Environmental and ecological economics

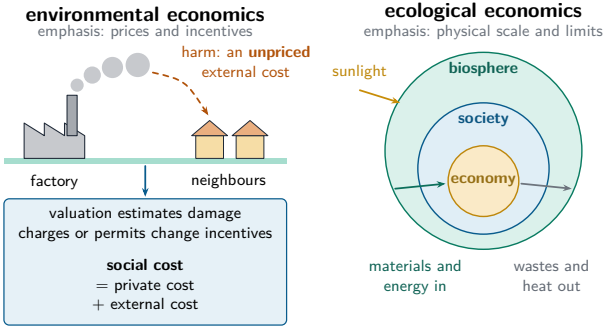
HL lens b · HL only

Putting a price on carbon

> Benchmark-based allocation is not identical to a fixed absolute emissions cap.

- China's national trading began in 2021.
- The 2025 MEE report documents more sectors and intensity-based allocation.

Two views of the economy



different emphases with much overlap
both treat the economy as physically dependent on nature

Analytical emphases overlap; all economic activity physically depends on nature.

Weak or strong sustainability?

Weak

Natural capital can be replaced.

Total capital is what matters.

Strong

Some natural capital is irreplaceable.

It must be kept.

Market failure

> An **externality** is a cost or benefit to others that the price leaves out.

- Public-good quality differs from finite pollution-assimilation capacity.
- Open access can overuse rival common resources; effective governance can change outcomes.

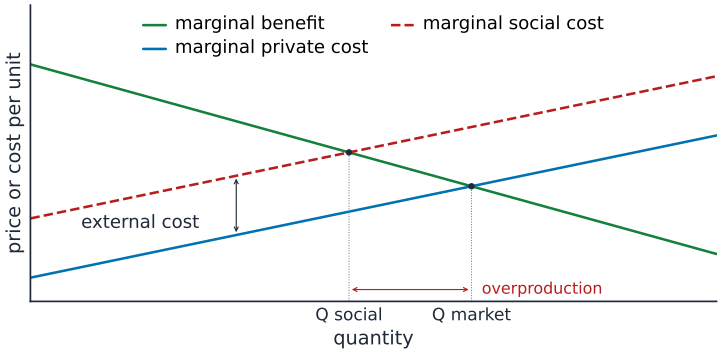
Social cost

- Invented constant cost: private 12 yuan plus external 5 yuan per extra item.
- Social cost 17; a 5-yuan charge matches the assumed marginal external damage.

$$\text{social cost} = \text{private cost} + \text{external cost}$$

When external costs are ignored, the product is too cheap.

Overproduction



The market stops where benefit meets private cost; society's best output is lower, where it meets social cost.

Public goods are not unlimited sinks

Clean-air quality

Non-rival enjoyment and difficult exclusion can support a public-good analysis.

Free-riding can undermine voluntary private provision.

Pollution capacity

The receiving environment has finite capacity and thresholds.

Shared fish stocks are rival; community institutions can regulate use.

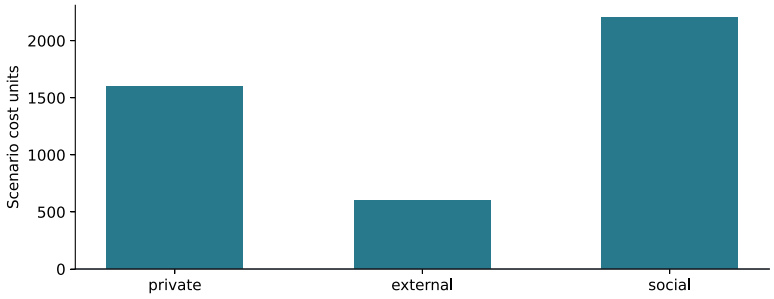
Four kinds of goods

	excludable	non-excludable
rival	**private goods** timber from a private forest	**common-pool resources** fish stocks: overuse risk
non-rival	**club goods** a fee-paying nature park	**public goods** clean air, stable climate: free-riding risk

plus **externalities**:
costs outside the price

> Common-pool resources are prone to overuse

Private, external and social cost



Social cost $1600 + 600 = 2200$

Tools to internalise costs

Tool	Example
Pigouvian tax	Sweden's **carbon tax**
Cap and trade	EU absolute cap; compare China's different allocation rules
Subsidy	Electric vehicles, solar
Payment for services	Xin'an River eco-compensation

Carbon tax or cap and trade?

