



BUS272 Changing Economies of Asia

The Environment and Economic Growth

Lecture 10

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Supplement Version

(Lee Lao Shi)

Introduction



- The NIEs provide a model of economic development but do they provide a model of *sustainable economic development*? (Refer to lecture 1 supplement notes on differences between sustainable growth and development. Sustainable development includes sustainability of environment)
- A wide range of **environmental problems** including water and air pollution, loss of forest, wildlife and biodiversity, generation of toxic wastes and generation of solid wastes
- In the last 30 years Asia has lost about 50% of its forest and fish stocks and nearly 33% of its land area has been degraded

Economics of the environment

- Market of an environmental good
- Market failure
 - When the market determined price and output levels of environmental goods **are not efficient** i.e., **disparity** between MSC and MPC or MSB and MPB for a market at Q^* level of production
- Externalities (Refer to Lecture 3 Supplement Notes)
 - An **externality** is a third party effect of market activity not recognised by the buyers and sellers participating in the market activity
 - Can be positive or negative e.g., Greenhouse gases represent an over use of a common property resource (the atmosphere)
- Externalities and property rights
- Solutions
 - **Public education**
 - **Regulations**
 - **Economic incentives**

Economics of the environment (Supplement Notes)



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Definition of MPC (Marginal Private Cost)

The marginal private cost is the **cost to the firm** of producing **an additional unit** of given good or service. There may also be external costs from production and these are added to the private cost to give the total social cost.

Definition of MPB (Marginal Private Benefit)

The **additional satisfaction or utility** that a person receives from **consuming an additional unit** of a good or service. A person's marginal benefit is the maximum amount they are willing to pay to consume that additional unit of a good or service. In a normal situation, the marginal benefit will decrease as consumption increases.

For example, assume there is a consumer wishing to purchase an additional burger. If this consumer is willing to pay \$10 for that additional burger, then the marginal benefit of consuming that burger is \$10. The more burgers the consumer has, the less he or she will want to pay for the next one. This is because the benefit decreases as the quantity consumed increases.

It is important to note that even though the consumer is willing to pay \$10 for the burger, this will not necessarily be the burger's price; this is determined by market forces. The difference between the market price and the price the consumer is willing to pay is called consumer surplus.

Economics of the environment (Supplement Notes)



Definition of MSC (Marginal Social Cost):

The **total cost to society** as a whole for **producing one further unit**, or taking one further action, in an economy. This total cost of producing **one extra unit** of something is not simply the direct cost borne by the producer, but also must include the **costs to the external environment and other stakeholders**.

Calculated as:

Where:

MSC = Marginal Social Cost

MPC = Marginal Private Cost

MEC = Marginal External Cost (Positive)

$$\mathbf{MSC = MPC + MEC}$$

Economics of the environment (Supplement Notes)



For example, take the case of a coal plant polluting a local river. If the coal plant's marginal social costs are more than its marginal private costs, the MEC must be positive (and therefore resulting in a negative externality, or effect on the environment.) The cost of the produced energy is more than just the rate charged by the company, as society must bear the costs of a polluted river and the effects of that action.

While marginal social cost represents a powerful economic principle, it can rarely be expressed in tangible dollars. We know that there are costs incurred by certain acts of production, although their far-reaching effects make them difficult to quantify. The theory helps legislators and economists come up with a framework to "incentivize" companies to reduce the marginal social costs of their actions.

Economics of the environment (Supplement Notes)



Definition of MSB (Marginal Social Benefit):

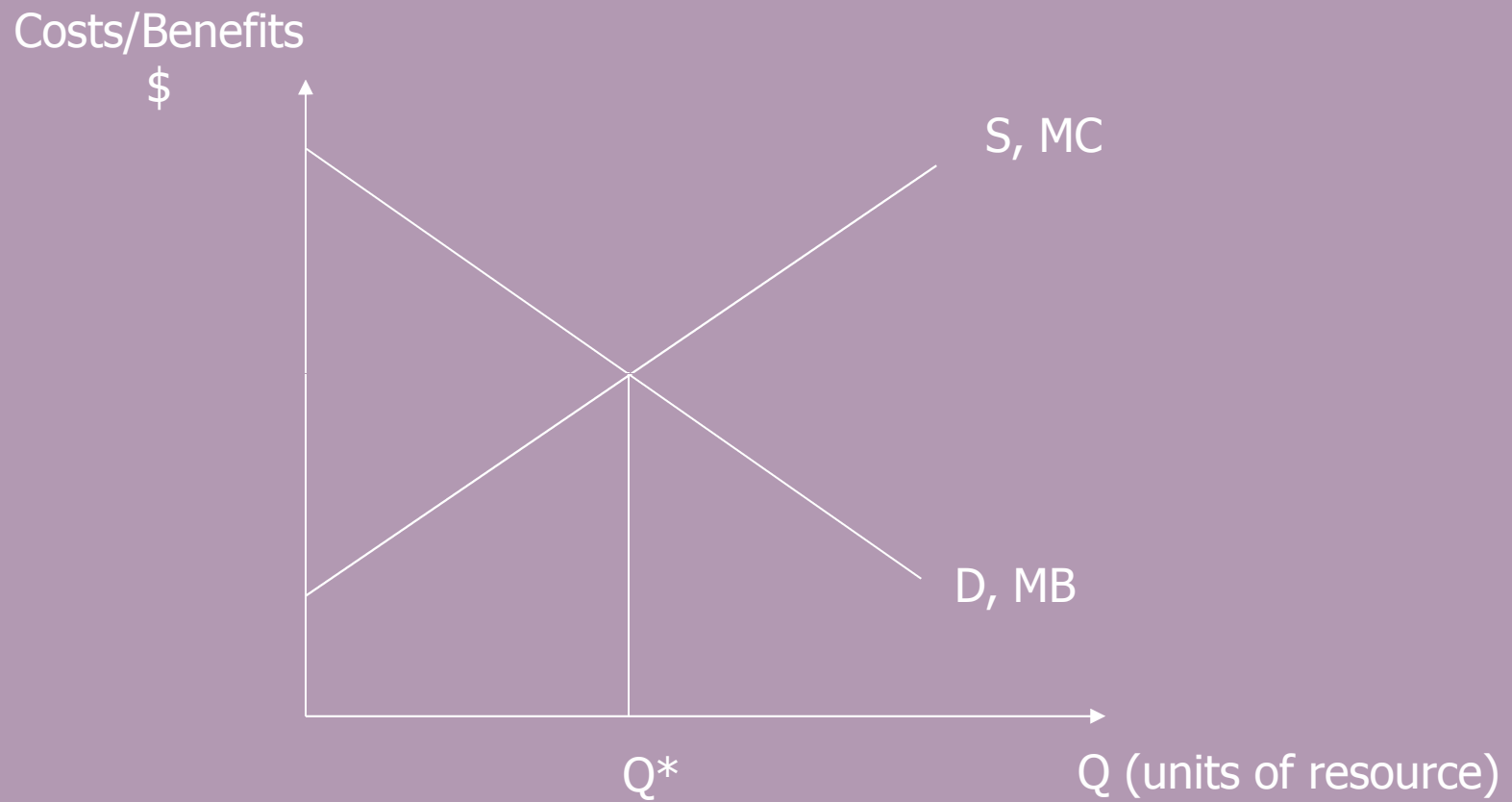
Marginal social benefit is equal to the private marginal benefit a good provides plus any external benefits it creates. In other words, MSB gives the total marginal benefit of the good to society as a whole. In mathematical notation:

$$\text{MSB} = \text{MPB} + \text{MEB} \quad (\text{where MEB is marginal externalities benefit})$$

