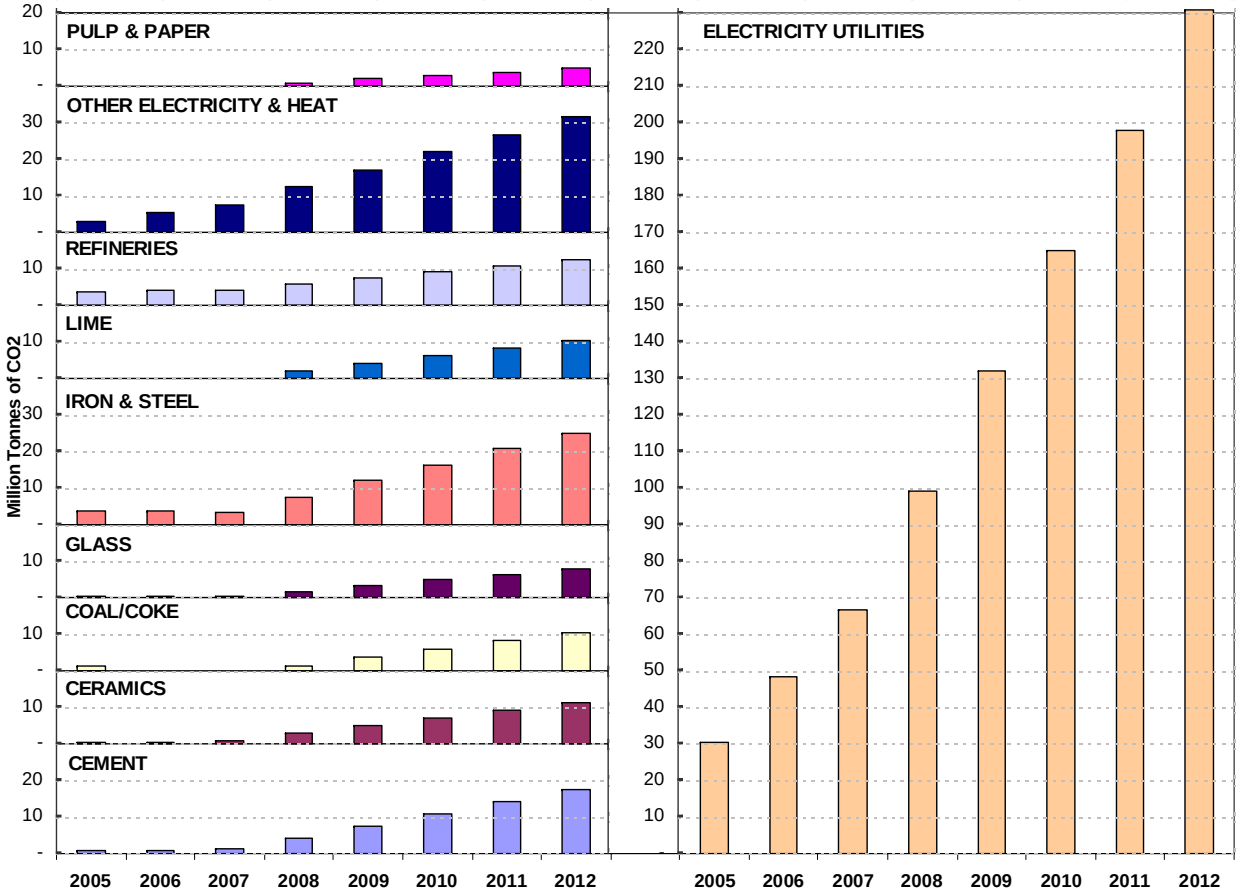
- ***Phase I participants apportion their allowance allocation equally in each year.***
- Phase II participants apportion their allowance allocation on a sloped trajectory
- The market clears each year, ie no banking or borrowing within phases 1 and 2.

We also need to project sector level growth rates

	Lowest Potential Value	Expected Value	Highest Potential Value
Emissions Variables			
EU Industrial Output (% change per year)			
Ferrous Metals	0.3%	0.4%	0.5%
Aluminium	1.1%	1.5%	1.9%
Cement	1.0%	1.4%	1.7%
Ceramics	0.8%	1.1%	1.3%
Glass	-0.1%	-0.1%	-0.1%
Other building materials (lime)	0.5%	0.7%	0.9%
Chemicals	1.9%	2.5%	3.1%
Paper and pulp	1.2%	1.6%	1.9%
Refineries	0.1%	0.2%	0.2%
Coal Transformation	-1.0%	-1.3%	-1.7%
Other Sectors			
GDP (Post 2005)	2.0%	2.6%	3.3%
CHP (growth in capacity)	2.6%	3.5%	4.4%
Electricity (Demand per Unit GI	-1.5%	-2.0%	-2.5%
Energy Intensity per Unit Output			
Average all sectors	-0.5%	-0.9%	-1.4%
Carbon Intensity per Unit Output			
Average all sectors	-0.2%	-0.3%	-0.5%