Carbon tax

Fixes the price.

Emissions cut uncertain.

Cap and trade

A well-enforced absolute cap constrains covered quantity.

Price varies; allocation, banking and offsets affect outcomes.

Why trading cuts the cost

1. **Same rule.** $50 \times 20 + 50 \times 80 = 5000$ yuan
2. **Trading.** $100 \times 20 = 2000$ yuan
3. **Saving.** 3000 yuan for the same 100 t cut

Decision

Cuts happen where they are cheapest, but local pollution may stay near B

Paying for ecosystem services

> Xin'an River: Zhejiang pays Anhui if the water at the border is clean, and Anhui pays if it is not.

- **Grain for Green** (since 1999) pays farmers to restore steep land.
- Costa Rica pays landowners to keep forest.

Payments are not all new resource costs

1. **Abatement** A cuts 100 t at 20 yuan/t:2000 yuan real abatement cost.
2. **Transfer** A sells 50 allowances at 50 yuan:2500 yuan paid by B to A.
3. **Aggregate** A net−500;B pays 2500; total resource cost remains 2000 yuan.

Decision

The payment redistributes costs; local exposure, monitoring and administration still matter.

Evaluate ecosystem-service payments

Design

Specify the service, provider, payer and agreed conditions.

Consider tenure, participation and who receives payment.

Evidence

Test additionality against a baseline, permanence and leakage.

Paying for an action does not prove the intended service improved because of it.

Four kinds of ecosystem services

PROVISIONING	REGULATING	CULTURAL	SUPPORTING
goods we take: food, timber, water, medicine	natural control: climate, floods, pollination, clean water	non-material: recreation, tourism, spiritual, education	underlie the rest: soil formation, nutrient cycling, habitat

Many have no market price

Total economic value

Use values	Non-use values
Direct, timber, fish, tourism.	Existence, knowing it survives.
Indirect, flood control; option.	Bequest, for future generations.

Pricing nature

For

Decision-makers listen to numbers.

Valuation can expose effects omitted from a money comparison.

Against

Some values cannot be measured.

Suggests nature can be bought.

Discounting the future

- Damage of 1 million yuan in 100 years.
- At 1 %, worth about 370 000 yuan today; at 5 %, about 7600.

$$\text{present value} = \frac{\text{future value}}{(1+r)^t}$$

Choosing the **discount rate** is partly an ethical choice.

Valuation: information and limits

Methods

Market prices, travel costs, hedonic methods and stated-preference surveys.

Use/existence/bequest values answer different questions.

Interpretation

Income and question wording can affect **willingness to pay**.

Avoid overlapping benefit totals; retain physical indicators and rights.

A social-cost estimate needs metadata

Dated EPA 2023 report

Central 190 estimate:2020 US dollars per metric tonne of CO_2 emitted in 2020.

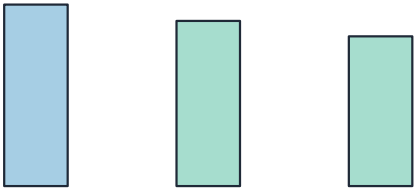
The cited case uses a 2% near-term discount-rate assumption.

Do not confuse quantities

Damage estimates differ from tax rates and allowance prices.

Emission year, dollar year, discounting and model scope affect comparison.

Discounting future values



today
£100

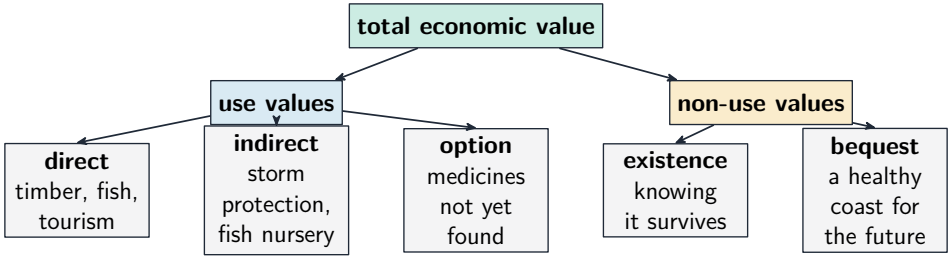
in 1 year
→ £91

in 2 years
→ £83

£100 received later is
worth less in today's money

A high **discount rate** makes the future count for little

The parts of total economic value



market prices value only some direct uses; surveys estimate willingness to pay for the rest

> Value includes more than what is sold

Beyond GDP

> GDP was never designed to measure wellbeing or sustainability.

