



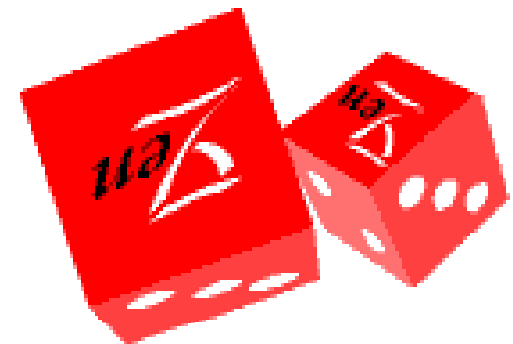
Carbon Price Impact

“Zest for Enlightenment”

“Business Costs Of Cap-and-Trade”

Professor Michael Mainelli

Z/Yen Group Limited
Risk/Reward Managers
5-7 St Helen's Place
London EC3A 6AU
United Kingdom
tel: +44 (20) 7562-9562



www.zyen.com



© Z/Yen Group
2009



Z/Yen Overview

- Special – the foremost risk/reward management firm – a commercial “think” & “do” tank
- Services – intelligence, research, projects, coaching/training, expertise on demand
- Sectors – technology, finance, voluntary, professional services, outsourcing
- Some highlights – *Clean Business Cuisine*, DERA/Qinetiq, Taskforce 2000, Investment Banking CCC’s, DTI Smart Award 2003 for PropheZy, DTI Foresight Challenge Award for Financial Laboratory, *IT in for Not-for-Profit Sector*, Global Financial Centres Index, Global Intellectual Property Index, London Accord

www.zyen.com



© Z/Yen Group
2009





Sustainability

www.london-accord.co.uk



www.zyen.com



© Z/Yen Group
2009



Winning Portfolios?

Successful model portfolios exist – though **concentrated** at \$30 to \$60 per tonne

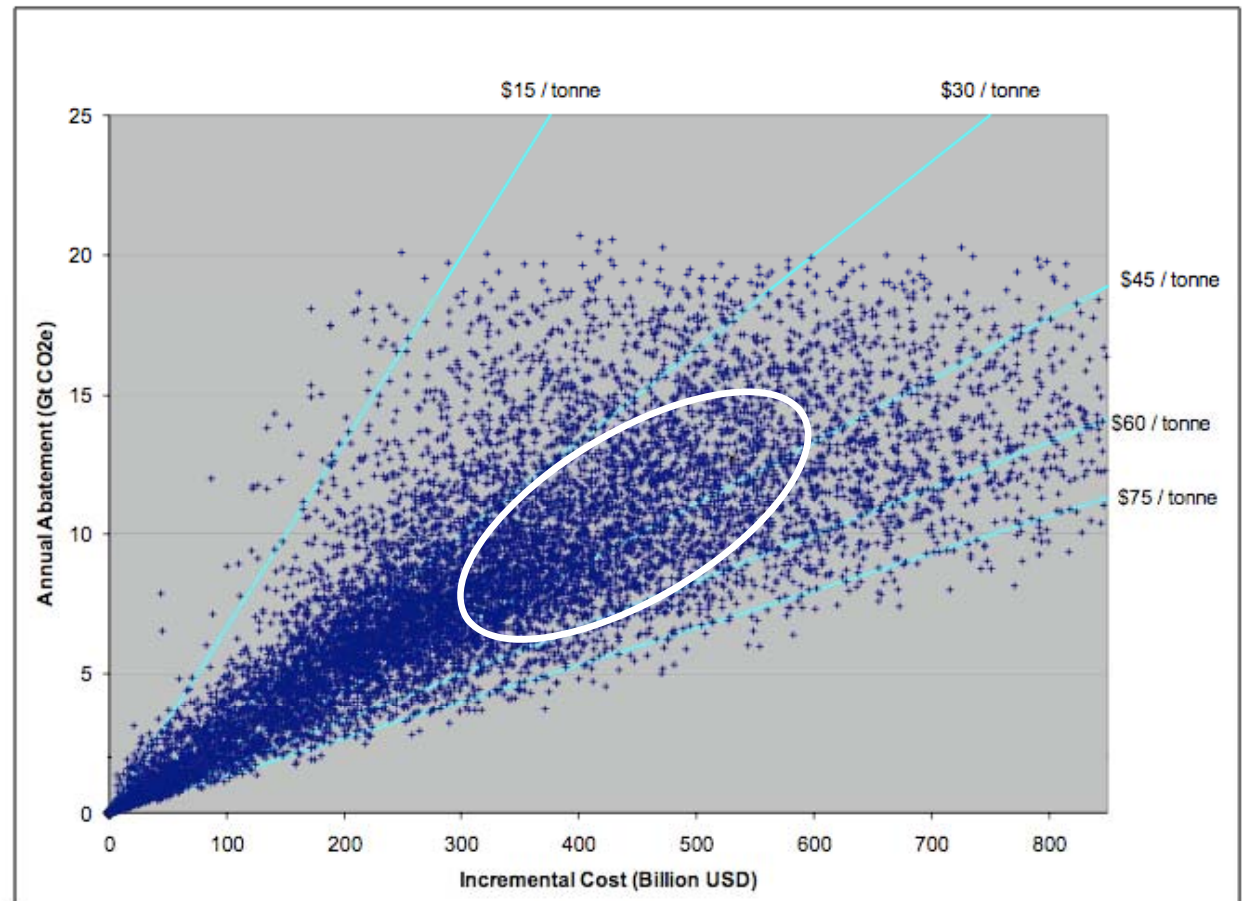
A **mix** of sectors and technologies is essential

