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£12

What's the Relevance of £12 per tonne of CO_2?
Making Sense of Marginal Abatement Costing

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Agenda

- Presentation (20 mins)
- Questions of clarification (5 mins)
- Group working (1 hour)
  - Develop a marginal abatement cost curve.
  - Decide a carbon trading strategy.
  - Take part in a sealed bid auction for carbon allowances.

How did I get into this?

Q. We have costed all our potential our carbon reduction projects…

and not one comes within the Energy Performance Commitment's £8 per tonne allowance price?

See me afterwards!!!

15:25 hrs on 25th January 200
LACMP 2nd Ideas Sharing Conferen
Reading Town Hall

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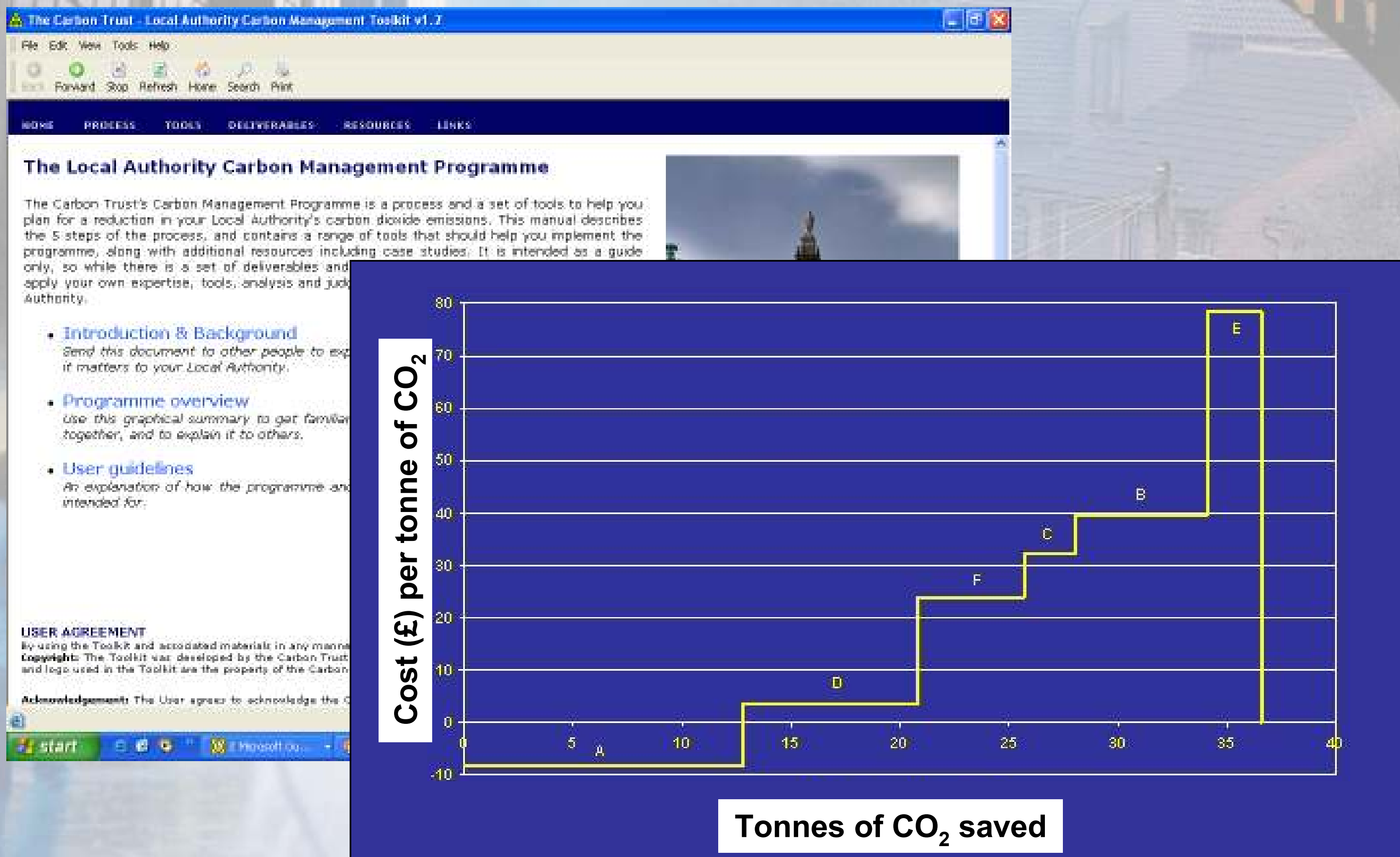
Carbon Trust's LACMP Toolkit



Health Warning

If you don't want to know the scores...

look away now!