- GDP counts clean-up costs as growth and ignores lost natural capital.
- Alternatives, HDI, the Genuine Progress Indicator, inclusive wealth.

Can growth be green?

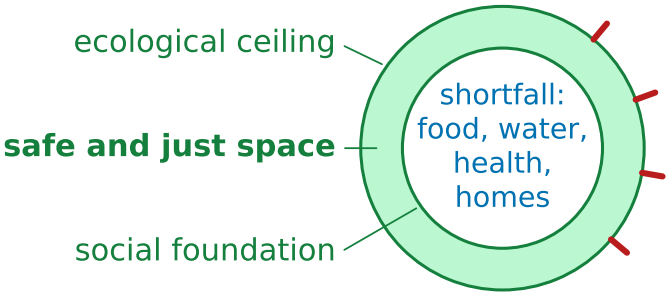
Relative decoupling

Pressure grows more slowly than GDP.

Absolute decoupling

Pressure falls while GDP grows.

Doughnut economics



Meet needs within ecological limits; this diagram is schematic.

Check: which tool?

Your turn

Which instrument directly constrains covered quantity under a monitored, enforced absolute cap?

A. A carbon tax
B. Cap and trade
C. A subsidy for solar panels
D. Contingent valuation

GDP: avoid counting the same value repeatedly

1. **Invented chain** Farm output 100; flour 160; final bread 250 units.
2. **Value added** $100+(160-100)+(250-160)=250$.
3. **Double-counting error** Adding every sale gives 510, counting intermediate value again.

Decision

GDP records final domestic production/value added, not total sales or complete wellbeing.

Efficiency and rebound

1. **Per-service gain** 20% less energy gives multiplier 0.8.
2. **More activity** 25% more services gives 1.25; total $0.8 \times 1.25 = 1.00$.
3. **Smaller response** 10% more services gives 0.88: a 12% energy reduction.

Decision

Efficiency does not guarantee a specific total-use outcome; calculate activity as well.

Test a green claim

Evidence

Check baseline, coverage, lifecycle and verified change.

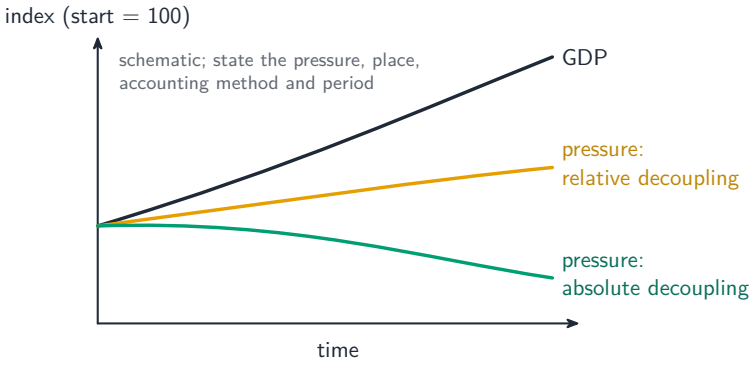
A logo or future target is not an achieved outcome.

Judgement

Use distribution, uncertainty, rights and ecological indicators.

Prices, legal limits and ethical reasoning can complement one another.

Relative and absolute decoupling



Only absolute **decoupling** cuts the total pressure

Exam tips

> Say which view you are using, environmental or ecological economics.

- Use **externality**, market failure, **public good** and internalise.
- For each tool, a named example, strengths and limits.
- Show working in trading and discounting.

Check yourself

Try these

Find the present value of 2 million yuan of damage in 50 years at 2 % and at 6 %.

Compare a carbon tax with cap and trade.

Evaluate putting a price on nature.