Abatement potential up to about 15 Gt

www.zyen.com

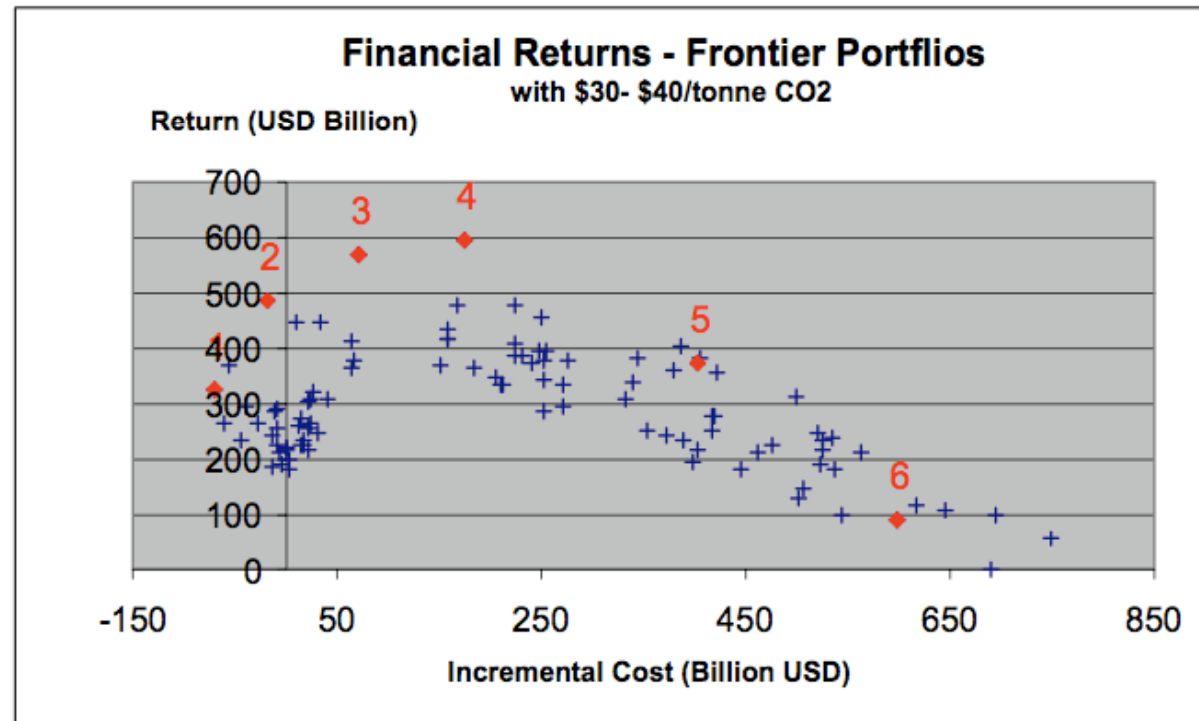


© Z/Yen Group
2009





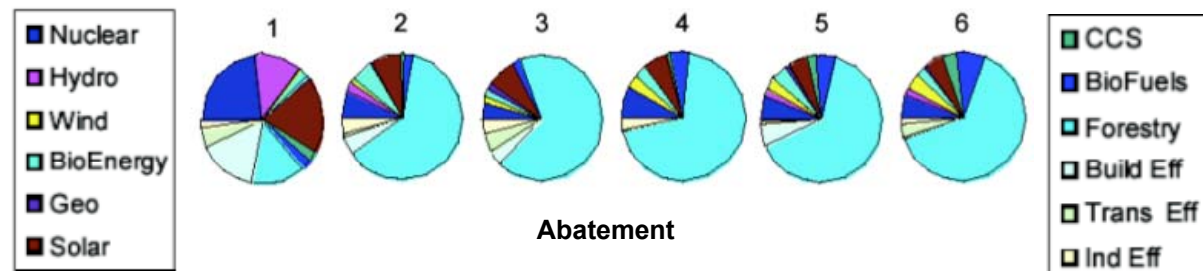
Not Easy



www.zyen.com



© Z/Yen Group
2009





Tomorrow's Company Project

- Business implications
- Publication – “Tomorrow’s Climate: Beyond Peak Carbon” with David Vigar
- Model - Dr Kevin Parker, Jan-Peter Onstwedder, Ben Morris and Professor Michael Mainelli

www.zyen.com



© Z/Yen Group
2009





What The EU Proposes, The Market Disposes

- Polluting organisations will have to purchase permissions to emit carbon
- Emissions can be traded between polluters and others
- The number of emissions permits will be reduced each year, most steeply after 2013

www.zyen.com



© Z/Yen Group
2009



It's Gonna Get Bad...

- “The costs of reaching low carbon will be enormous”
- “Emissions trading will impose enormous costs on UK industry”
- “It will require huge investment to reach EU targets”
- So, how bad will it get...?

www.zyen.com



© Z/Yen Group
2009



Potentially Expensive

