Environmental Economics

Sustainability, valuing externalities and policies to redress environmental degradation

How to use this guide

Information in this guide is colour-coded and labelled. Each coloured box carries a word label as well as a colour, so you can use it whether or not you distinguish the colours easily.

KEY DEFINITION	The precise meaning of a syllabus term. Learn the wording.
AUSTRALIAN CONTEXT	Real Australian evidence or data you can quote as examples.
WORKED EXAMPLE	A model, diagram or calculation worked through step by step.
COMMON MISTAKE	An error that commonly costs marks — check yourself against it.
EXAM TIP	How to turn the knowledge into marks in an exam response.
BRETTONOMICS INTERACTIVE	A matching interactive tool on brettonomics.com.

SECTION 1 Key concepts and terminology

Term	What it means
Ecologically sustainable development	Development that meets present needs without compromising the ability of future generations to meet their own needs, by maintaining the natural capital that production depends on.
Natural capital	The stock of natural assets — soil, water, air, biodiversity, minerals — from which economic activity draws.
Environmental degradation	The depletion or deterioration of natural capital through pollution, over-extraction or habitat loss.
Common access resource	A resource that is rival but non-excludable, such as fish stocks or the atmosphere, prone to over-use.
Intergenerational equity	Fairness between present and future generations in the use of natural resources.
Carbon price	A price placed on greenhouse gas emissions, through either a tax or a tradable permit scheme, so emitters face the external cost.

IN ONE SENTENCE Environmental problems are externality and property-rights problems expressed in physical form.

SECTION 2 Sustainability and the three efficiencies

2.1 Allocative efficiency

- Where production generates pollution, marginal social cost exceeds marginal private cost, so the market over-produces.
- Allocative efficiency requires output at the point where marginal social benefit equals marginal social cost, not where private curves intersect.
- Note that the socially optimal level of pollution is almost never zero: abatement itself uses resources, so the optimum balances damage avoided against the cost of avoiding it.

2.2 Productive efficiency

- Producing with less energy, water and waste per unit of output lowers cost and reduces environmental pressure simultaneously.
- Where a resource is unpriced or under-priced, firms have no incentive to economise on it, so it is used wastefully.

2.3 Dynamic efficiency

- Long-run environmental improvement depends on innovation — cleaner technologies, renewable generation, circular processes.
- A credible, durable carbon price supports dynamic efficiency by making low-emission innovation commercially rewarding.

COMMON MISTAKE

The optimal level of pollution is not zero. Eliminating all emissions would require abandoning most production. The economic objective is the socially optimal level, where the marginal cost of further abatement equals the marginal benefit of the damage it avoids.

IN ONE SENTENCE Sustainability is an efficiency problem across time, not simply an environmental preference.

SECTION 3 Environmental impacts of economic activity

3.1 The main channels

- **Emissions and pollution:** greenhouse gases, air and water pollution, and waste.
- **Resource depletion:** extraction of minerals, water, timber and fish stocks faster than they regenerate.
- **Habitat loss:** land clearing and development reducing biodiversity.
- **Land degradation:** erosion, salinity and declining soil fertility from intensive agriculture.

AUSTRALIAN CONTEXT

Australian evidence to quote. Coral bleaching events on the Great Barrier Reef; reduced inflows and over-allocation in the Murray–Darling Basin; land clearing and threatened species listings; and Australia's high emissions per person by international standards.

Using it well. Pick one example and trace it through the model — identify the external cost, who bears it, and why the market price does not reflect it.

IN ONE SENTENCE Every environmental impact in this topic is a cost borne by someone other than the decision-maker.

SECTION 4 Growth versus sustainability

4.1 The trade-off

- Higher output generally means more energy and resource use, so growth and environmental quality can conflict in the short run.
- The counter-argument is that growth funds the technology and regulation that reduce environmental pressure, so the conflict weakens as incomes rise.

4.2 The environmental Kuznets curve

KEY DEFINITION

The environmental Kuznets curve

The hypothesis. Environmental damage rises with income in the early stages of development, peaks, then falls as richer societies demand and can afford cleaner production — an inverted U.

Why it might hold. Economies shift from agriculture to industry to services, technology improves, and environmental quality behaves like a good people buy more of as income rises.

The optimism bias. Treating the curve as automatic justifies "grow now, clean later". But some damage is irreversible, some is exported to poorer countries rather than eliminated, and the curve is weak or absent for greenhouse gases.