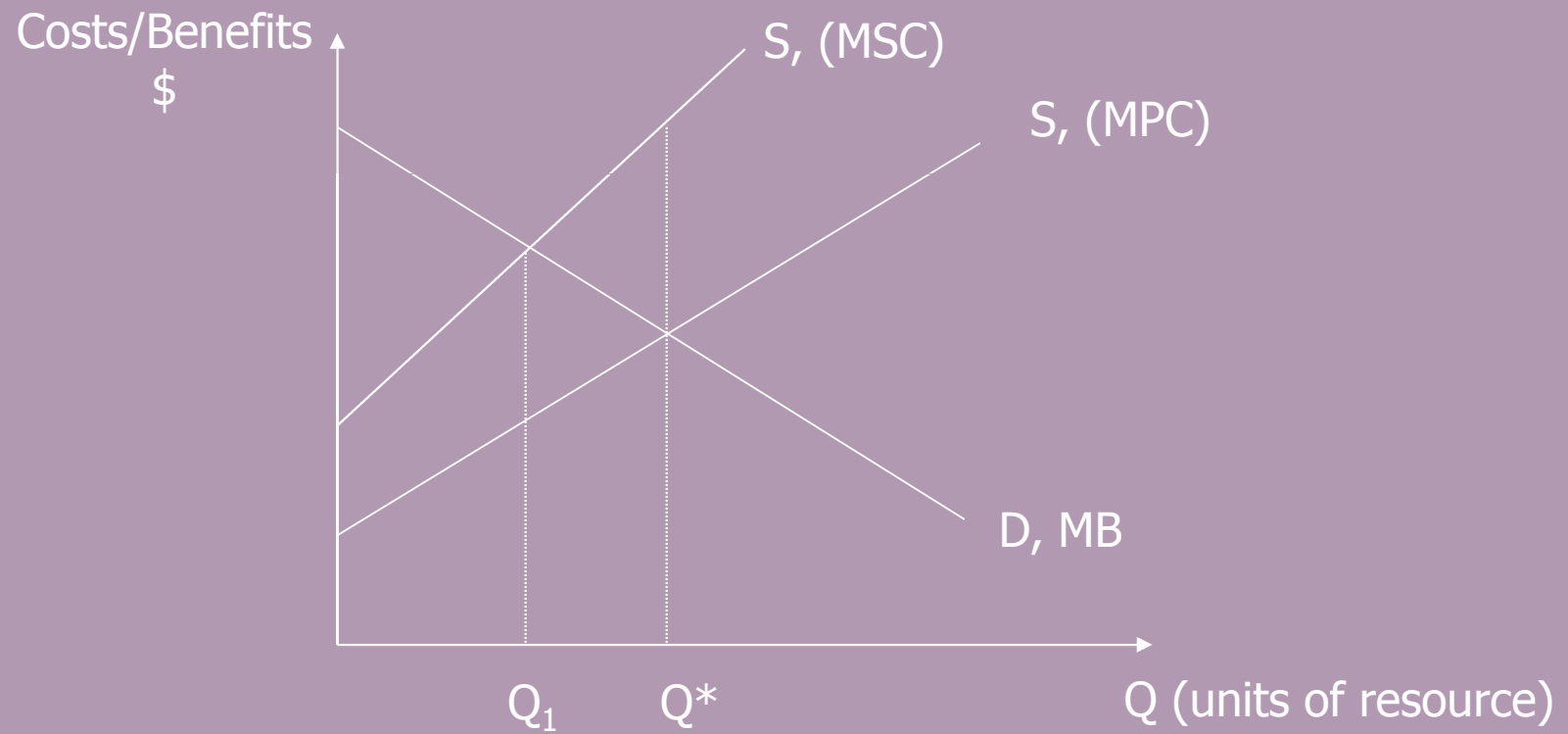
It is used for evaluating efficiency in the presence of positive externalities.

As an example, suppose a company is thinking about buying and redeveloping part of an old abandoned industrial site near the center of a city. Such areas are called "brownfields" and are a big problem for many cities because they are unsightly and may be polluted. Thus by redeveloping it, it adds a scenic view and reduces pollution level to the city dwellers – a MSB here.

The Market of an Environmental Good



An Example of Market Failure



Sustainable economic development

- **Environmental degradation** refers to **damage** that reduces the **sustainability of economic growth** and **human welfare**
- If development is to be sustainable **greater attention** has to be given to the **environment**. **Rising real income** will remain a **major goal** but there is a need to understand the **environmental trade offs**
- **Definition:** A **development path** is **sustainable** if and only if the stock of overall **capital assets** remains **constant** or **rises** over time
 - Capital Assets include:
 - manufacturing machines
 - human capital
 - environmental capital
- Living within ones means is not decreasing **overall** capital assets

Supplement Notes

Environmental Degradation is the **deterioration in environmental quality** from ambient concentrations of pollutants and other activities and processes such as improper land use and natural disasters.

In most instances the definition is derived from statistical standards developed by international organisations such as the IMF, OECD, Eurostat, ILO. Where possible, the definition has been quoted word for word from the source.

-- Source: OECD

Nominal vs Real Income

Nominal income is the term used to describe an **individual's wages** based in a particular currency without factoring in inflationary or deflationary effects on the unit of measure. **Real income** is the term used to describe an individual's wages based on their **actual purchasing power** (i.e., in relation to inflation effect).



Relax: Watch a video now!!!

- **The world greatest industrial disaster.**
- **Bhopal Gas Tragedy, India.**
- **December 1984**
- **MNC involved: Union Carbide**
- **Effect: 5,000 to 20,000 dead, 500,000 permanently affected in health condition, many turned blinded**
- **Justice: yet to be settled in court appeal**