Impact of Emissions Trading on Energy Demand

Average prices 2000-2010		Incremental Price			
		2015	2020	2025	2030
Electricity	€ 97	€ 25	€ 31	€ 28	€ 18
Elasticity	-0.1				
Change from Carbon Pricing		26%	32%	29%	19%
Change in demand		-2.6%	-3.2%	-2.9%	-1.9%
Gasoline	€ 1.01	€ 0.10	€ 0.13	€ 0.11	€ 0.07
Elasticity	-0.7				
Change from Carbon Pricing		10%	13%	11%	7%
Change in demand		-7.2%	-8.9%	-7.9%	-5.2%
Diesel	€ 0.90	€ 0.13	€ 0.15	€ 0.14	€ 0.09
Elasticity	-0.7				
Change from Carbon Pricing		14%	17%	15%	10%
Change in demand		-9.8%	-12.0%	-10.8%	-7.0%
Jet fuel	0.678	€ 0.12	€ 0.15	€ 0.13	€ 0.08
Elasticity	-0.6				
Change from Carbon Pricing		17%	22%	19%	13%
Change in demand		-10.5%	-12.9%	-11.5%	-7.5%

www.zyen.com



© Z/Yen Group
2009

Scenario: IPCC Cat 1 1%

Elasticity -0.8

Efficiency: 1.50%



EU ETS Scheme

- About 46% total emissions
- Covers emissions from power stations and various heavy industries - cement, steel
- Will be extended to include
 - Air travel by 2013
 - Other transport?
 - NB: over 40% of EU GHG comes from heating/cooling/lighting buildings, transport about 15%