COMMON MISTAKE

The Kuznets curve is a hypothesis, not a law. Do not assert that pollution will fall automatically once income rises. The syllabus specifically asks you to recognise the optimism bias in that reasoning.

4.3 Measuring environmental performance

- The Environmental Performance Index ranks countries on environmental health and ecosystem vitality, allowing comparison over time.
- Composite indices depend heavily on which indicators are included and how they are weighted, so rankings should be read as indicative rather than definitive.

IN ONE SENTENCE Growth can fund environmental improvement, but nothing guarantees it will.

SECTION 5 Valuing externalities

5.1 Why valuation is hard

- Many environmental assets are not traded, so there is no market price to observe.
- Damage may occur decades later, raising the question of how to discount future costs.
- Some losses, such as species extinction, are irreversible and arguably not substitutable for money at all.
- Benefits are widely dispersed while costs of action are concentrated, which shapes the politics as well as the economics.

5.2 How economists approach it

- **Revealed preference:** inferring value from related markets, for example house prices near a polluted site.
- **Stated preference:** surveying willingness to pay for an environmental improvement.
- **Replacement cost:** measuring what it would cost to restore or replace the asset.

WORKED EXAMPLE

From degradation to the socially optimal quantity

1. Draw the market. Marginal private cost (supply) and marginal private benefit (demand) give the market quantity Qm.

2. Add the external cost. Marginal social cost sits above marginal private cost by the value of the environmental damage per unit.

3. Locate the optimum. Qs is where marginal social cost meets marginal social benefit — to the left of Qm.

4. Shade the welfare loss. The triangle between the social cost and benefit curves from Qs to Qm measures the cost of over-production.

5. Set the correction. A tax equal to the external cost per unit at Qs shifts private cost onto social cost and moves the market to the optimum.

6. State the caveat. The whole correction depends on valuing the damage accurately — which is the practical difficulty.

IN ONE SENTENCE The model is straightforward; putting a defensible number on the external cost is the hard part.

SECTION 6 Government strategies and interventions

6.1 Price-based instruments

- **Carbon tax:** a tax per unit of emissions, internalising the external cost and letting firms choose how to respond.
- **Rehabilitation charges:** a charge on resource extraction that funds restoration of the site.
- **Subsidies:** payments for renewable generation, efficiency upgrades or revegetation.

6.2 Quantity-based instruments

- **Tradable permits:** the government caps total emissions, issues permits to that level and allows trading, so the target is met at least cost.
- **Quotas:** caps on catch, water extraction or logging, often allocated as transferable entitlements.

6.3 Tax versus permits

KEY DEFINITION

The central policy choice

A tax fixes the price. Firms know the cost per tonne, but the total quantity of emissions is uncertain.

Permits fix the quantity. The environmental outcome is certain, but the permit price — and therefore the cost to firms — fluctuates.

Choosing between them. Where the damage threshold matters most, cap the quantity. Where cost certainty matters most for investment, set a price.

6.4 Regulation and direct provision

- Standards, bans and licensing conditions set behaviour directly, which is effective where monitoring is simple and the harm is severe.
- Governments also provide environmental goods directly, through national parks, water infrastructure and restoration programs.

AUSTRALIAN CONTEXT

Australian climate policy. A carbon price operated from 2012 to 2014 before being repealed. The Safeguard Mechanism, reformed in 2023, now requires large industrial facilities to reduce their baseline emissions over time.

Legislated targets. Australia has legislated a 43% reduction on 2005 levels by 2030 and net zero by 2050, and in 2025 set a 2035 target of a 62–70% reduction on 2005 levels.

Resource management. Murray–Darling water entitlements and transferable fishing quotas apply the property-rights approach to common access resources.

IN ONE SENTENCE Price instruments reveal the cheapest abatement; quantity instruments guarantee the environmental result.

SECTION 7 Evaluating environmental policy

7.1 Criteria

- **Efficiency:** does it move output toward the socially optimal level at least cost?
- **Effectiveness:** does it achieve a measurable reduction in damage?
- **Equity:** who bears the cost, and is the burden regressive?
- **Dynamic effect:** does it reward innovation in cleaner technology?
- **Durability:** can it survive changes of government?