Source: Enviros EU Carbon Balances Model, Aug 2004

This results in the following pattern of net demand by sector and year



Annual EU demand in Phase I approx 45 – 85MtCO2

Source: Enviros EU Carbon Balances Model, Aug 2004

Supply side variables

Key supply side assumptions

- Enviros model has 172 abatement technologies (ref: University of Utrecht, ICARUS database)
- Power sector options:
  - *Change in the utilisation rate of existing generation capacity* – based on country specific load factors applied to installed thermal capacities.
  - *Capital investment in new generation capacity* - "Business as Usual" investment in CCGT is included in the baseline energy projections for each country.
  - *Capital investment in new CHP capacity*. CHP is modelled as part of the power sector (separately identified)
- Fuel price assumptions. Prices in €/MWh. Scenarios relate to gas prices.

	Low	**Base Case**	**High Gas**	Feb 2005
Electricity	48.0	48.0	48.0	41 (base)
Gas	8.4	10.2	12.1	14 (Bunde)
Oil	9.0	11.4	13.8	14
Coal	6.6	6.6	6.6	8.5

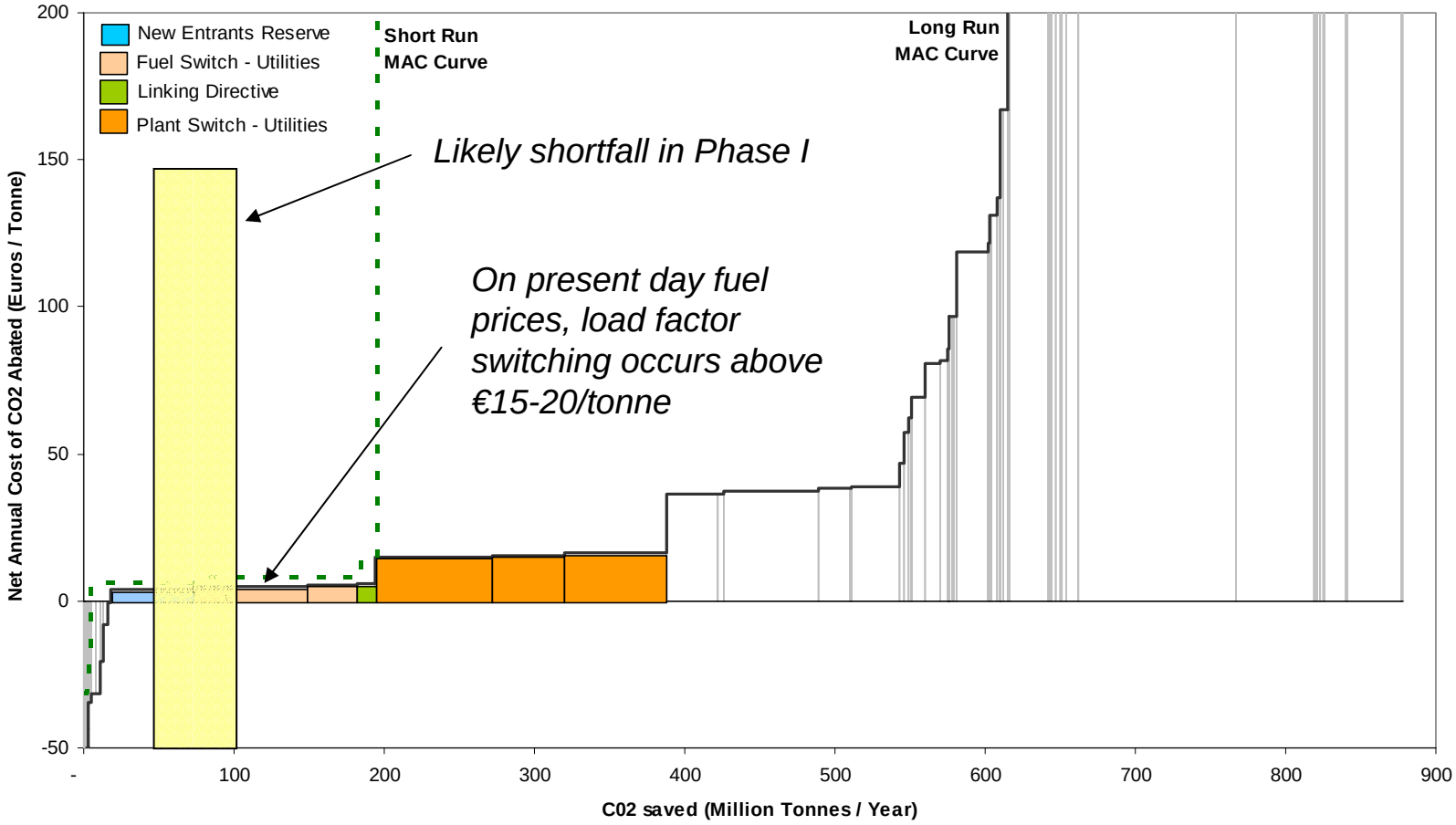
Assumptions relating to CDM / JI

Supply curve based on:

- Evidence from the WB PCF (number and size of CDM projects)
- Estimates of the timescale for project completion and the probability of the project being accepted by the UNFCCC's methodology panel.
- Estimates of the proportion of investment funds contributed by government and commercial investors to CDM / JI projects (eg ERUPT).

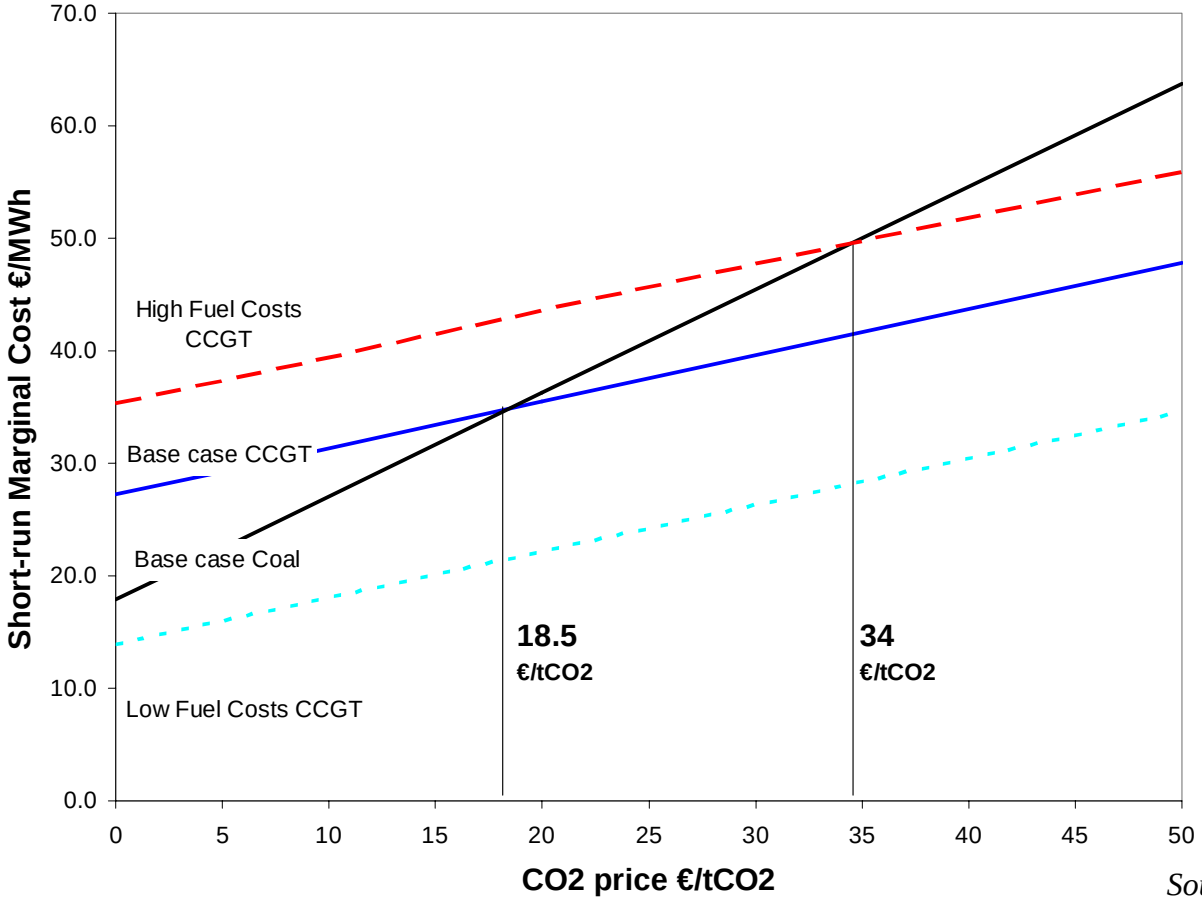
MtCO2/yr	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Weak	4.2	6.9	11.5	25.4	33.0	42.9	55.8	72.4
Baseline	7.0	11.5	19.2	42.3	55.0	71.5	93.0	120.9
Strong	9.8	16.1	26.9	59.2	77.0	100.1	130.2	169.2