www.zyen.com



© Z/Yen Group
2009

Three Scenarios

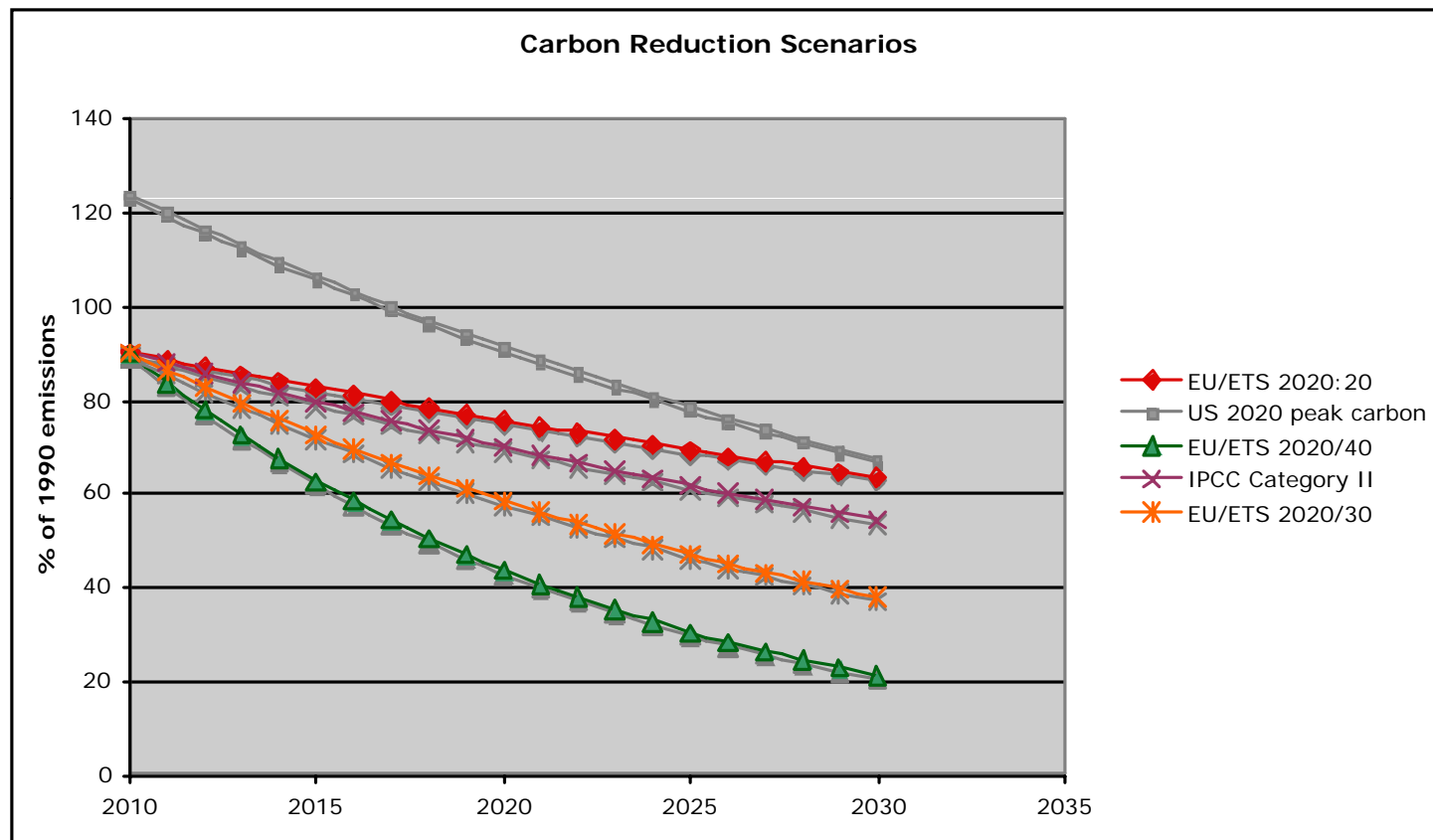
- Current, unilateral ETS scheme - **Red** scenario
 - Reduce 1990 emissions by 20% in 2020
 - Restrict permits by 1.74% pa
- EU 'offer' if 2010 Copenhagen talks are successful - **Orange** scenario
 - Reduce emissions by 30% in 2020
 - Implies permits restricted by approx 4.5% pa
- Rapid reduction as demanded by IPCC and some developing countries - **Green** scenario
 - Reduce emissions by 40% by 2020
 - Implies permits restricted by approx 7% pa