Lecture 10 - Bhopal Disaster.mp4

Sustainable economic development

- **Measuring sustainable income** requires **adjustment of national accounts**

$$\text{NET NATIONAL PRODUCT} = \text{GNP} - \text{Dm} - \text{Dn}$$

Dm = depreciation on manufactured capital

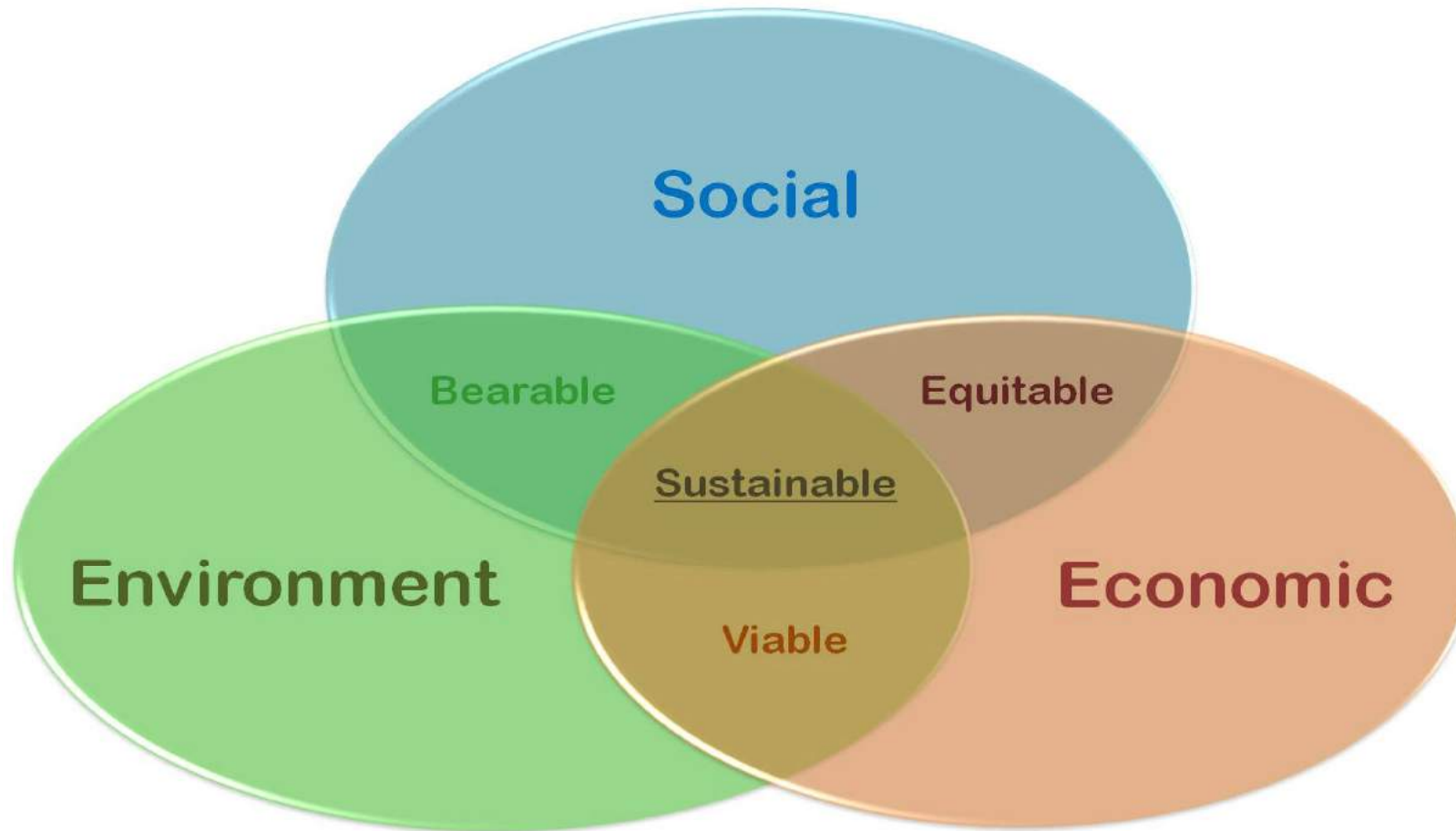
Dn = depreciation on natural (environmental) capital

Dn is made up in 2 ways:

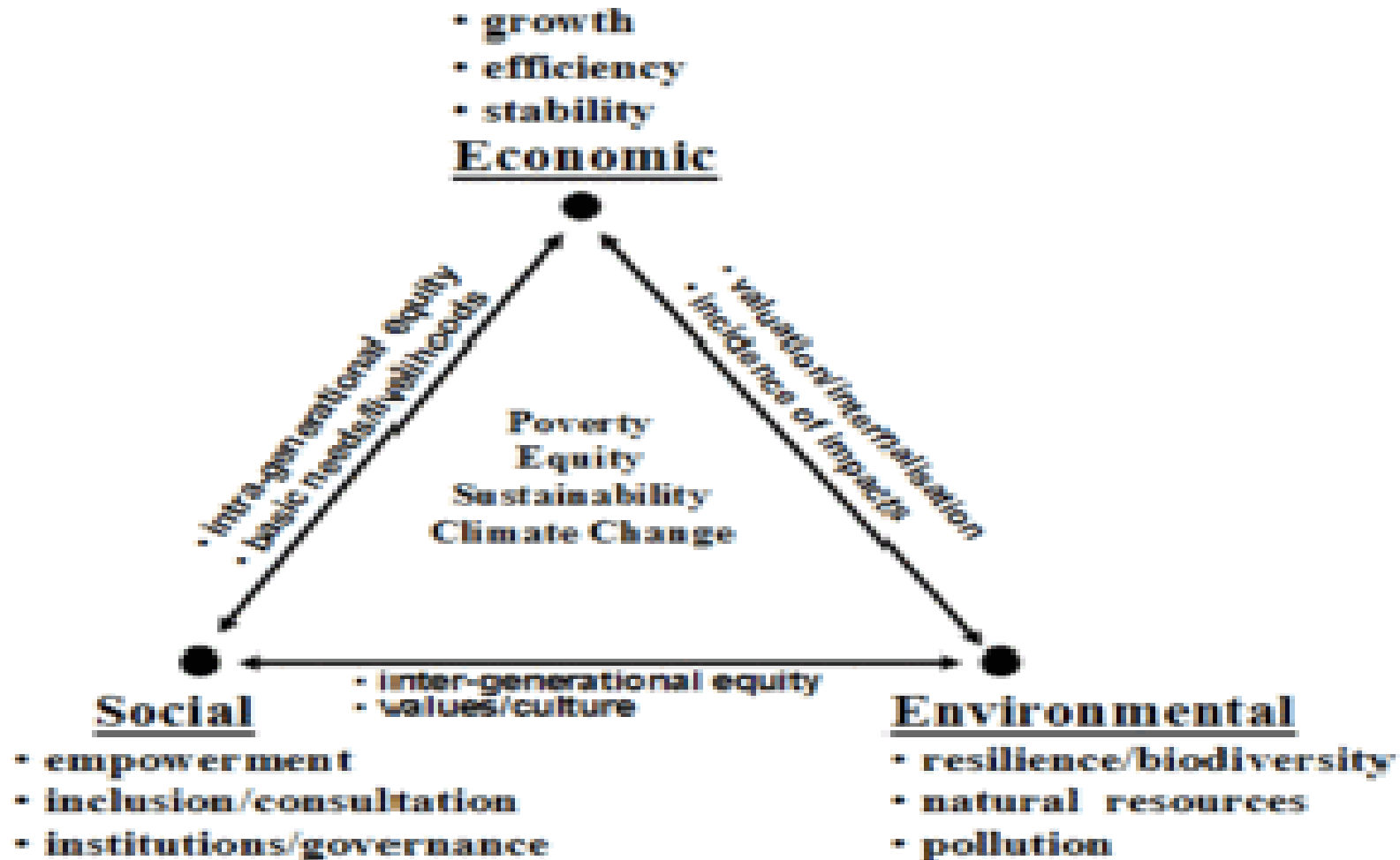
- losses of unrecorded GNP eg wildlife species
 - losses of GNP that would otherwise be recorded eg pollution
- This approach can be expanded as follows
 - R = restorative expenditure
 - A = aversive expenditure
 - N = overstatement due to non-optimal use of resources

So **Sustainable National Income = GNP - (R + A + N) - (Dm + Dn)**

Sustainable economic development



Sustainable economic development



Source: Ida Kubiszewski,

<http://theconversation.com/beyond-gdp-are-there-better-ways-to-measure-well-being-33414>