This product contains maths!

Background

Energy White Paper (2007)

The Carbon Reduction Commitment (CRC) will apply **mandatory emissions trading** to cut carbon emissions from large commercial and public sector organisations.

Climate Change Bill (2008?)

Sets a **legally binding target** for reducing UK CO_2 emissions by at least 26% by 2020 and at least 60% by 2050 compared to 1990 levels.

Provides **powers to establish trading schemes** for the purpose of limiting greenhouse gas.

CRC – Are we in?

Threshold = annual electricity consumption of +6,000 MWh

Devon County Council

+50,000 MWh

Best I find something out about carbon trading!!

What is Carbon Trading?

Principal Aim

Use market forces to reduce emissions at the lowest cost to society.

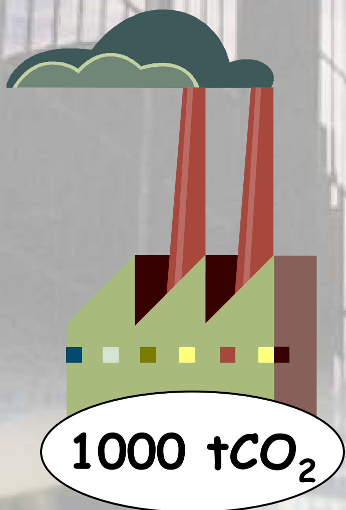
How?

By placing a 'cap' on the CO_2 emissions allowed from a predefined market place.....

....and, by auctioning off the capped emissions, creating a price for carbon.

A 'Cap and Trade' System

Auction or Trading Strategy

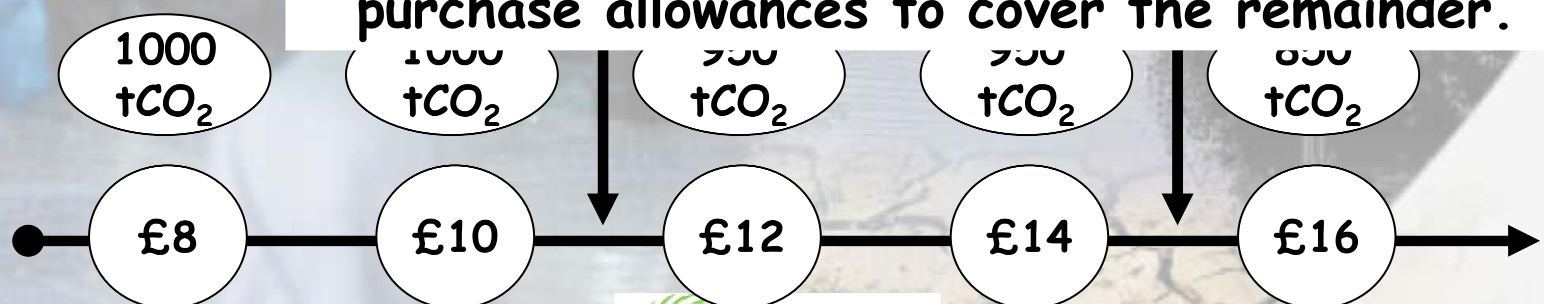


Basic Aim
The business must hold sufficient allowances at the end of the trading year to cover all its emissions.