7.2 Unintended consequences

- **Carbon leakage:** emissions-intensive production relocating to jurisdictions with weaker rules, reducing global benefit.
- **Regressive effects:** energy and fuel charges absorbing a larger share of low-income household budgets.
- **Structural adjustment:** closures concentrated in particular regions and industries.
- **Investment uncertainty:** policy reversal deterring the long-lived investment the policy was meant to encourage.

> EXAM TIP
>
> **Address the equity objection directly.** The strongest answers acknowledge that environmental pricing can be regressive and then explain the remedy — recycling revenue through household compensation or income tax cuts — rather than ignoring the objection.

> IN ONE SENTENCE Judge environmental policy on damage avoided per dollar of cost, and on who ends up paying.

ASSESSMENT Multiple choice questions

20 questions covering Unit 2 Topic 2 Case option B. Answers and explanations follow the question set.

Question 1

Ecologically sustainable development is best defined as development that:

A. Maximises economic growth in the shortest possible time
B. Meets present needs without compromising the ability of future generations to meet theirs
C. Eliminates all environmental impact from production
D. Prevents any extraction of non-renewable resources

Question 2

The socially optimal level of pollution is:

A. The level where the marginal cost of further abatement equals the marginal benefit of the damage avoided
B. Always zero, since pollution imposes external costs
C. The level chosen by firms maximising private profit
D. Whatever level current technology makes unavoidable

Question 3

A factory emitting pollution causes the market to over-produce because:

A. Marginal social benefit exceeds marginal private benefit
B. Marginal private cost exceeds marginal social cost
C. Demand is more elastic than supply
D. Marginal social cost exceeds marginal private cost, so the price understates the true cost

Question 4

The environmental Kuznets curve hypothesises that environmental damage:

A. Falls continuously as income rises
B. Rises continuously and without limit as income rises
C. Rises with income, peaks, then falls as societies become richer
D. Is unrelated to the level of national income

Question 5

The "optimism bias" criticism of the Kuznets curve is that it:

A. Encourages a "grow now, clean later" approach even though some damage is irreversible
B. Overstates the cost of environmental regulation
C. Assumes governments will never intervene in markets
D. Applies only to developing economies

Question 6

A carbon tax corrects a negative externality by:

A. Capping the total quantity of emissions permitted
B. Paying firms to reduce emissions below a baseline
C. Requiring firms to install specified technology
D. Raising private cost to equal social cost, so emitters face the external cost of their decisions

Question 7

The central difference between a carbon tax and a tradable permit scheme is that:

A. A tax raises revenue while permits cannot be sold
B. Permits apply only to electricity generation
C. A tax fixes the price of emitting while permits fix the quantity of emissions
D. A tax guarantees a specific emissions outcome

Question 8

Tradable permits achieve an emissions target at least cost because:

A. They prohibit all emissions above a fixed level per firm
B. Firms that can abate cheaply do so and sell permits to firms facing higher abatement costs
C. They remove the need to set a total emissions cap
D. They guarantee that permit prices remain constant

Question 9

Carbon leakage refers to:

A. Emissions-intensive production relocating to jurisdictions with weaker environmental rules
B. Greenhouse gases escaping from storage facilities
C. Permit prices falling below the cost of abatement
D. Governments failing to collect carbon tax revenue

Question 10

A rehabilitation charge on mining is best described as:

A. A quantity instrument capping total extraction
B. A subsidy encouraging further resource development
C. A form of direct state provision
D. A price instrument requiring the extractor to fund restoration of the site

Question 11

The main difficulty in applying the externality model to environmental problems is:

A. Drawing the marginal social cost curve above marginal private cost
B. Placing a defensible monetary value on the environmental damage
C. Identifying which firms are producing the output
D. Determining whether the good is rival or excludable

Question 12

Stated preference valuation methods work by:

A. Surveying how much people say they would pay for an environmental improvement
B. Observing house prices near environmental amenities
C. Calculating the cost of replacing a damaged asset
D. Measuring the market price of emissions permits

Question 13

Which is the strongest equity objection to carbon pricing?