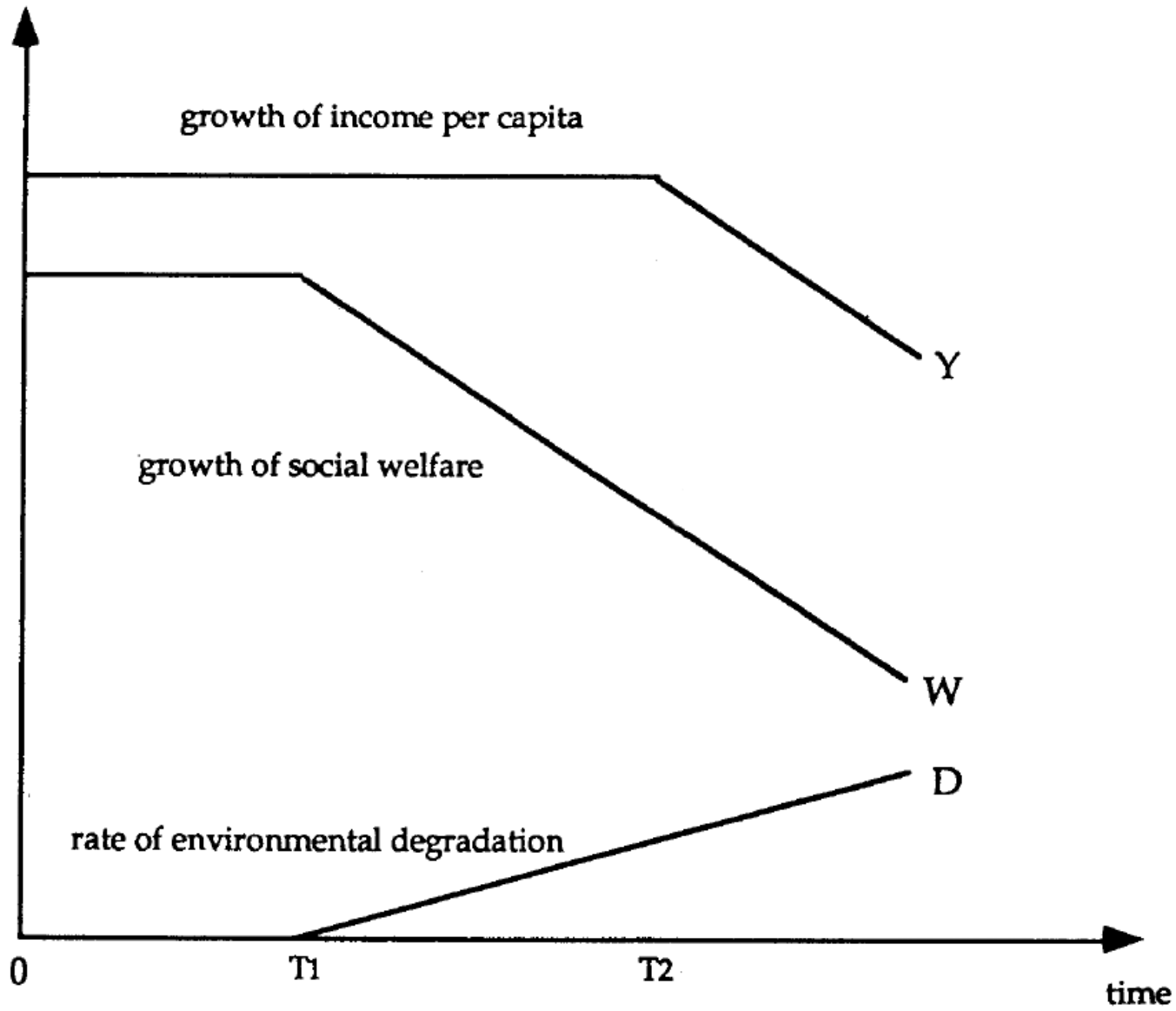
Alternative national indicators of welfare and well-being

Indicator	Explanation	Coverage
<p>Index of Sustainable Economic Welfare (ISEW) & Genuine Progress Indicator (GPI)</p> <p>Type: GDP modification Unit: dollar</p>	<p>Personal consumption expenditures weighted by income distribution, with volunteer and household work added and environmental and social costs subtracted.</p>	<ul style="list-style-type: none"> 17 countries, several states and regions 1950 - various years subtracted.
<p>Genuine savings</p> <p>Type: Income accounts modification Unit: dollar</p>	<p>Level of saving after depreciation of produced capital, investments in human capital, depletion of minerals, energy, and forests, and damages from local and global air pollutants are accounted for.</p>	<ul style="list-style-type: none"> 140 countries 1970 - 2008
<p>Inclusive Wealth Index</p> <p>Type: Capital accounts modification Unit: dollar</p>	<p>Asset wealth including built, human, and natural resources.</p>	<ul style="list-style-type: none"> 20 countries 1990-2008
<p>Australian Unity Well-Being Index</p> <p>Type: Survey based index Unit: Index</p>	<p>Annual survey of various aspects of well-being and quality of life.</p>	<ul style="list-style-type: none"> Australia 2001-present
<p>Gallup-Healthways Well-Being Index</p> <p>Type: Survey based index Unit: Index</p>	<p>Annual survey in taking into account five elements: purpose (employment, etc), social, financial, community and physical (health).</p>	<ul style="list-style-type: none"> 50 states of the USA, expanded to 135 countries in 2013. 2008-present
<p>Gross National Happiness</p> <p>Type: Survey based index Unit: Index</p>	<p>Detailed in-person survey around nine domains: psychological well-being, standard of living, governance, health, education, community vitality, cultural diversity, time use, and ecological diversity.</p>	<ul style="list-style-type: none"> Bhutan 2010
<p>Human Development Index</p> <p>Type: Composite index Unit: Index</p>	<p>Index of GDP per person, spending on health and education, and life expectancy.</p>	<ul style="list-style-type: none"> 177 countries 1980 - present
<p>Happy Planet Index</p> <p>Type: Composite index Unit: Index</p>	<p>A calculation based on subjective well being multiplied by life expectancy divided by ecological footprint.</p>	<ul style="list-style-type: none"> 153 countries 3 years
<p>OECD Better Life Index</p> <p>Type: Composite index Unit: Index</p>	<p>Includes housing, income, jobs, community education, environment, civic engagement, health, life satisfaction, safety, and work-life balance.</p>	<ul style="list-style-type: none"> 36 OECD countries 1 year

The impact of economic growth on the environment and social welfare

- The figure illustrates the **hypothetical relationship between growth and the environment**
- Beyond point **T2 economic productivity may fall**