Aggregate marginal abatement cost curve 2006



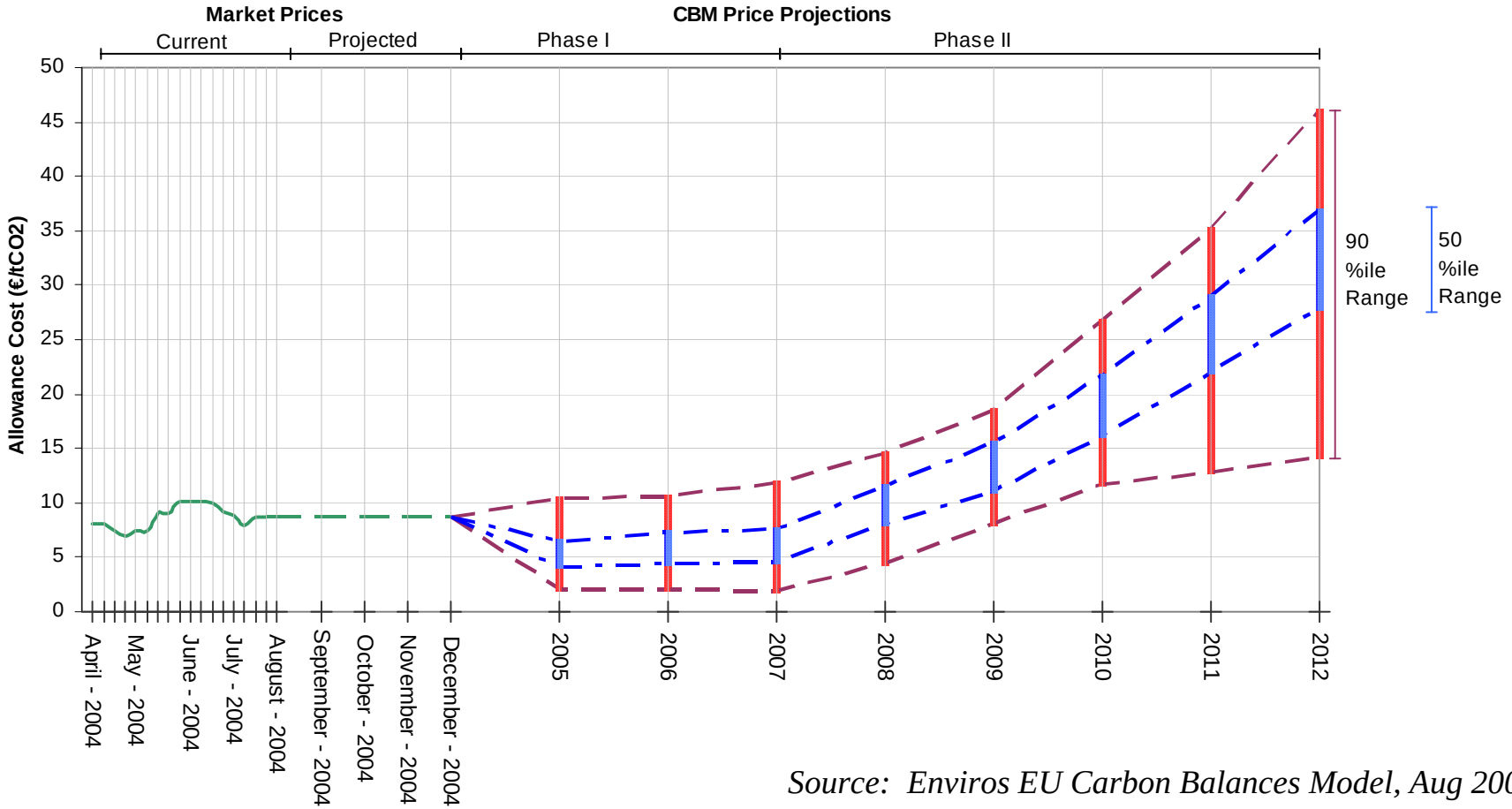
Source: Enviros EU Carbon Balances Model, Aug 2004