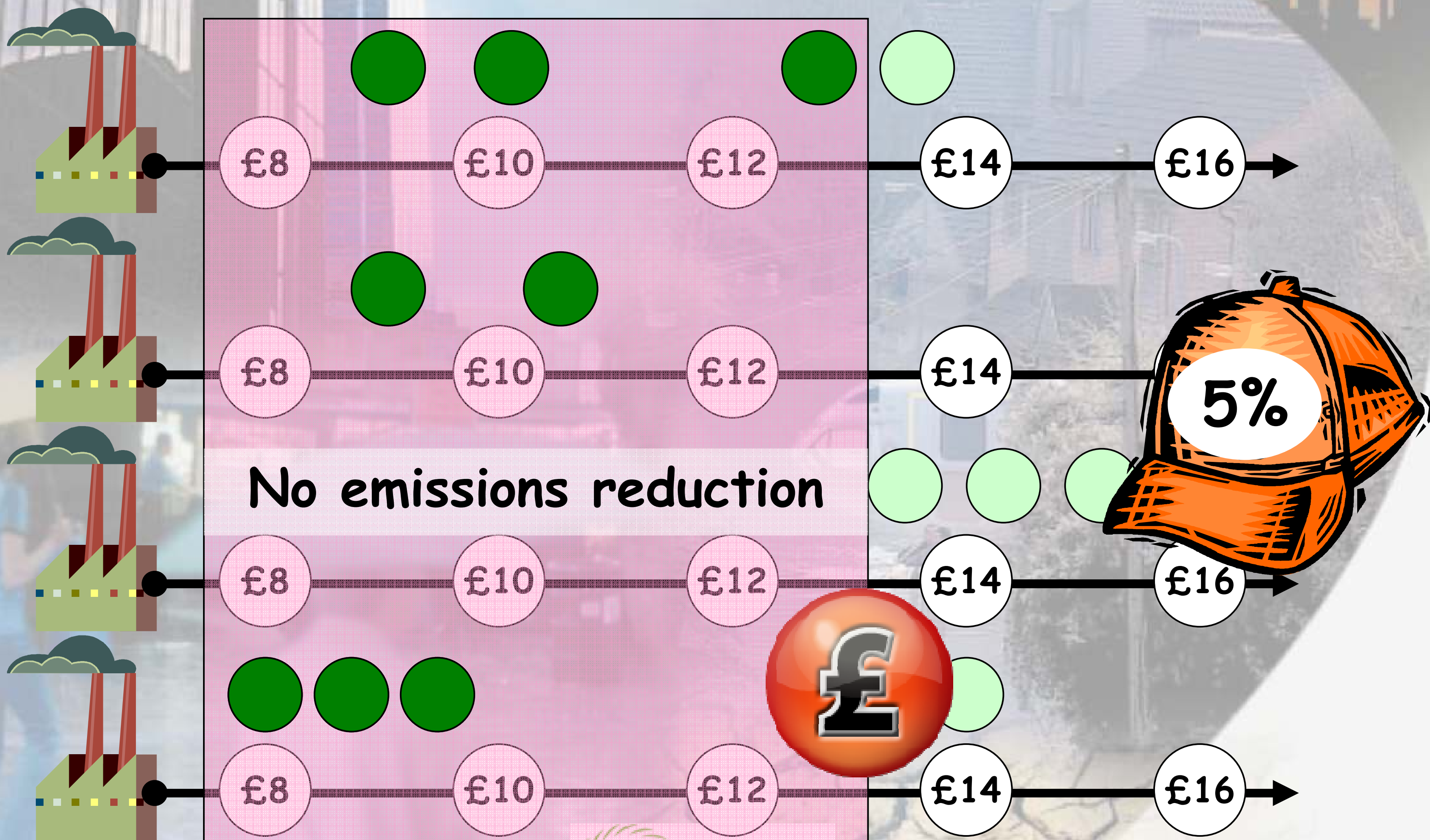
Must hold allowances for 1000 tCO_2 at the end of the year

OR

implement projects to reduce emissions
and
purchase allowances to cover the remainder.



The Market Price



Summary of Carbon Trading

To reduce carbon emissions

at the lowest cost to society

Effectively, for an organisation in a carbon trading system, it's no longer about the relentless pursuit of a % carbon reduction target.

The "market" will do it!

Relevance of £12 per tonne

To reduce carbon emissions

at the lowest cost to society

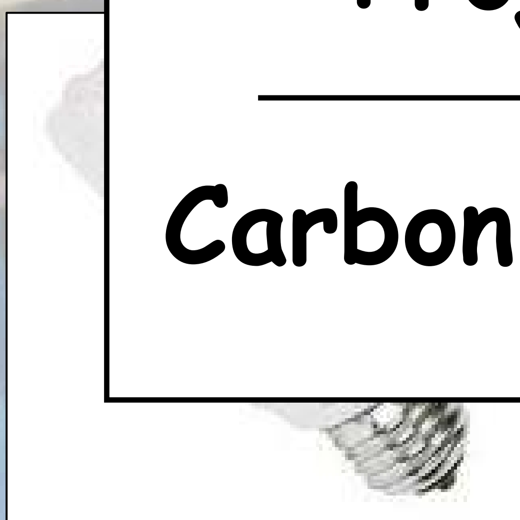
Project cost > £12 per tonne – cheaper to buy allowances

£12 per tonne of CO_2

Project cost < £12 per tonne – cheaper to implement

Calculating Project Costs

£12 per tonne of CO_2



$$\frac{\text{Project Cost (£)}}{\text{Carbon Savings (tonnes)}}$$

£192 per tonne of CO_2

Is a CFL Cost-Effective?

£12 per tonne of CO_2

Project cost
£5

Annual Energy Saving

A – 49 … d by 11w)
B – 1…
C – 9.…

A x B x C…

No Brainer!

Payback period = just over 1 year

Is a CFL Cost-Effective?