The relationship between economic development and environmental degradation



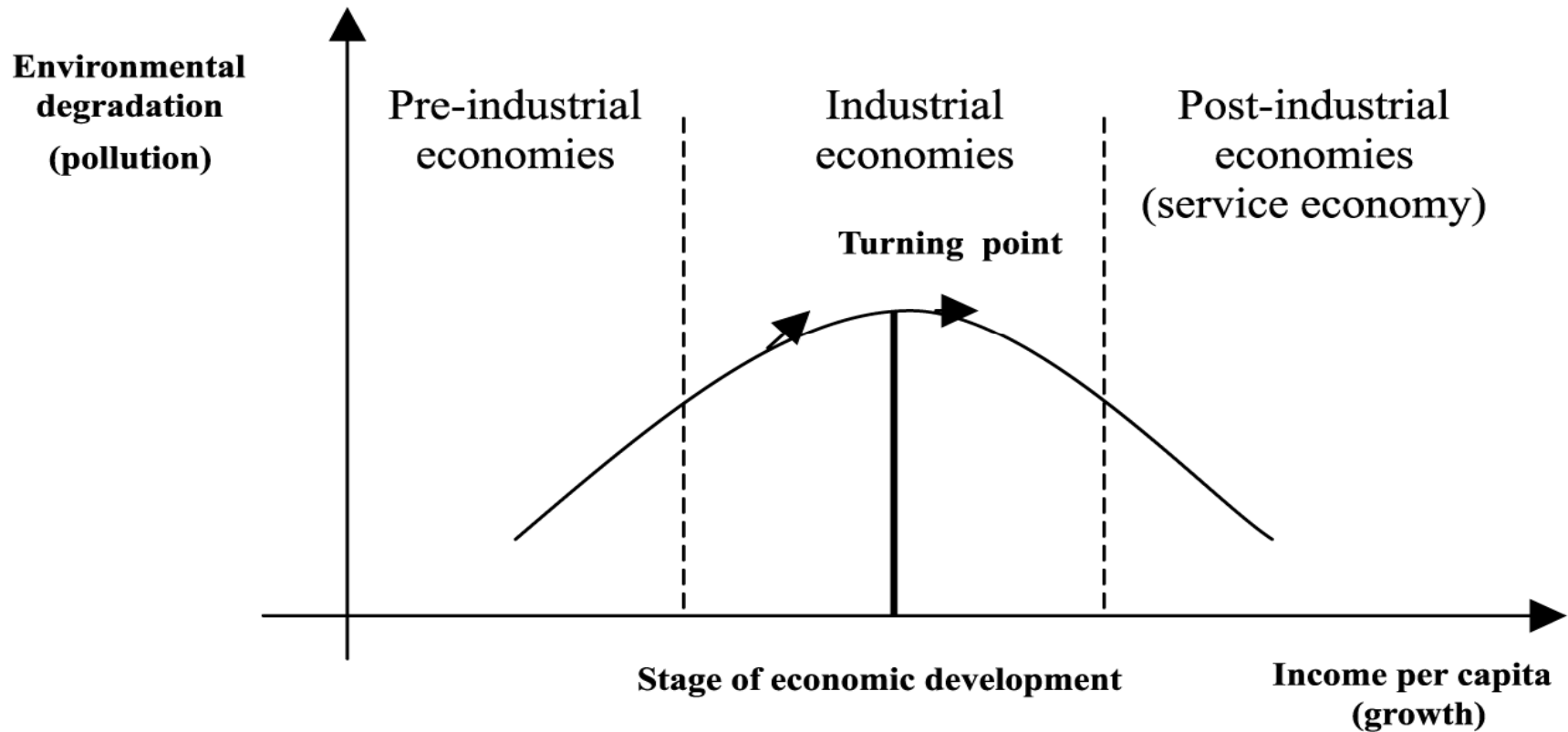
Source: The Steering Committee, *Taiwan 2000*, p. 290.

The relationship between growth and the environment

- There are at least **three possibilities**:
 - **Increased output may lead to improvements in environmental quality**
 - There may be an **inverted U shaped relationship between growth and the environment** (Environmental Kuznet's Curve)
 - Some types of **pollutants may continue** to increase along with the growth of output

Environmental Kuznet's Curve

(Supplement Notes)



Source: Panayotou (1993)

Environmental Kuznet's Curve

(Supplement Notes)

The **Environmental Kuznets curve** is a hypothesised relationship between environmental quality and economic development: various indicators of environmental degradation tend to get worse as modern economic growth occurs until average income reaches a certain point over the course of development. Although the subject of continuing debate, some evidence supports the claim that **environmental health indicators**, such as water and air pollution, show the **inverted U-shaped curve**. It has been argued that this trend occurs in the level of many of the environmental pollutants, such as sulfur dioxide, nitrogen oxide, lead, DDT, chlorofluorocarbons, sewage, and other chemicals previously released directly into the air or water.

Growth and the environment

- **Structural change** can generate **environmental *gratis* effects** (i.e, the environment becomes beneficial to us, usually cost-free or positive externalities then, thru its improvement by deliberate structural change.)
- ‘**Environmental dumping**’
- **Advantages of backwardness-** But why have developing countries not benefited from the experience of developed countries?
- The **environment is a *normal good***, ie., it has a **positive income elasticity**. Thus as incomes rise people demand improvements in environmental quality

ENVIRONMENTAL EFFICIENCY (Supplement Notes)

Macro-economy – structural change

- From manufacturing to service industry
- From energy intensive to information intensive

Micro-economy – innovation

- From 'dirty' to 'clean' technologies
- From 'end-of-pipe' to 'up-stream' solutions

Environmental Dumping

Environmental dumping is the practice of transfrontier shipment of waste (household waste, industrial/nuclear waste, etc.) from one country to another. The goal is to take the waste to a country that has less strict environmental laws, or environmental laws that are not strictly enforced. The economic benefit of this practice is cheap disposal or recycling of waste without the economic regulations of the original country.

Definition of 'Normal Good'

An economic term used to describe the **quantity demanded for a particular good or service** as a result of a **change in the given level of income**. A normal good is one that experiences an **increase in demand** as the **real income of an individual or economy increases**.

Another way to define a normal good is by calculating its **income elasticity of demand**. If this coefficient is positive and lower than 1, the good is considered to be a normal good.

In most circumstances, as the income of an economy increases, there is an increase in the demand for goods and services. One example might be luxury cars; as the income level increases, more people buy or demand these cars.

However, when income rises, demand for some goods and services may be negatively affected. For example, as the income level increases, fewer people might use the public transportation system. In this case, the bus or train would be considered an inferior good or service because its demand has gone down.

In this topic here, we consider **Environment** is a **normal good** here. When an individual or economy grows in real income, the demand of Environment as good (namely in **good quality condition**) grows correspondently.

Impact of the Asian crisis 1997

- In the short run, sharp falls in incomes and output reduced pollution
- A prolonged recession places increased pressure on natural resources e.g., forests, fish stocks and minerals as people try to maintain consumption or pay debts
- Public expenditure on environmental management was reduced
- The financial and environmental crises had similar roots i.e., rapid growth without adequate safeguards and controls
- Collusion between government and private sector has prevented adequate regulation and management e.g., forests in Indonesia

International cooperation

- A role for **international agencies** such as the OECD, ASEAN, APEC
- **Kyoto Protocol 1997**
 - Countries that ratified this protocol agreed **to reduce their emissions of greenhouse gases**, or engage in **emissions trading** if they maintained or increase emissions of these gases
 - 2008-2012 first commitment period
- **Doha Amendment 2013- 20**
 - **37 countries signed up** for second commitment period including Australia and EU

Stern Review on the economics of climate change (2006)