Load factor switching in excess of €15/tonne



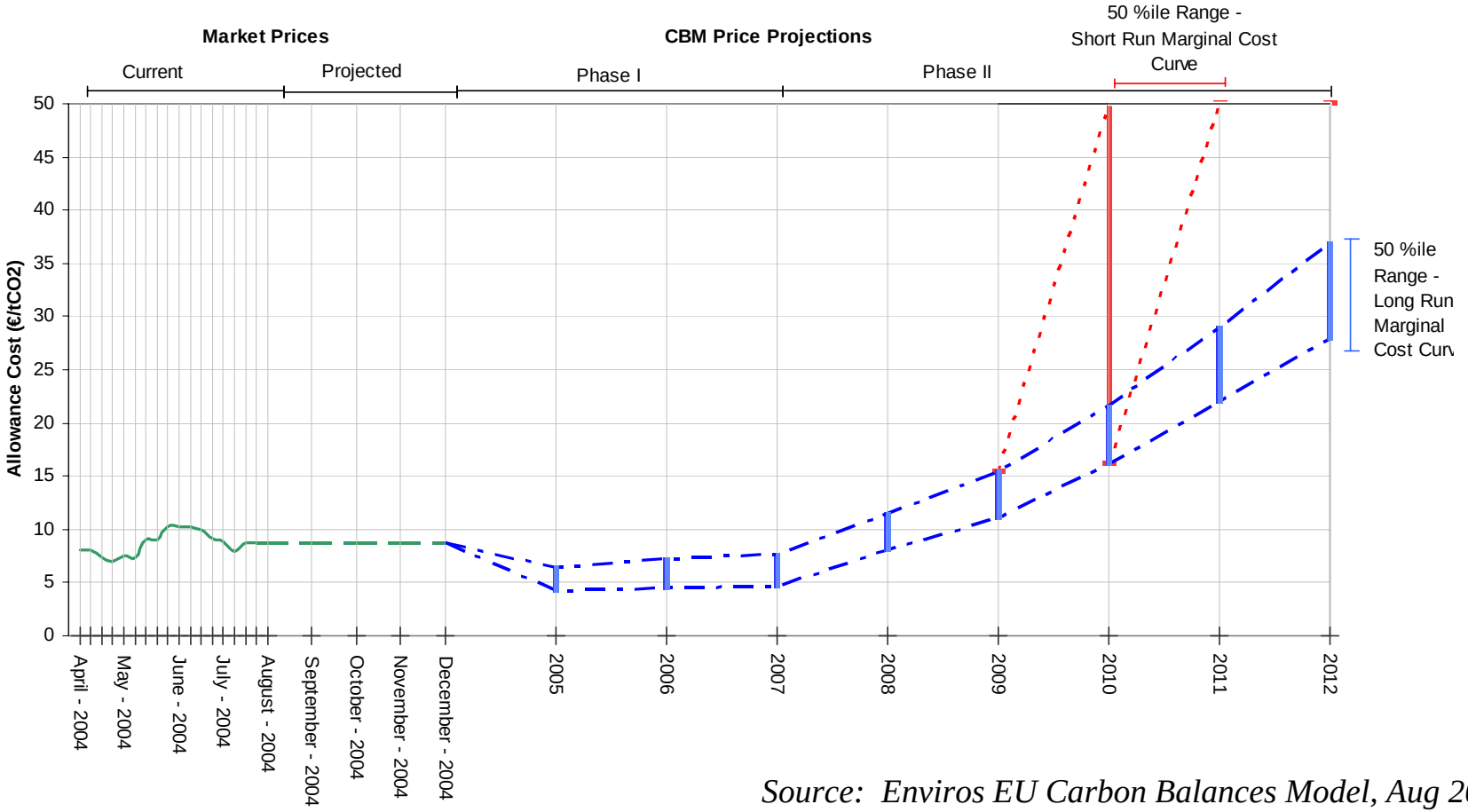
Source: adapted from IEA, 2004

On latest model run, prices will stabilise around €5-8/t. This is likely to be a low estimate. Prices will rise in Phase II