£12 per tonne of CO_2

£5.0

ng

$$\frac{\text{Project Cost (£)- Project Saving (£)}}{\text{Carbon Savings (tonnes)}}$$

er kWh

£10.77 per tonne of CO_2

Whole life costs?

But surely the light bulb makes savings in years 2, 3, 4 etc?

…..and at no additional cost?

…..and you don't have to buy so many replacements ?

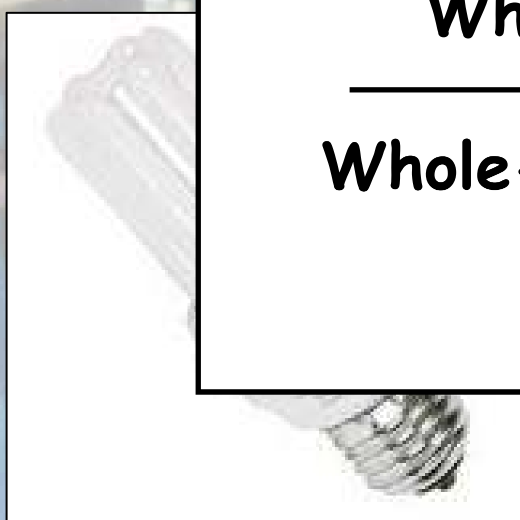
Is a CFL Cost-Effective?

£12 per tonne of CO_2

Whole-li…

£5 - £47.2…

…ing



…yr life)

…kWh

$$\frac{\text{Whole-life Cost (Saving) (£)}}{\text{Whole-life Carbon Savings (tonnes)}}$$

- £171 per tonne of CO_2

Time Value of Money (& Carbon)

Principle

With all else being equal…

an investor prefers to receive a payment of a fixed amount of money today, rather than an equal amount in the future.

The Net Present Value

The value of a future sum, "discounted" to a present value.

Discounted Methodology

Marginal Abatement Cost (M)

$$\frac{\text{Discounted 10 yr Cost (Saving) (£)}}{\text{Discounted 10 yr Carbon Savings (tonnes)}}$$

Is a CFL Cost-Effective?

PROJECT	Replace 60 watt tungsten bulb with an 11 watt compact fluorescent bulb								
Project Cost	£5.00								
Costs		x 60 watt bulbs @ 16p)							
METH		ement Cost Curve Method							
Power		s							
Annual		s							
Life		s	10.0						
Annual									
Electric									
CO_2 co		D_2/kWh							
Discour									
Project		nnual efit/Cost £	Simple Payback Years	An Saving tonnes	years		not discounted) £/tonne	Disc life sa of carbon tonnes	MAC (c disc d) £/tonne
Project Name	£3.40	£4.72	0.7	0.026	10	-£26	-£100	0.157	-£162.48

No Brainer!

- £162.48 per tonne of CO_2

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Voltage Optimiser

PROJECT	**Voltage Optimiser for County Hall**								
Project Cost	**£55,000**								
Methodology	**Marginal Abatement Cost Curve Methodology**								
Power Consumption	2,979,225	kWh							
Power Saving	6.8%								
Annual energy saving	202,587	kWh							
Electricity Price per kWh	£0.08								
CO2 content of Electricity	0.523	kgCO2/kWh							
Discount Rate	10%								
Project Name	Capital Cost £	Annual Benefit/Cost £	Simple Payback Years	Annual C02 Savings tonnes	Project Life years	NPV £	MAC (carbon not discounted) £/tonne	Discounted life savings of carbon tonnes	MAC (carbon discounted) £/tonne
Project Name	**£55,000**	**£16,617**	3.3	**106**	10	-£47,107	-£44	651.036	-£72.36