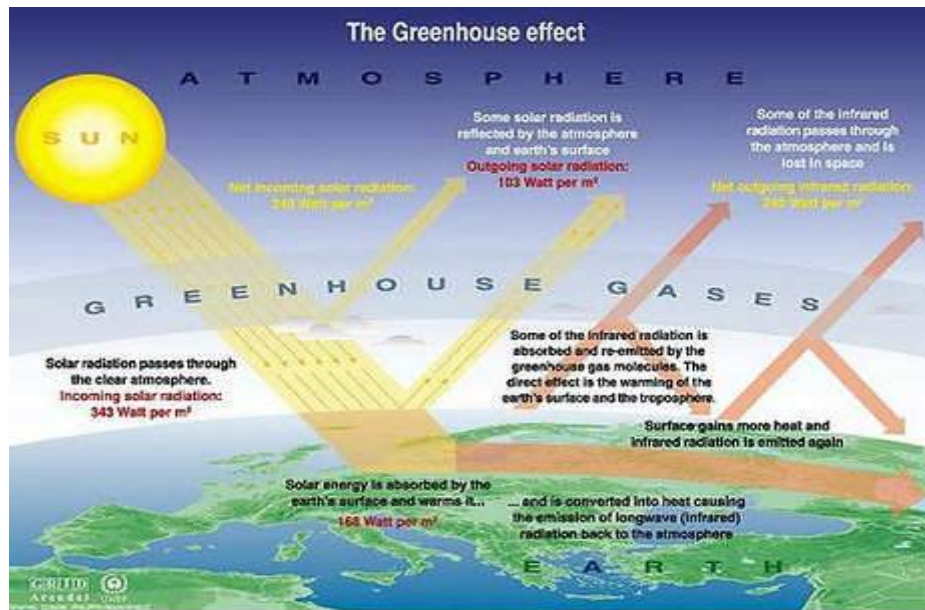
- Greenhouse gas emissions are an externality, “the greatest market failure the world has seen” (Stern, 2006)
- Risks of severe climate change increases as global temperatures rise
- Global emissions vary by sector of the economy but all need attention
- Review estimated that the cost of climate change is equivalent to 5 per cent of global GDP per year, but it could rise to as high as 20 per cent
- The cost of reducing greenhouse gas emissions is about 1 per cent of global GDP per year

Supplement Notes

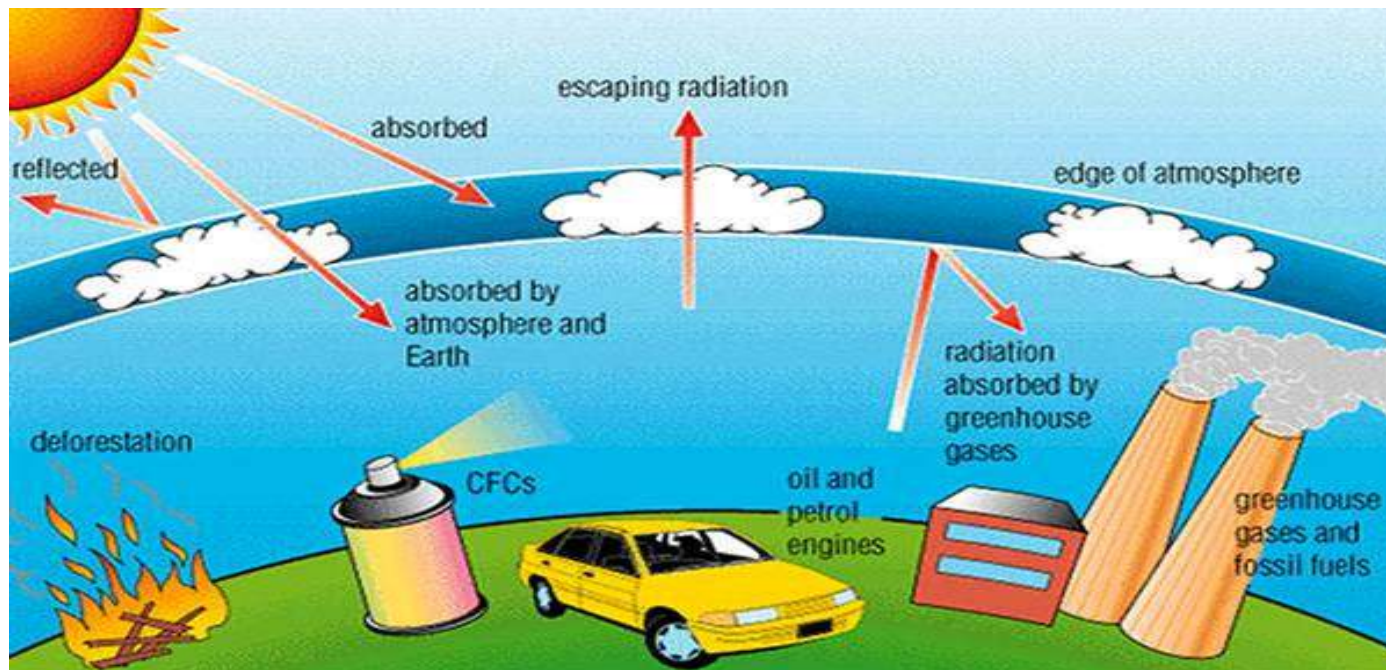
Greenhouse Gases include methane, chlorofluorocarbons and carbon dioxide. These gases act as a shield that **traps heat in the earth's atmosphere**. The resulting greenhouse gas effect is thought to contribute to **global warming**.

Greenhouse Effect: The retention of part of the Sun's energy in the **Earth's atmosphere** in the form of **heat** as a result of the **presence of greenhouse gases**. Although some of this **radiation** escapes into space, much of it is absorbed by greenhouse gases in the lower atmosphere, which in turn **re-radiate a portion back to the Earth's surface**. The intensification of its effect due to increased levels of greenhouse gases in the atmosphere is considered to be the main contributing factor to **global warming**.

