
# Energy and Environmental markets

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# Definition

Energy and environmental markets are markets related to trading of energy products or their derivatives.

The energy goods they can trade are:

- **Electricity** (power, capacity and ancillary services)
- **Natural gas** (and its derivatives)
- **Petroleum** (and its derivatives)
- **Emission certificates**/allowances
- **Green Certificates**\guarantees of origin
- **White Certificates**
- ….

# Energy markets structure

Energy markets (electricity and natural gas) **were liberalized rapidly** over the last decade in most countries, enabling private companies to compete state-owned companies.

The liberalization was based on studies and t**heoretical approaches** that liberalized markets **operate more effectively**:

- **Energy efficiency, reliability**
- **Quality of service**
- **Social welfare (final cost to the consumer)**
- **Total economic growth**


**Technological developments** also enabled small and large energy consumers to meet their energy needs, speeding up their ability to participate in a free market.

At the same time, the gradual development of economic and political institutions(i.e. the EU) has prompted the need **to integrate energy markets** for the sake of designing wider (regional) energy policies.

# Energy markets structure

The market also includes two components:

- purchase of **physical quantities** (in spot, future markets or through OTC long-term contracts)
- purchase of **financial derivatives** (futures linked on physical quantities or not...)

# Energy markets structure

The stakeholders involved in organizing the markets are:

- **Supervisory Body - Regulator**

Public body (i.e. Regulatory Authority for Energy).

- **Energy Exchange** (Market Operator and Clearing House)

Private or semi-public body (i.e. SEEPEX in Serbia,LAGIE in Greece).

- **Transmission and Distribution System Operators (TSOs/DSOs)**

  Energy companies (private or public) with ownership and/or management in transmission/distribution networks, energy storage facilities (i.e. DESFA, EDA, ADMIE, DEDDIE in Greece


- **Participants in the wholesale market** for physical quantities / derivatives.

  Private or public companies licensed to **produce, supply, market, self-purchase and trade** either on a bilateral or exchange basis for both physical quantities and derivatives (i.e. PPC, Heron, Protergia, M & M).

- **Private operators offering services** to market players in the wholesale or retail market (training, technical and financial advice, legal advice, dealers, call centers, internet site developers, SEO, e-commerce, execution of orders, banking, etc. .)

# Energy markets structure

**Derivatives** are separated based on whether they are traded or not on energy exchanges. Key types of derivatives are:

- **Futures**

  Contract for the purchase / sale of a specific volume of commodities at a pre-agreed price and at a specific future date

- **Options**

  Agreement that gives the choice and not the obligation to buy / sell a commodity at a pre-agreed price for a period or a specific future date

- **Warrants**

  similar to the option, but only sold by financial institutions that already own the underlying products

- **Swaps**

  an agreement between two parties to exchange cash flows in a future period (eg interest rates, currency, equity, commodity, credit default swaps)


There are also Derivatives such as Futures and Swaps, where the counterparty is not the Exchange, which ensures confidentiality but not guarantee of the transaction. (**Over the Counter-OTC**)

# Energy markets structure

The liberalization of energy markets is constantly evolving in the EU, where it has some **delays** in relation to its **original objectives**:

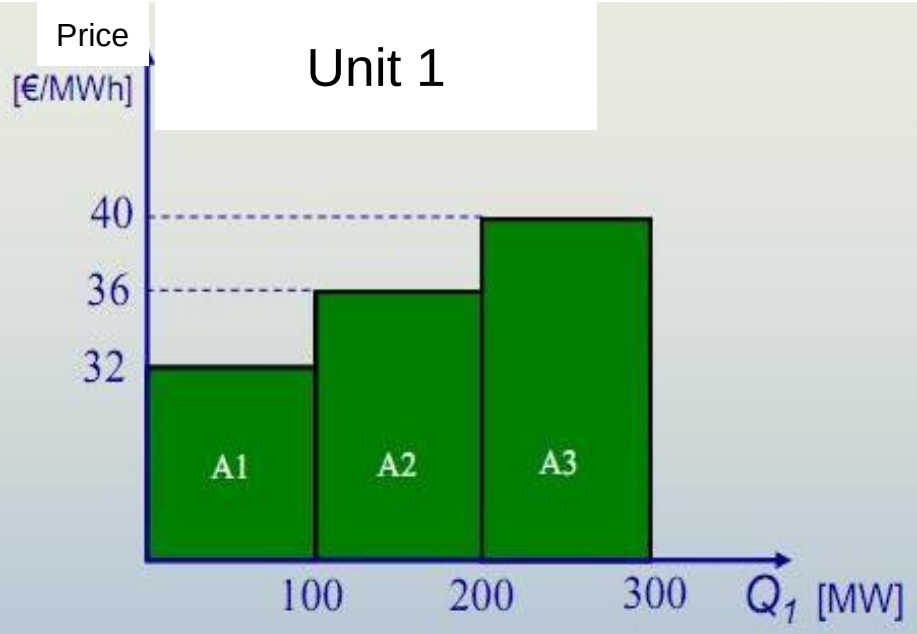
- It has not led yet to the **integration of energy markets / policies**
- Has led to a **small drop** in energy commodity **prices**
- The **existence of oligopolies**, with the strong presence of mainly public companies
- It **has not achieved full ownership unbundling of vertically integrated businesses** in all countries
- In some cases (California, Italy) it has led to problems of **energy reliability**