- £72 per tonne of CO_2

Street Lighting

Annual allocation for carbon emissions reduction

£200k

66 tCO_2

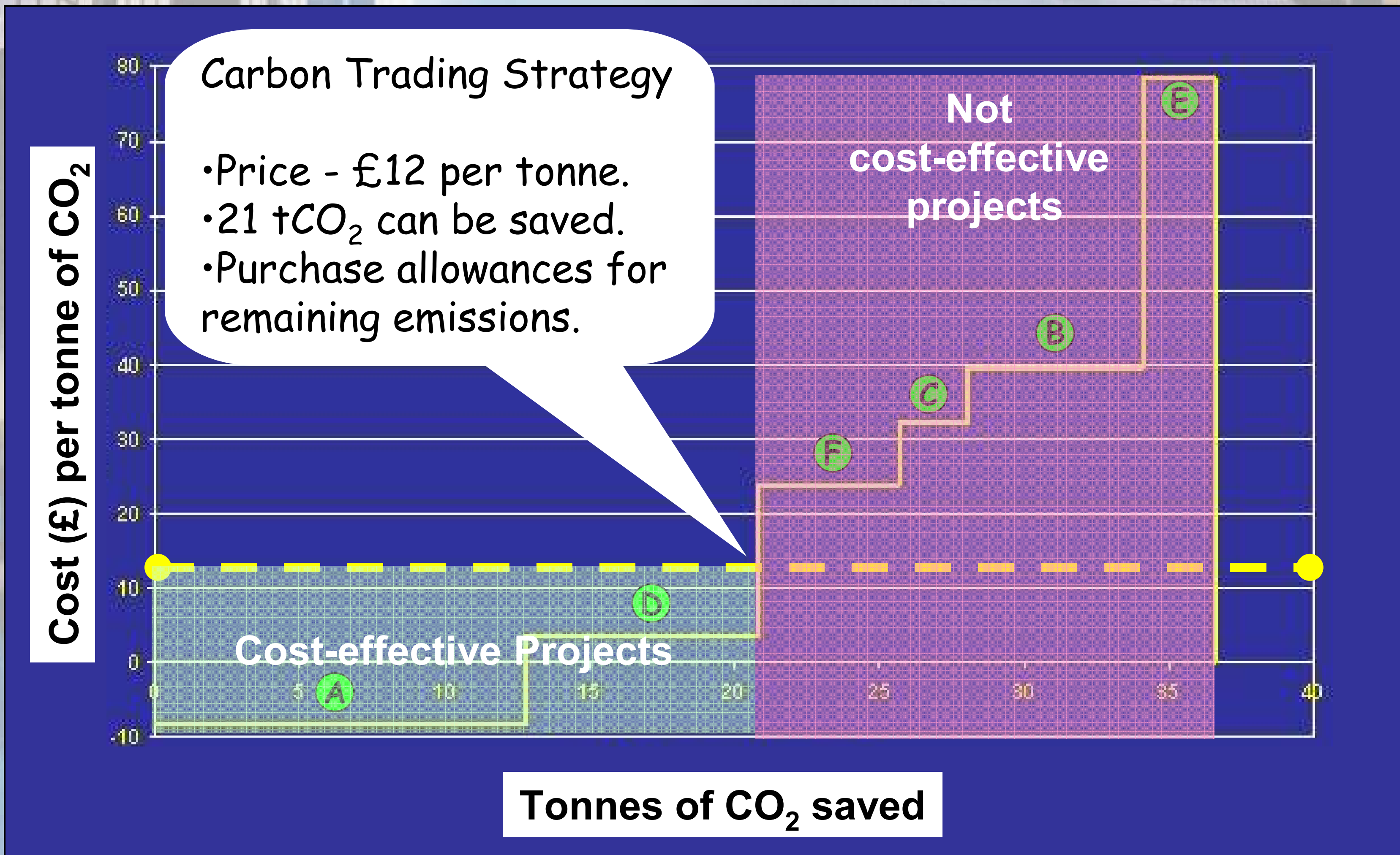
Street Lighting

PROJECT	Carbon Reduction in Street Lighting				
Project Cost	£200,000				
METHODOLOGY	Marginal Abatement Cost Curve Methodology				
Carbon (CO_2) saving	66	tonnes			
Annual energy saving	126,195	kWh			
Electricity Price per kWh	£0.0592				
CO_2 content of Electricity	0.523	kgCO_2/kWh			
Discount Rate	10%				
Project Name	Capital Cost £	Annual Benefit/Cost £	Simple Payback Years	Annual C02 Savings tonnes	Proj y
Project Name	**£200,000**	**£7,470.75**	26.8	**66**	