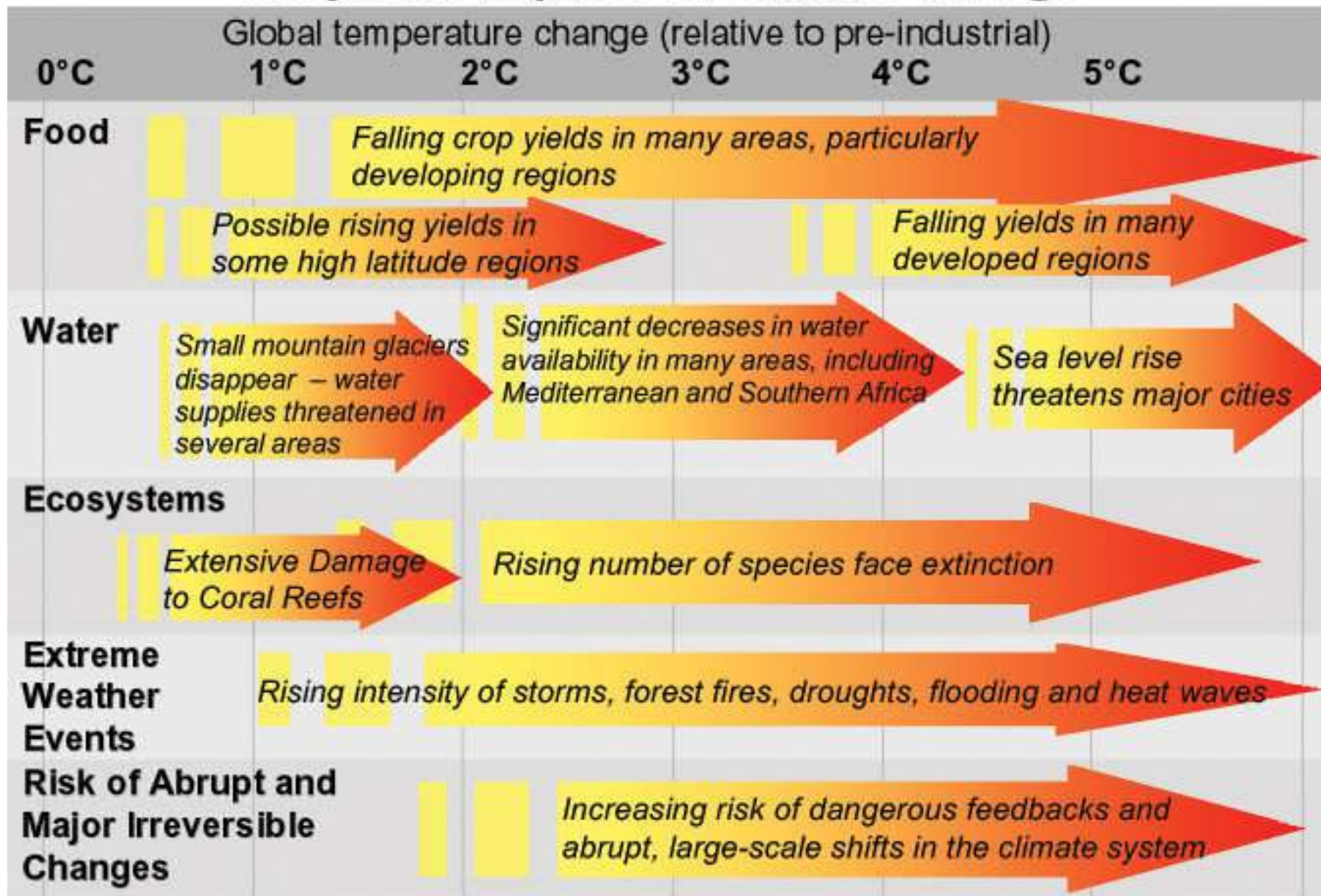
Global Warming: an **increase in the earth's atmospheric and oceanic temperatures** widely predicted to occur due to **an increase in the greenhouse effect** resulting especially from **pollution**. The present warming is generally attributed to an increase in the **greenhouse effect**, brought about by increased levels of **greenhouse gases**, largely due to the effects of **human industry and agriculture**. Expected long-term effects of current global warming are **rising sea levels, flooding, melting of polar ice caps and glaciers**, fluctuations in temperature and precipitation, more frequent and stronger El Niños and La Niñas, drought, heat waves, and forest fires.



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography, United States Environmental Protection Agency (EPA), Washington, Climate change 1996, The science of climate change, contribution of working group I to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

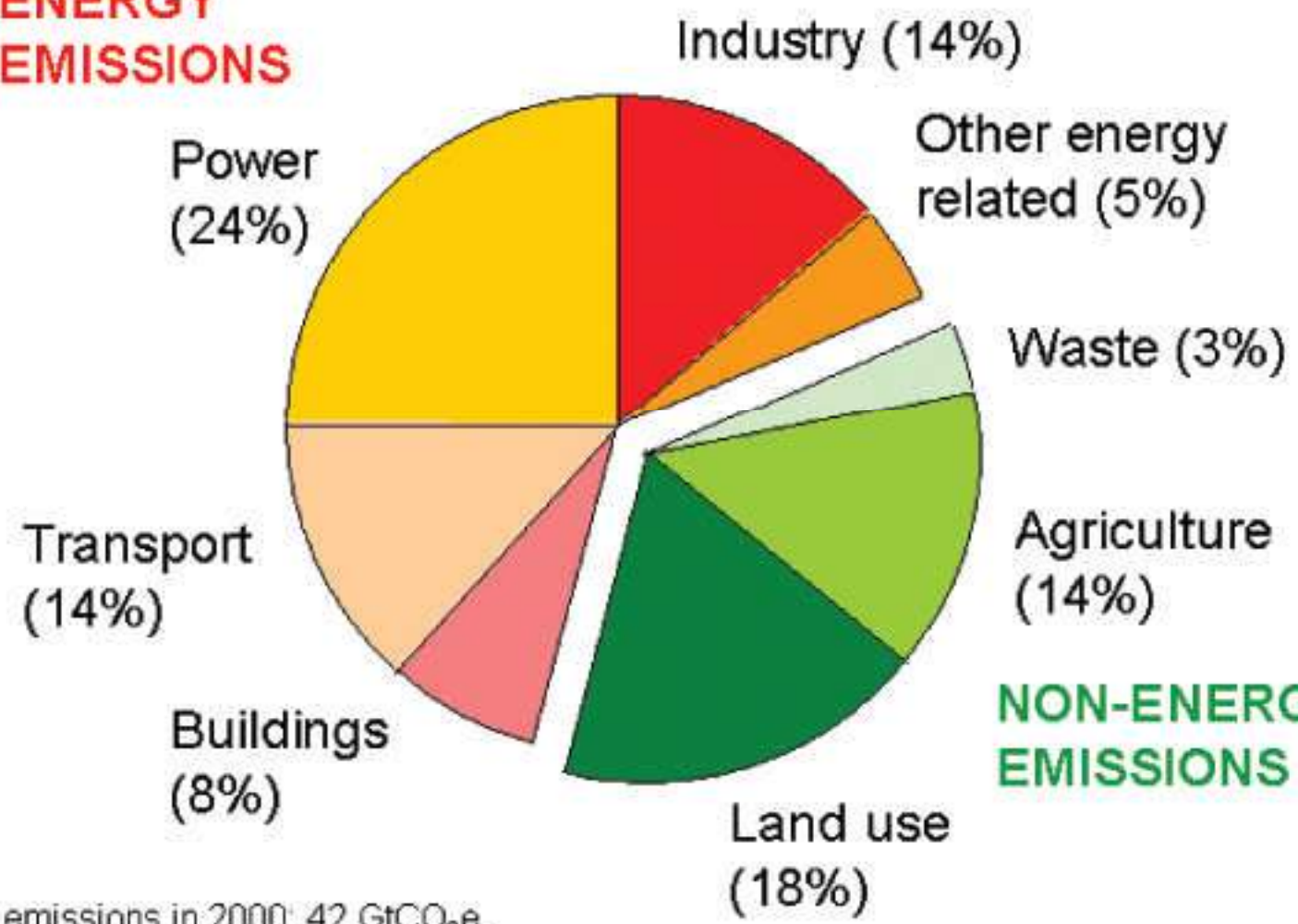


Projected Impacts of Climate Change



Global Emissions by Sector

**ENERGY
EMISSIONS**



**NON-ENERGY
EMISSIONS**

Total emissions in 2000: 42 GtCO₂e.

Stern Review on the economics of climate change (2006)

- According to the Review the **policies needed include:**
 - Carbon tax
 - Improved technology
 - Deal with market failure
 - Multilateralism
 - **Increase overseas aid** to 0.7 per cent of GDP by 2015

A **Carbon Tax** is usually defined as a **tax based on greenhouse gas emissions** (GHG) generated from burning fuels.

It puts a **price on each tonne of GHG emitted**, sending a **price signal** that will, over time, elicit a powerful market response across the entire economy, resulting in **reduced emissions**. It has the advantage of providing an incentive without favouring any one way of reducing emissions over another.

By reducing fuel consumption, increasing fuel efficiency, using cleaner fuels and adopting new technology, businesses and individuals can reduce the amount they pay in carbon tax, or even offset it altogether.