Source: Enviros EU Carbon Balances Model, Aug 2004

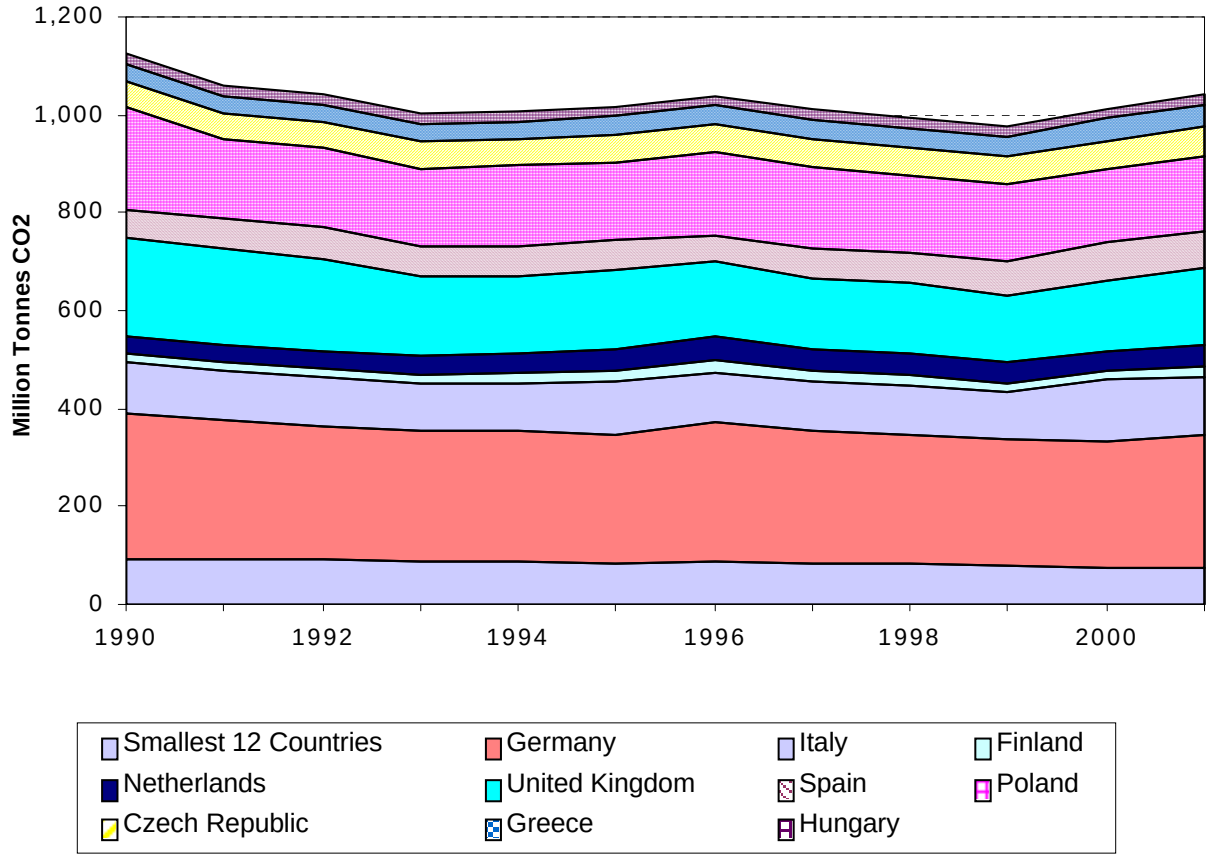
Unless capital investment is made in the power sector, prices could rise steeply in Phase II