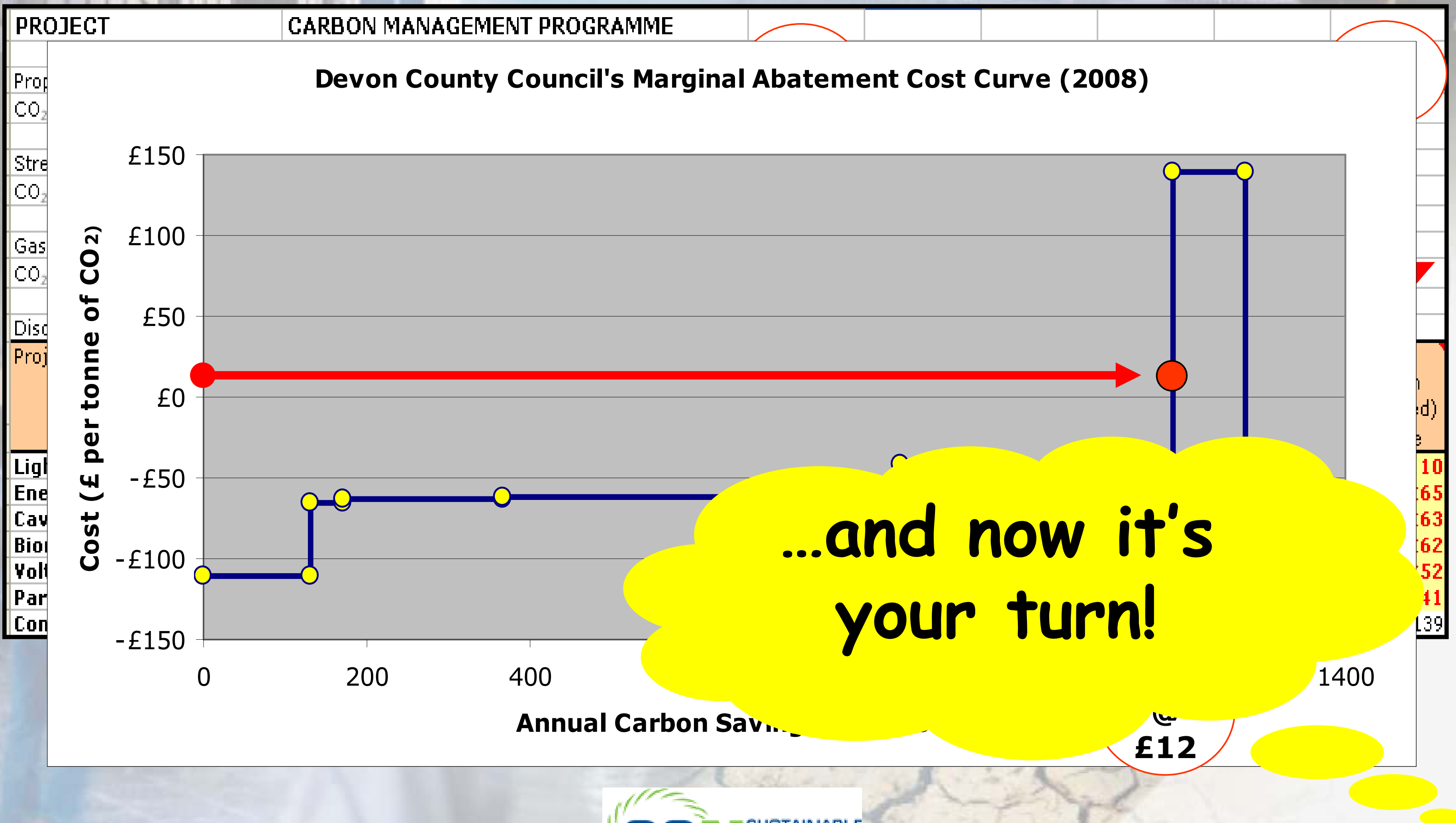
£380 per tonne of CO_2

Simple Payback = +26 years

The MAC Curve



MACC for DCC


PROJECT
CARBON MANAGEMENT PROGRAMME
Devon County Council's Marginal Abatement Cost Curve (2008)
£150
£100
£50
£0
-£50
-£100
-£150
Cost (£ per tonne of CO2)
0
200
400
1400
Annual Carbon Sav
£12
...and now it's
your turn!

Questions

Group Work

- **TASK 1**
  - To create a Marginal Abatement Cost Curve.

- **TASK 2**
  - To use the MACC to bid for allowances in a sealed bid auction.