Climate change

- In an interview at the World Economic Forum in Davos, Stern said:

"Looking back, I underestimated the risks. The planet and the atmosphere seem to be absorbing less carbon than we expected, and emissions are rising pretty strongly. Some of the effects are coming through more quickly than we thought then" (*The Observer*, Saturday 26 January 2013)

- Also at Davos, Jim Yong Kim, president of the World Bank, warned about the risk of conflicts over natural resources if the forecast of a 4 degree increase above the historical average proves accurate:

"There will be water and food fights everywhere"

A case study of Taiwan

- In 1945 Taiwan was a **backward agricultural economy**, suffering from severe **war damage**
- By the 1990s Taiwan was a **developed economy** characterised by a low level of foreign debt, inflation and unemployment, a substantial trade surplus and a population enjoying rapidly rising living standards
- Along with other **Newly Industrialising Economies**, Taiwan has succeeded in mastering modern technology but it has been **less successful** in managing the **environmental risks** associated with economic growth
- In many respects, Taiwan has **replicated the environmental history** of Asia's first industrial nation, **Japan** (See M. Tull and A. R. Krishnan, 'Resource use and environmental management in Japan 1890-1990', *Australian Economic History Review*, Vol, 34, No. 2 (1994) pp.3-23).





A case study of Taiwan

- The Portuguese called Taiwan Formosa, or 'Beautiful Island', but **much of that beauty has disappeared** in the interests of economic development
- Taiwan is a **densely populated island** with **few natural resources**
- Almost all of **Taiwan's rivers** are **polluted** by the time they reach the sea
- Its farmers are some of the world's **heaviest users of fertilisers and pesticides** and this has led to **contamination of water sources**
- Less than ten per cent of **human waste** receives **primary sewage treatment**; most raw sewage is simply **discharged straight into rivers or the sea**
- The lack of adequate treatment of human waste has contributed to the **spread of hepatitis and other water-borne diseases**
- **Emissions from vehicles** are high and **air pollution** is a serious problem in the **major cities**

A case study of Taiwan



- A **major turning point** occurred in the late **1980s**
- The **removal of martial law** in 1987 and the move towards **democracy** made it **possible for Taiwanese citizens to actively oppose developments** which threatened the environment
- “At first, economic development covered only our ankles, and we wanted more. Now, it is up to our waists, and many people feel they have enough. What we fear most is that we' ll find ourselves up to our necks in development, and then it will be too late.”
- Hs_ Han-ch'ing, a teacher at a school in Lukang, Taiwan, 1988 (cited in Reardon-Anderson 1992, p.13).

A case study of Taiwan



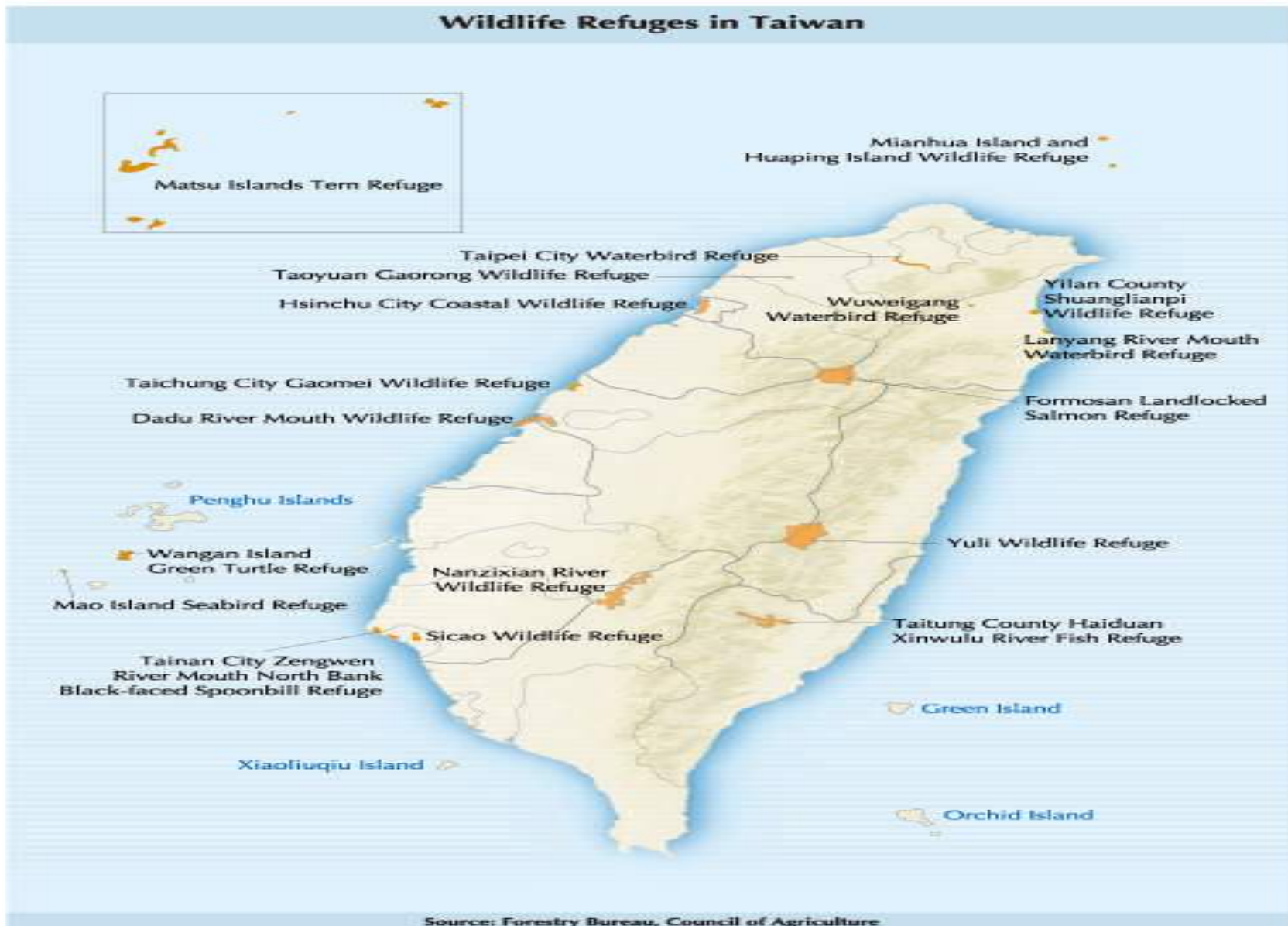
- *Taiwan 2000*, a detailed report on **Taiwan's environmental situation** published in 1989, concluded that the 'growth at all costs strategy' had led to serious damage to the environment and threatened to turn Taiwan into 'a sort of poisonous garbage dump' (The Steering Committee 1989, pp. 15-23)
- The government publicly conceded that 'Taiwan has paid a **heavy price** for its **economic miracle**' (ROC *Yearbook*, 1993, p.249)

A case study of Taiwan



- The government established an **Environmental Protection Agency** in 1987 and has implemented **numerous initiatives** to improve the environment
- **‘Public Policies Go Green’** - for details see Yearbook 2012
http://www.ey.gov.tw/en/Content_List.aspx?n=5715464F025572FF
- **Relationship with China-** the **re-unification** issue

Wildlife Refuges in Taiwan



Source: Forestry Bureau, Council of Agriculture

Summary and conclusions

- Economic growth in many NIEs is not environmentally sustainable
- Increasing pressure on the global environment eg., the Greenhouse effect, means that a ‘*grow now, clean up later*’ approach to the environment is no longer possible
- Challenge of climate change
- International cooperation is vital if solutions are to be found