Annualised Abatement

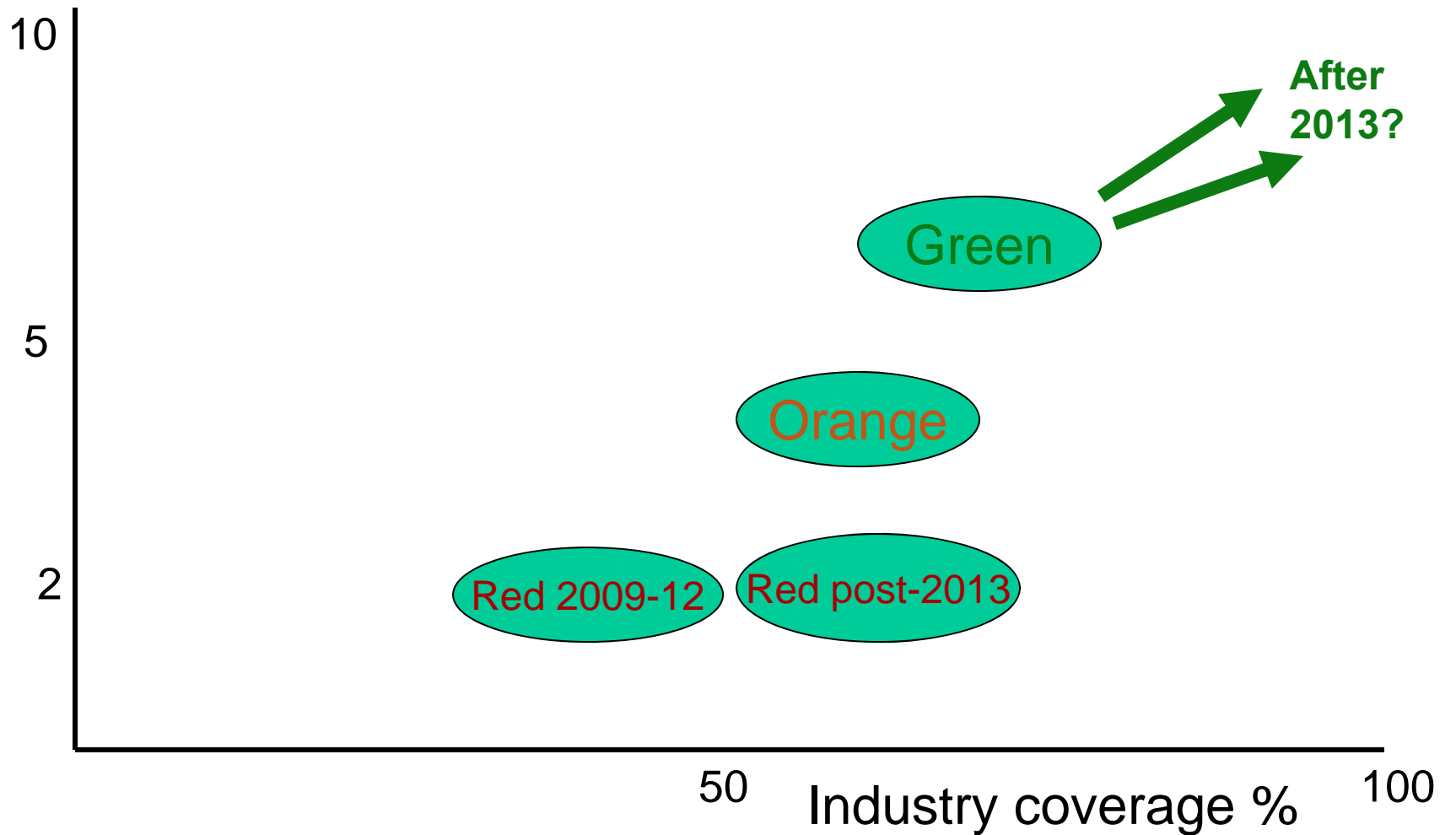
● EU, IPCC, US





Comparison of Scenarios

Annualised abatement target %



www.zyen.com



© Z/Yen Group
2009



Supply & Price

- How will carbon prices respond to permit restriction?
- If demand stays the same, then a reduction in amount of permits issued will cause the price of each permit to rise
- Will supply and price change in strict proportion?
 - e.g. 10% restriction causing a 10% price increase (price elasticity -1.0)
- Or will the price change be greater?
 - e.g. 10% restriction causing a 20% price increase (price elasticity -0.5)

www.zyen.com



© Z/Yen Group
2009



Elasticity \neq Simplicity

- Elasticity depends on how fast users economise and adapt
- Some comparisons
 - short term elasticity of gasoline is about -0.5, long term(>3-5 years) about -0.8
 - short term elasticity of electricity is about -0.15, longer term about -0.4
- Will carbon be more like gasoline or electricity?

www.zyen.com



© Z/Yen Group
2009



Technology To The Rescue?