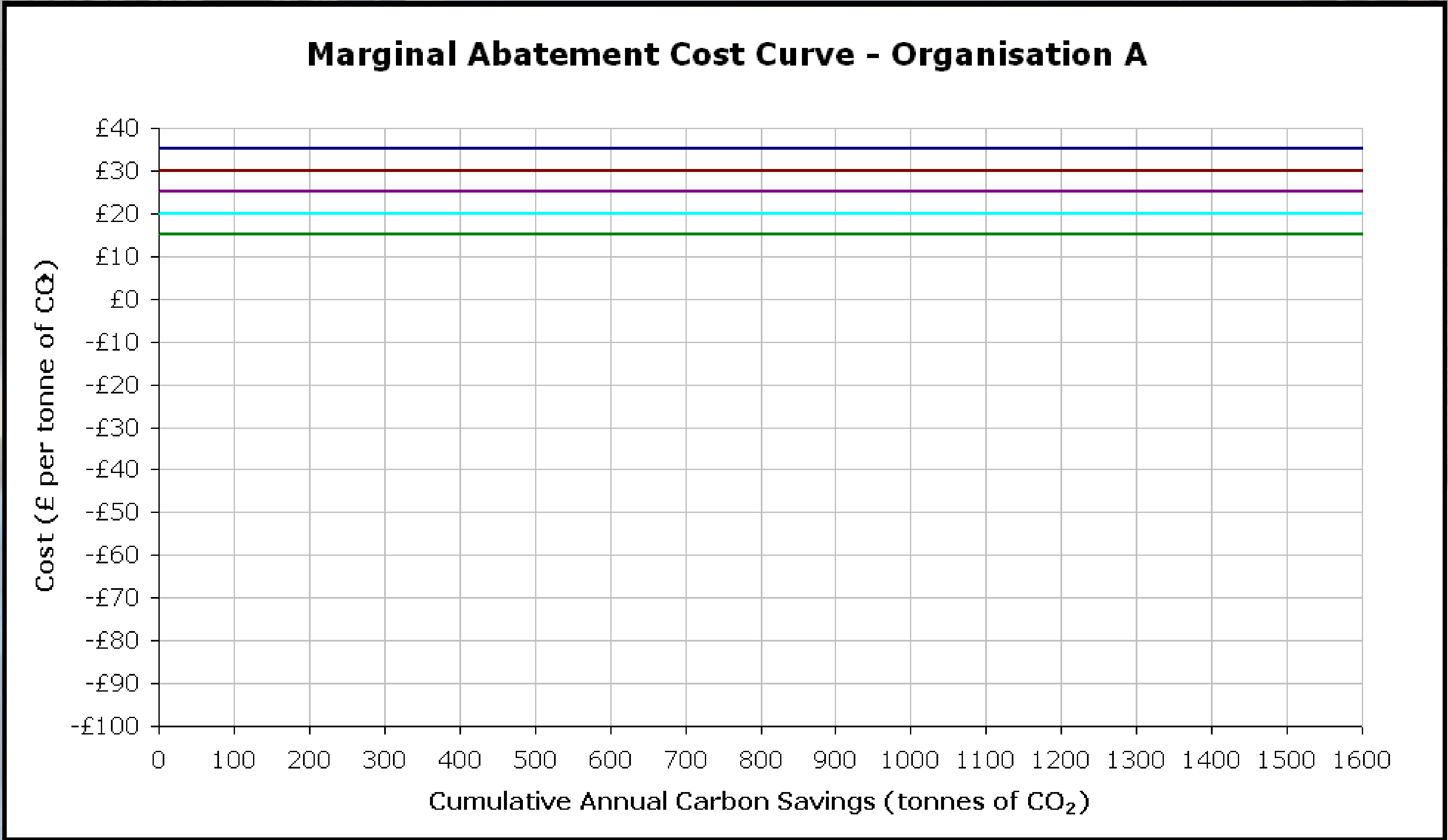
MACC Data

X Y

Project Portfolio

Project Name	Capital Cost £	Annual Benefit/Cost £	Simple Payback Years	Annual CO_2 Savings tonnes	Cumulative Annual CO_2 emissions savings	Project Life years	NPV £	MAC (carbon not discounted) £/tonne	Discounted life savings of carbon tonnes	MAC (carbon discounted) £/tonne
Energy Awareness Campaign	**£10,000**	**£6,000**	1.7	**50**	50	10	-£26,867	-£54	307	-£87
Biomass Boiler	**£200,000**	**£57,000**	3.5	**350**	400	10	-£150,240	-£43	2,151	-£70
Cavity Wall Insulation	**£100,000**	**£30,000**	3.3	**200**	600	10	-£84,337	-£42	1,229	-£69
Lighting Adapters	**£80,000**	**£21,000**	3.8	**150**	750	10	-£49,036	-£33	922	-£53
Voltage Optimiser	**£75,000**	**£17,000**	4.4	**150**	900	10	-£29,458	-£20	922	-£32
Part Night Street Lighting	**£145,000**	**£20,000**	7.3	**200**	1100	10	£22,109	£11	1,229	£18
Dimming Street Lighting	**£35,000**	**£2,000**	17.5	**160**	1260	10	£22,711	£14	983	£23
Low Energy Street Lighting	**£55,000**	**£2,000**	27.5	**190**	1450	10	£42,711	£22	1,167	£37
Solar PV Array	**£24,000**	**£500**	48.0	**2**	1452	10	£20,928	£1,046	12	£1,703

