Minerals are natural compounds formed through geological processes that are extracted from the Earth in order to undergo a technological process that will make them suitable for human use.

- They are **non-renewable**, **spatially distributed**, **durable** and can be **metals** or **non-metals**.

$$S_1 = S_0 - Q_0 + \Delta S$$

- For a **non-renewable resource** $\Delta S = 0$.
- For recyclable (durable resources $\Delta S = cQ_0$ where **c** is the fraction recycled.

Mineral Industries are productive organisations that engage in exploration for minerals, their extraction, processing, transport, marketing and financing.

Mineral Deposits (**Proven Reserves**) can be treated as valuable assets in their naturally occurring state.

The **economic problem** is how to allocate these scare resources or assets for use in a most economically efficient way, taking into account the relationship between **technology**, **resource availability**, **prices**, **investment opportunities and returns**, and **human time preferences**.

Economic growth is not always related to a country's availability of resources but rather the way in which they are managed and the way the proceeds from mining of minerals are **re-transmitted in the economy**.

Resource Curse Hypothesis theories that countries that rely more on mineral sector of the economy tend to have lower rates of economic growth, speculating as to whether resources are a curse or a blessing.

As mineral resources are typically under **public ownership**, **optimal taxation** of developers and miners for the use of these resources is necessary.

- **High taxation** will result in underdevelopment and underuse of minerals, **low taxation** will result in the giving away of public wealth.

The **extraction of minerals** from their natural state disturbs the environment, whilst processing and mineral use also causes **environmental damage**.

- This is not always reflected in the market due to **externalities** and **public goods**, resulting in **market failure**.

Energy is the capacity of a physical system to do work.

Energy Industries are organisations that are engaged in extraction, transformation, delivery, and marketing of energy to various users of energy.

There is a **high correlation between energy consumption and GDP growth** due to the energy intensity of an economy.

World GDP growth and growth in energy are linked, however GDP is increasing at a greater rate due to improvements in **efficiency**.

Most energy still comes from **fossil fuels** which have adverse impacts on the environment such as climate change.

Human history can be traced through transition between **primary energy sources**:

- **Current photosynthesis**: hunter gatherers/farming societies.
- **Past photosynthesis**: coal and the beginning of industrialisation, oil and gas and post-industrial societies.
- **From photosynthesis to current insolation**: wind and solar.

There is debate as to whether or not Australia should introduce the use of **nuclear energy**.

Less developed countries usually have fewer mineral and rely more on them in their economic life.

Dutch Disease is an currency (exchange rate) phenomenon whereby the rapid growth in income from an industry such as mining results in an appreciation of the domestic currency. This **reduces the competiveness of other domestic industries**, but makes imports cheaper.

- Subsequently whilst the resource sector booms the rest of the economy is **sluggish**.
- This occurred in the **Netherlands in the late 1960s** as a result of natural gas, and potentially occurred in **Australia during the commodities boom**.

Gold is seen as the ultimate store of value.
Market Structure describes the degree of competition in a market ranging from ranging from **perfect competition** to a non-competitive structure such a **monopoly** and markets of varying degrees of competition in between.
Determinants of market structure include:

- **Barriers to entry** relating to freedom of firms to enter and exist the industry. Can existing firms block new entrants?
- The **nature of the product** relating whether it is homogenous or differentiated.
- The degree of **control over industry supply/output**.
- The degree of **control over price**.

The **Minerals Industry** shows some aspects of an **Oligopoly** market structure:

Some characteristics of this model:	Minerals
– Industry dominated by small number of large firms, but there are many firms making up the industry	√
– High barriers to entry	√?
– Products could be highly differentiated – branding, or homogenous	— √
– Non–price competition	—
– Price stability within the market	—
– Potential for collusion	√
– Abnormal profits	√
– High degree of interdependence between firms	√?

Market Concentration is a function of the number of firms in the market and their respective market shared.

- The **Concentration Ratio** is the proportion of market share (proportion of total sales turnover or total revenue) accounted for by top x number of firms.
- According to these measures the **mineral industry** looks fairly **highly concentrated and not very competitive**.
- The **Herfindahl-Hirschman Index (HHI)** is calculated by summing the squares of the individual market shares of all the participants.

$$H = \sum_{i=1}^{n} s_i^2$$

  - It reflects both the **distribution** of the market shares of the top four firms and the **composition** of the market outside the top four firms.
  - It gives **proportionately greater weight to the market shares of the larger firms**, in accord with their relative importance in competitive interactions.
  - A **HHI below 1000 (0.1)** indicates a **low level** of concentration in an industry.
  - A **HHI between 1000 and 1800 (0.1 to 0.18)** indicates a **moderate level** of concentration in an industry.
  - A **HHI above 1800 (0.18)** indicates a **high level** of concentration in an industry.
  - A market with shares of 30%, 30%, 20%, and 20% for example results in a HHI of $30^2 + 30^2 + 20^2 + 20^2 = 2600$.
  - Using HHI the **mining industry is slight moderately concentrated**.

The **mining industry** is characterised by **several dominant players, but also a large number of smaller players**.

- It is to an extent **oligopolistic**.
- It shows signs of **moderate concentration**.

Mineral Deposits are a concentration of elements or minerals formed by geological processes.

- If these deposits can be extracted 'at profit' they become **Ore Deposits**.