A. It reduces the profits of emissions-intensive firms
B. It requires government to establish a new regulator
C. Energy and fuel costs absorb a larger share of low-income household budgets, making the burden regressive
D. It makes the total quantity of emissions uncertain

Question 14

Australia has legislated an emissions reduction target for 2030 of:

A. 26% below 2005 levels, with no net zero commitment
B. 43% below 2005 levels, alongside net zero by 2050
C. 70% below 1990 levels, with net zero by 2035
D. A reduction to be determined by the Safeguard Mechanism

Question 15

The Safeguard Mechanism operates by:

A. Taxing every tonne of emissions from all sources
B. Banning new fossil fuel projects outright
C. Subsidising household solar installations
D. Requiring large industrial facilities to reduce their baseline emissions over time

Question 16

Transferable fishing quotas address over-exploitation primarily by:

A. Banning commercial fishing in all Australian waters
B. Subsidising fishers to purchase more efficient vessels
C. Capping the total catch and giving holders a tradable share, so conservation has private value
D. Taxing each kilogram of fish landed

Question 17

Why is a durable, credible carbon price argued to improve dynamic efficiency?

A. It makes low-emission innovation commercially rewarding over the life of long-lived investments
B. It lowers the average cost of existing production immediately
C. It guarantees that emissions fall to zero
D. It removes the need for environmental regulation

Question 18

The Environmental Performance Index should be interpreted cautiously because:

A. It measures only greenhouse gas emissions

B. It is published only for developing economies

C. It cannot be compared across time periods

D. Composite indices depend on which indicators are chosen and how they are weighted

Question 19

A government must choose between a carbon tax and a permit scheme where exceeding a specific emissions threshold would cause irreversible damage. The stronger choice is:

A. A carbon tax, because it gives firms certainty about cost

B. A permit scheme, because it fixes the quantity of emissions and so guarantees the threshold is not breached

C. Neither, because both leave the outcome uncertain

D. A subsidy for abatement, because it avoids imposing costs on firms

Question 20

Which statement best reflects a balanced evaluation of environmental intervention?

A. Any intervention that reduces emissions is economically justified

B. Intervention is never justified because it reduces economic growth

C. Intervention is justified where the damage avoided exceeds the cost of the policy, including its distributional and adjustment effects

D. Environmental policy should be judged only on its effect on GDP

ASSESSMENT

Marking guide

Answer key

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	A	D	C	A	D	C	B	A	D
Q11	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**	**Q17**	**Q18**	**Q19**	**Q20**
B	A	C	B	D	C	A	D	B	C

Explanations

Q1 **B** The definition centres on intergenerational equity and maintaining natural capital, not on eliminating impact altogether.

Q2 **A** Abatement uses resources, so the optimum balances damage avoided against the cost of avoiding it. Zero pollution is not an economic objective.

Q3 **D** The unpriced external cost means the supply curve understates the true social cost of production.

Q4 **C** The hypothesis is an inverted U. Whether it holds, especially for greenhouse gases, is contested.

Q5 **A** Treating the downturn as automatic ignores irreversibility and the export of polluting production to other countries.

Q6 **D** A tax is a price instrument that internalises the external cost; capping quantity describes a permit scheme.

Q7 **C** With a tax the emissions total is uncertain; with a cap the price is uncertain. That trade-off drives the policy choice.

Q8 **B** Trading concentrates abatement where it is cheapest, which is the efficiency argument for cap and trade.

Q9 **A** Leakage reduces the global benefit of unilateral action, which is why coordination problems matter in this topic.

Q10 **D** The charge internalises the restoration cost that would otherwise fall on the community.

Q11 **B** The theory is straightforward; valuing non-traded, long-delayed and sometimes irreversible damage is the practical obstacle.

Q12 **A** Stated preference asks directly; revealed preference infers value from behaviour in related markets.

Q13 **C** The regressive burden is the standard equity objection, usually answered by recycling revenue to households.

Q14 **B** The Climate Change Act legislates 43% by 2030 and net zero by 2050; a 2035 target of 62–70% below 2005 was set in 2025.

Q15 **D** It is a baseline-and-decline scheme applying to large emitting facilities rather than an economy-wide tax.

Q16 **C** Defining and capping the right internalises the depletion cost; tradability moves the right to its highest-value use.

Q17 **A** Investment in clean technology is long-lived, so expectations about future policy determine whether it is funded.

Q18 **D** Index construction choices drive rankings, so the EPI is indicative rather than definitive.

Q19 **B** Where the physical threshold is what matters, certainty about quantity outweighs certainty about price.

Q20 **C** The test is net benefit including equity and adjustment costs, not emissions reduction or growth considered in isolation.