MACC Chart



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Sealed Bid

Sealed Bid for Organisation A		
Carbon Footprint	50,000	tonnes of CO_2
Bid Price	No of Allowances Bid	Total Cost (for info only)
£15		
£20		
£25		
£30		
£35		

n

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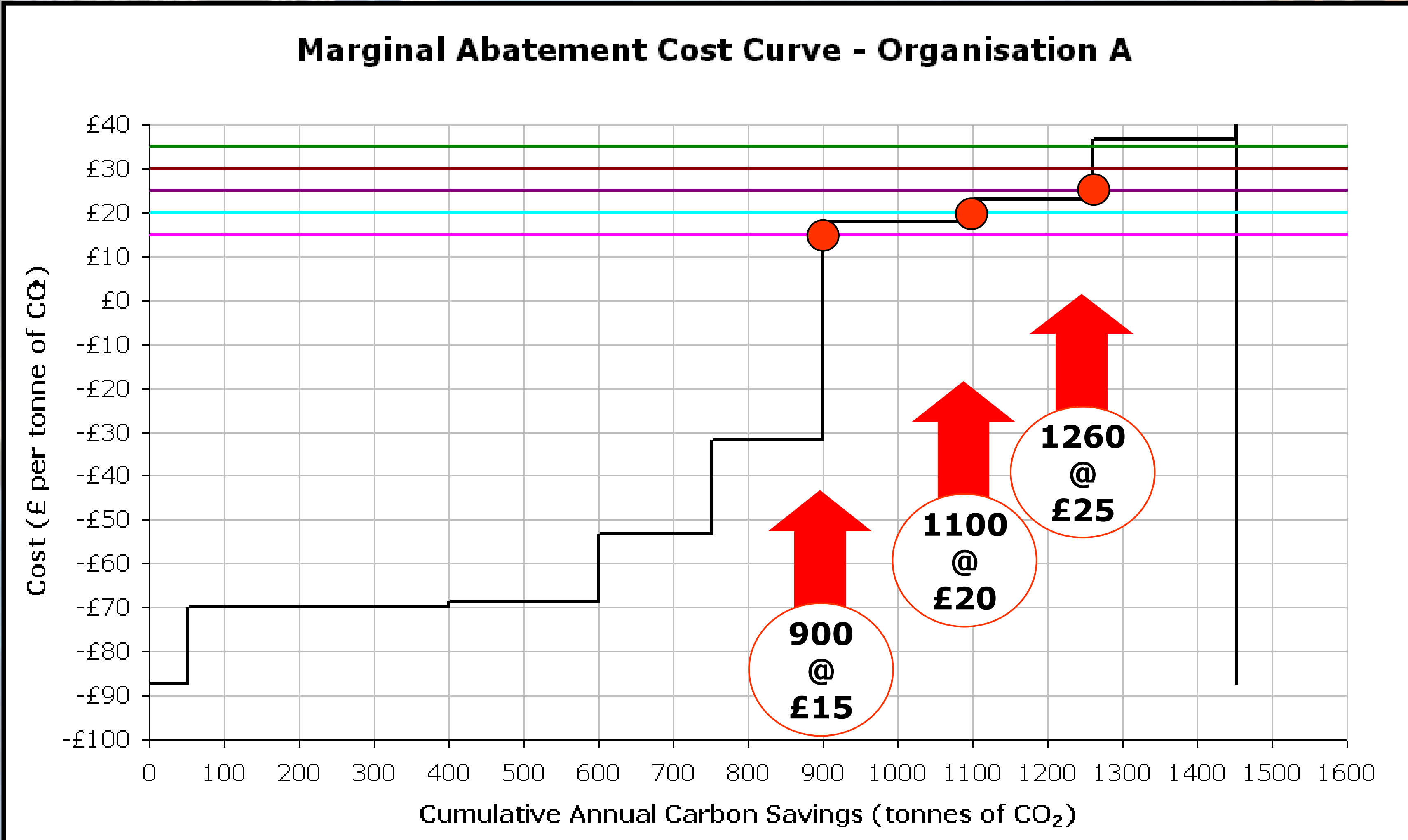
Answer - Task 1



Possible Answer – Task 2

Sealed Bid for Organisation A		
Carbon Footprint		50,000 tonnes of CO_2
Bid Price	**No of Allowances Bid**	**Total Cost (for info only)**
£15	49,100	£736,500
£20	48,900	£978,000
£25	48,740	£1,218,500
£30	48,740	£1,462,200
£35	48,740	£1,705,900

The Low Energy Light Bulb Test

How much would you pay for one of these?

£5 £10 £20 £33

+£12 per tonne Project = **The £33 Low Energy Bulb**

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Questions