- Rate of installation of alternative energies
- about 1.75% pa
(Santa Fe Institute)
- Rate of Improved Housing thermal
efficiency - about 1% pa since 1970
(Building Research Establishment)
- Efficiencies demanded from UK power
suppliers - about 3% pa
Ofgem

www.zyen.com



© Z/Yen Group
2009



Our Pricing Model

- A Choice of scenarios
 - Red, Orange, Green
- A Choice of price elasticities for carbon
 - $-(1.0)$ to $-(0.4)$
- A Choice of efficiency gains
 - 1 to 3% pa
- Calculates carbon prices, resultant fuel and electricity prices, and company specific 'cost of carbon footprint'

www.zyen.com

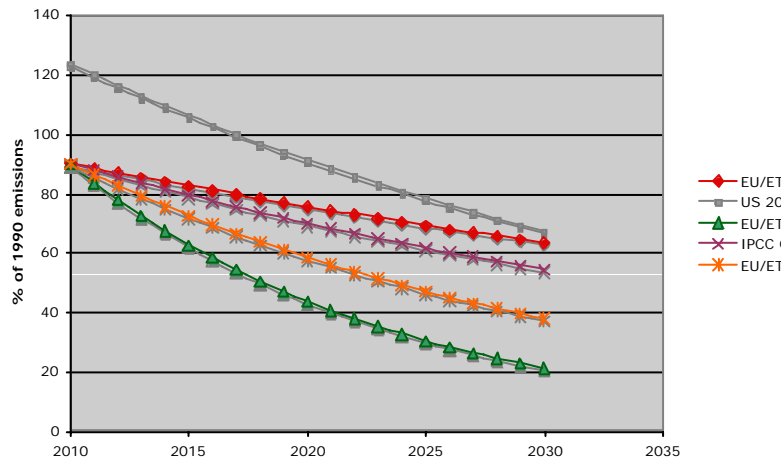


© Z/Yen Group
2009

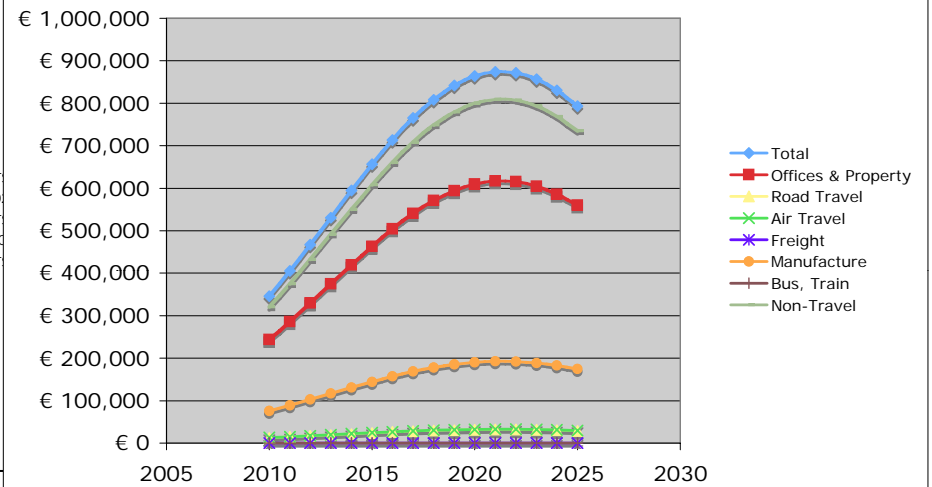


Model Outputs

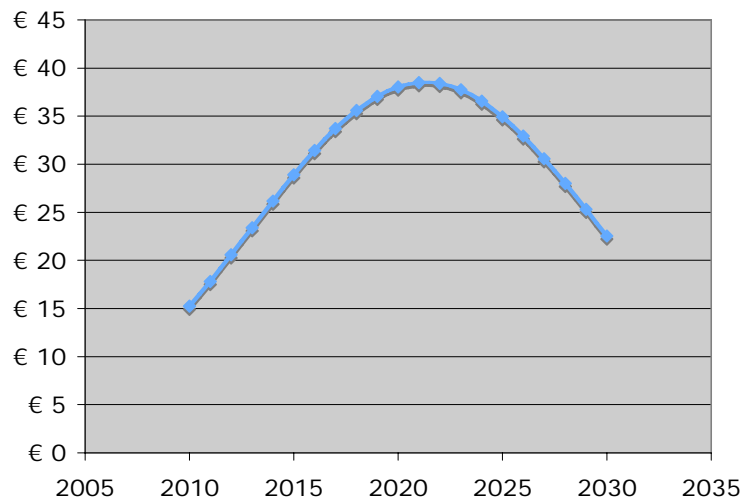
Carbon Reduction Scenarios



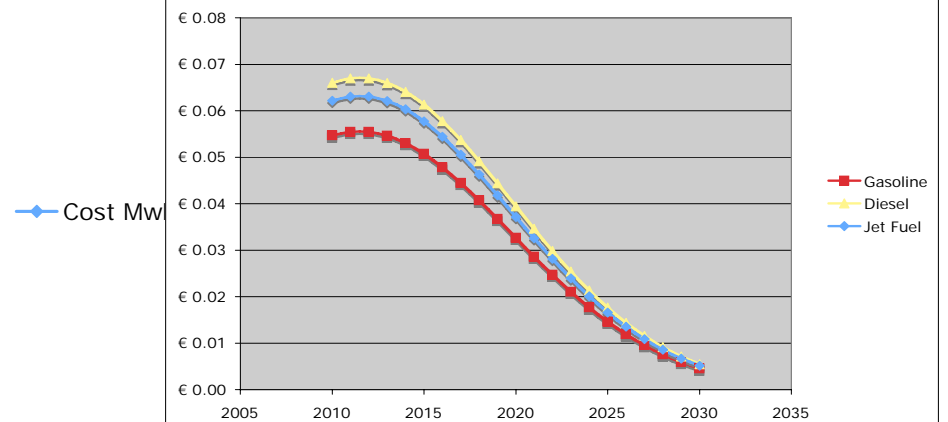
Cost of CO2e Emissions



Impact of Carbon Trading on Electricity Prices



Impact of Carbon Trading on Fuel Prices



www.zyen.com



© Z/Yen Group
2009



Red Scenario (20% reduction by 2020)

	2015			2020		
	best*	expected	worst	best	expected	worst
CO ₂ price €/tonne	€21	€22	€28	€10	€12	€24
Estimated change in electricity price	+11%	+12%	+16%	+6%	+7%	+13%
Notional change in gasoline price	+4%	+5%	+6%	+2%	+3%	+5%
Incremental cost of non-AC office (€/sq metre)	€1.2	€1.3	€1.7	€0.6	€0.8	€1.4
Incremental cost of AC office (€/sq metre)	€4.9	€5.3	€6.7	€2.5	€3.0	€5.7