Source: Enviros EU Carbon Balances Model, Aug 2004

Variability

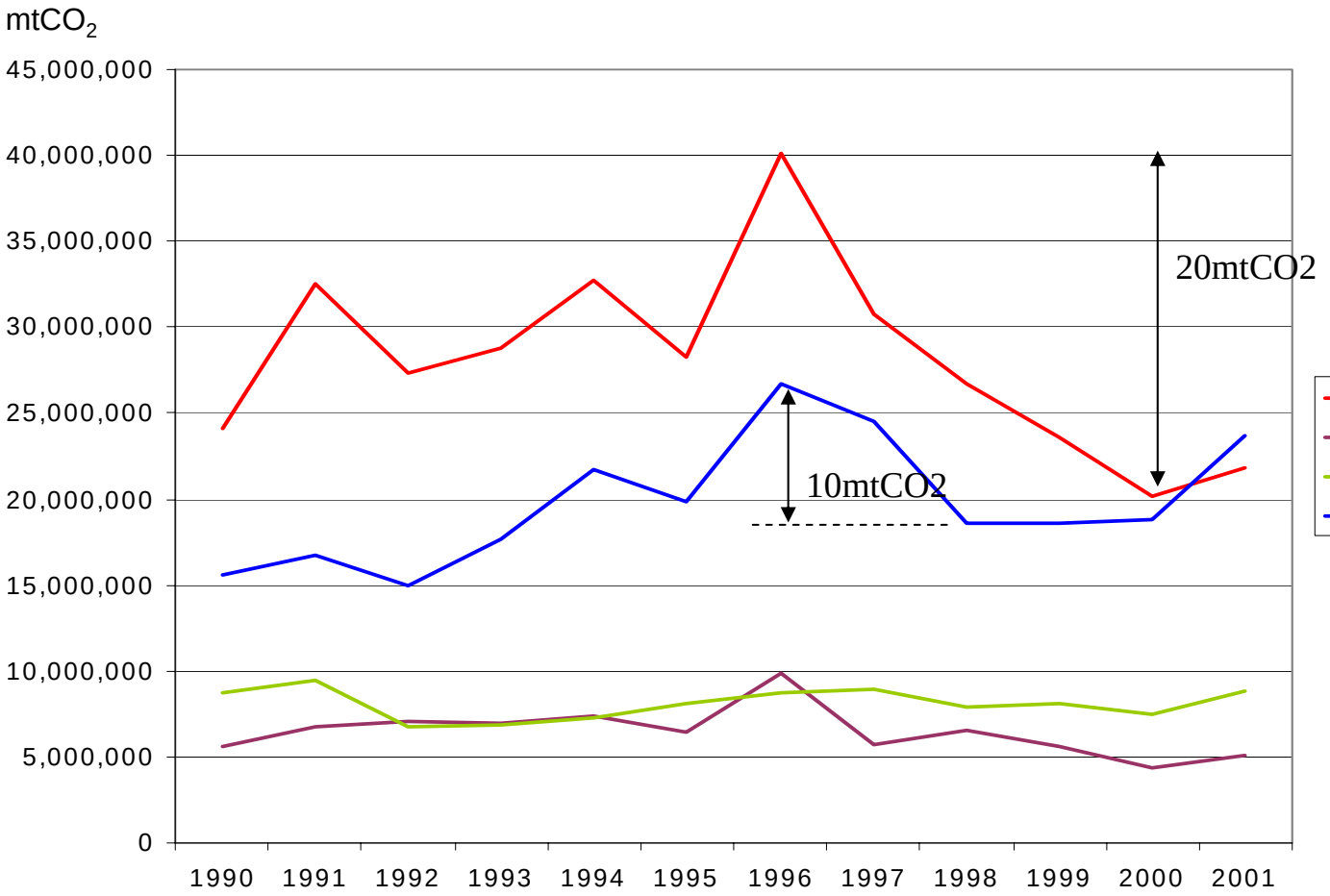
Weather, especially Scandinavia rainfall tends not to have a significant impact on long term emissions



- Broadly level CO_2 profile for Europe
- Germany was the cause for increase in 1996, not Scandinavia

Weather will however have a material short term effect (intra year)

Will rainfall in Scandinavia affect yearly average EU ETS prices?



Max deviation in Denmark and Finland = 30mt ~3% of EU25 emissions.

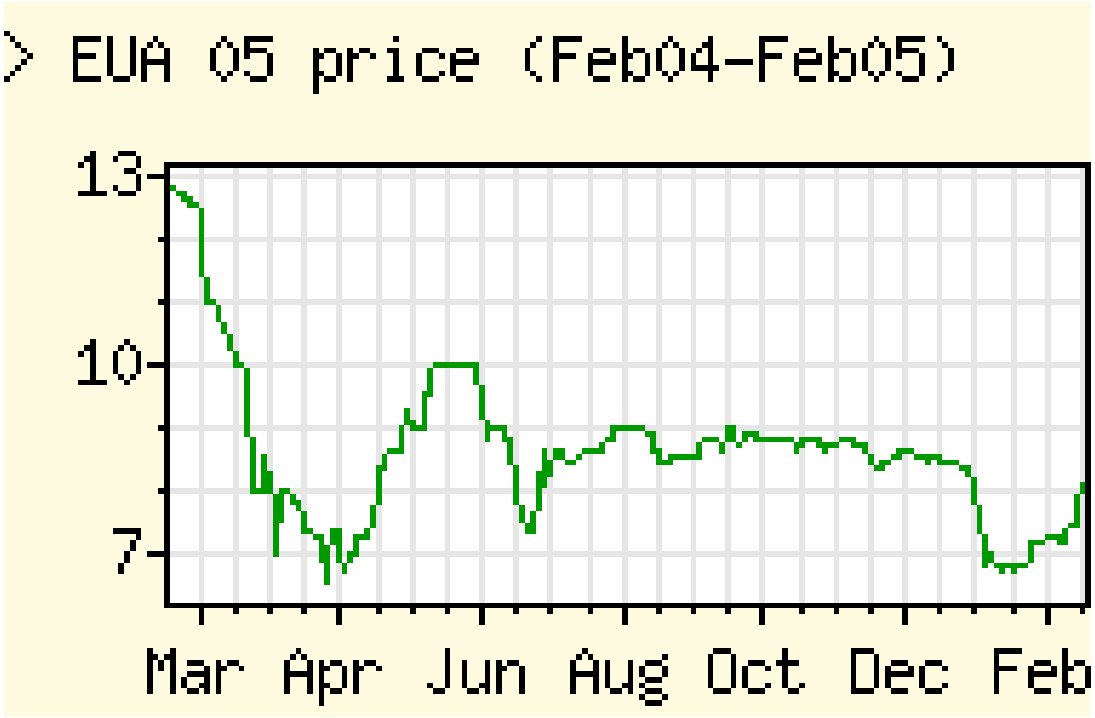
Will this be sufficient to step up to the next level on the MAC curve?