www.zyen.com



© Z/Yen Group
2009

*'Best': Elasticity -1.0, 2% efficiency gain pa. 'Expected' -0.8, 1.75%. 'Worst' -0.4, 1.0%



Orange Scenario (30% reduction by 2020)

	2015			2020		
	best*	expected	worst	best	expected	worst
CO ₂ price €/tonne	€25	€28	€43	€15	€19	€53
Estimated change in electricity price	+14%	+15%	+24%	+8%	+11%	+29%
Notional change in gasoline price	+5%	+6%	+9%	+3%	+4%	+12%
Incremental cost of non-AC office (€/sq metre)	€1.5	€1.7	€2.6	€0.9	€1.2	€3.2
Incremental cost of AC office (€/sq metre)	€5.9	€6.6	€10.3	€3.5	€4.5	€12.6

www.zyen.com



*'Best': Elasticity -1.0, 2% efficiency gain pa. 'Expected' -0.8, 1.75%. 'Worst' -0.4, 1.0%



Green Scenario (40% reduction by 2020)

	2015			2020		
	best*	expected	worst	best	expected	worst
CO ₂ price €/tonne	€30	€35	€65	€21	€29	€114
Estimated change in electricity price	+17%	+19%	+36%	+11%	+16%	+63%
Notional change in gasoline price	+7%	+8%	+14%	+5%	+6%	+25%
Incremental cost of non-AC office (€/sq metre)	€1.8	€2.1	€3.9	€1.3	€1.8	€6.9
Incremental cost of AC office (€/sq metre)	€7.1	€8.3	€15.4	€5.0	€7.0	€27.1

www.zyen.com



Summary

- Most 'likely' scenarios show:
 - carbon costs below €100/tonne
 - increased fuel and electricity costs of tens of percentage points, not orders of magnitude
 - for UK companies, costs of heating and lighting offices are important - big difference between best and worst buildings