Other key factors affecting intra-year variability

- Lack of banking from Phase I to Phase II (downward pressure)
- Compliance mentality amongst smaller players. Unwilling to sell. (upward pressure)
- Vagaries of CDM supply
- Lack of consistent information on market status and supply curves

Market Perspectives

EUAs are currently trading around €8/tonne, having fallen from €9/tonne for Q3,4 2004



Combination of warm and wet weather in Northern Europe

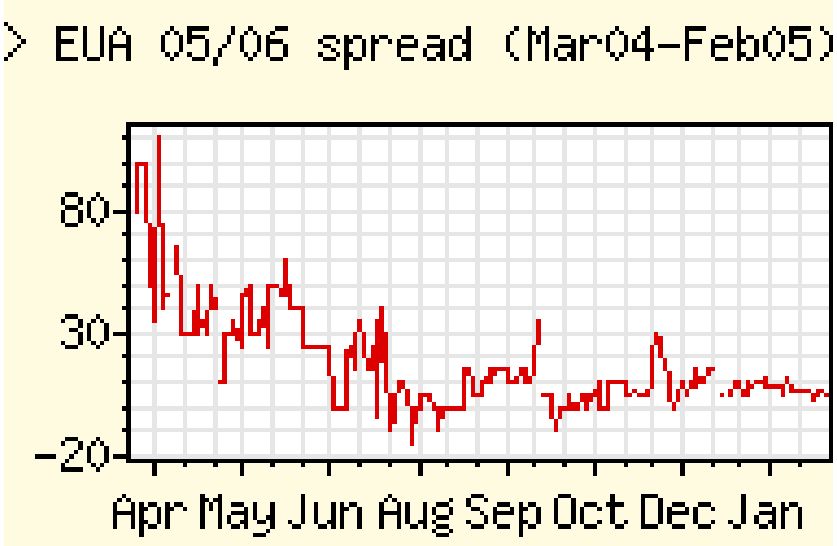
This weeks cold spell has seen prices rise

CO2 market seems to track power markets

Why not wait until year end? Balance books in short term.

Source: Evolution Markets

Forward price differentials show 2006/2007 prices settling €c20 above 2005 prices

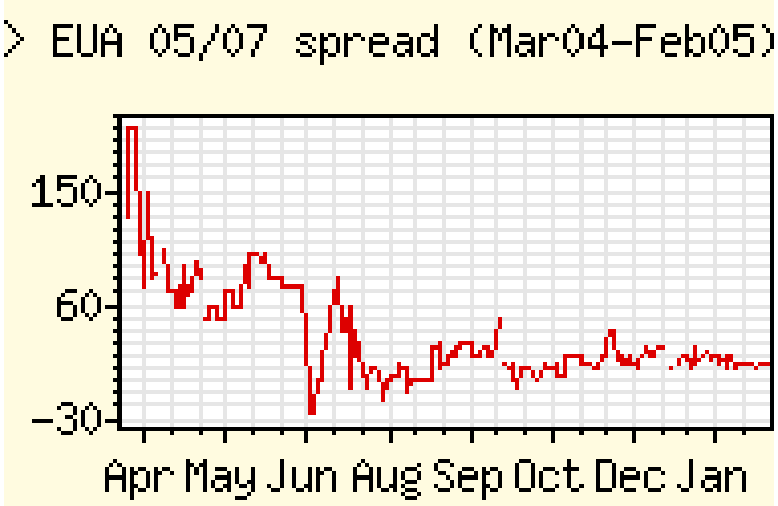


2005 vintage more valuable than 2007 since greater optionality?

NB charts do not take into account underlying price.

NB: very illiquid forward curves, esp 2004.

Curves seem to show efficient forward markets in Phase I. Little variation other than cost of borrowing. Euro interest rates 4.5% implies a yearly forward price differential of €c20.



Summary

- Long term fundamentals are complex but can be simplified for each EU ETS trading period. CDM supply is a key assumption.

- Market likely to flip around costs of load factor switching depending on overall market demand and CDM supply.

- All things considered, likely price ranges:

  – Phase I €6 – 20 (could be volatile)
  – Phase II €10 - 25