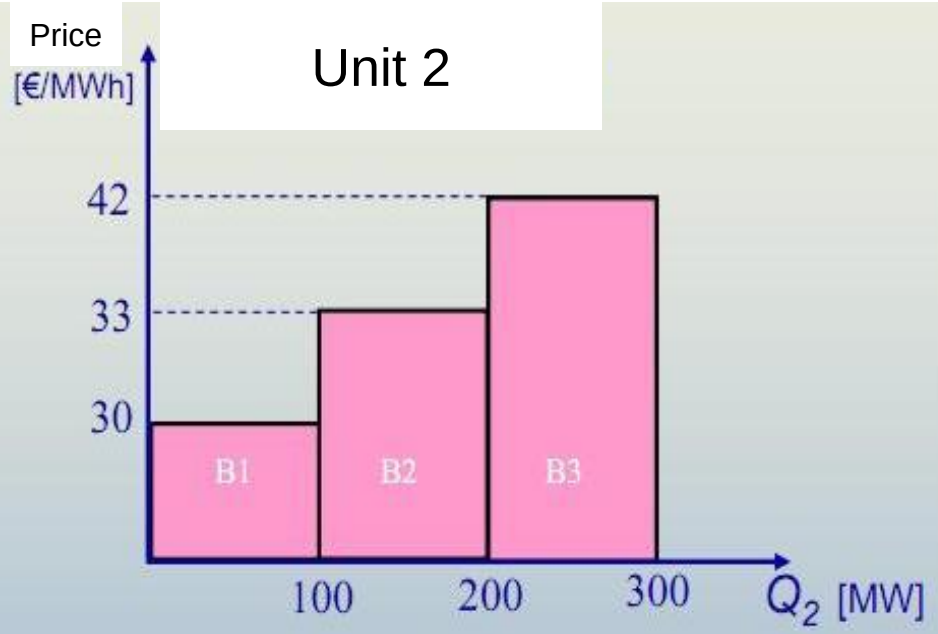
**The role of Regulators and Market Operators is particularly important, and there is a tendency to further strengthen them**

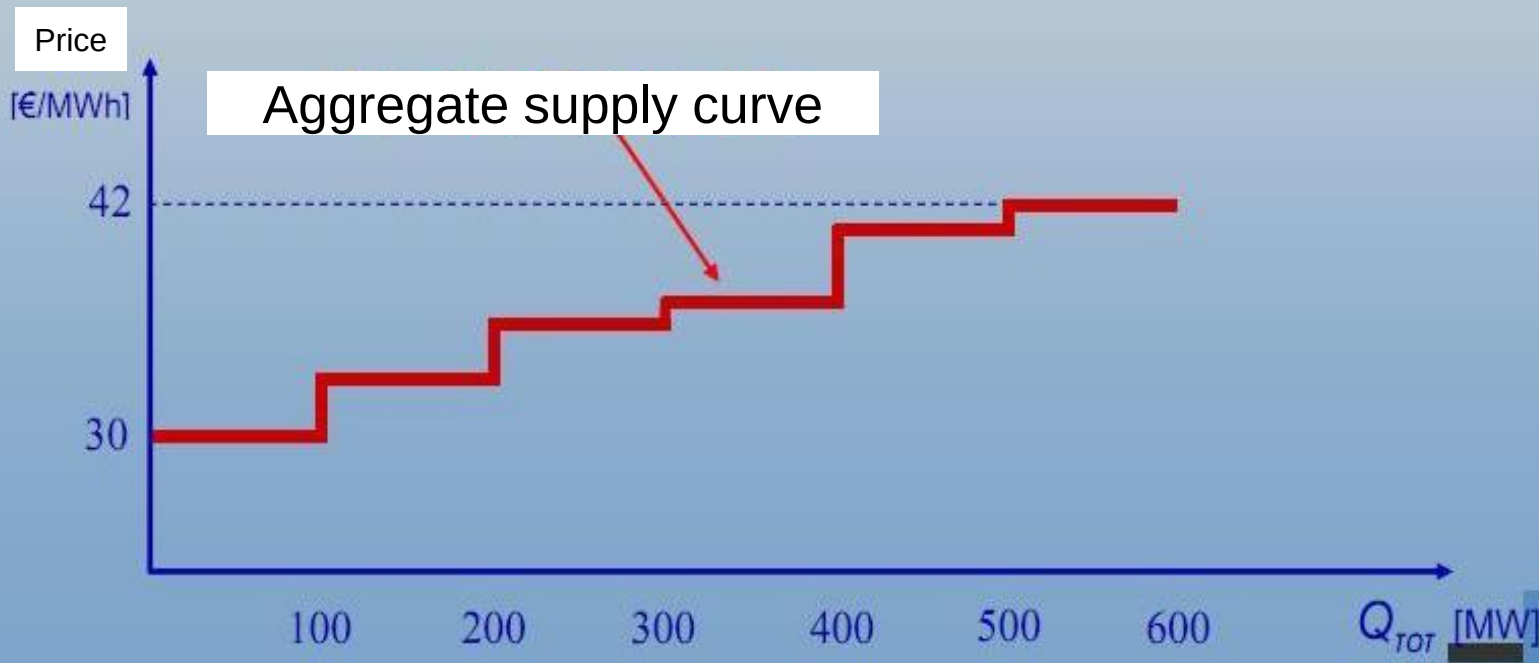
# First conclusions

- Energy markets deal with the **purchase of energy goods** (oil, gas, electricity, certificates, pollution permits ...).
- Apart from buying and selling physical products, **financial derivatives** are also available in the energy markets, which are traded on exchanges.
- In recent years there has been a **gradual liberalization** of the electricity and gas markets (the oil market is already liberalized) and the introduction of **new energy products** in the markets
- The liberalized energy markets are governed by the following structure:
  - **Supervisory Body - Regulator**
  - **Energy Exchange** (Market operator and/or Clearing House)
  - **System Operators**
  - **Participants in energy markers**
  - **Advisors/consultants**
- The liberalization has not **led yet to desired results**
  - Price decrease, energy security and reliability, competition

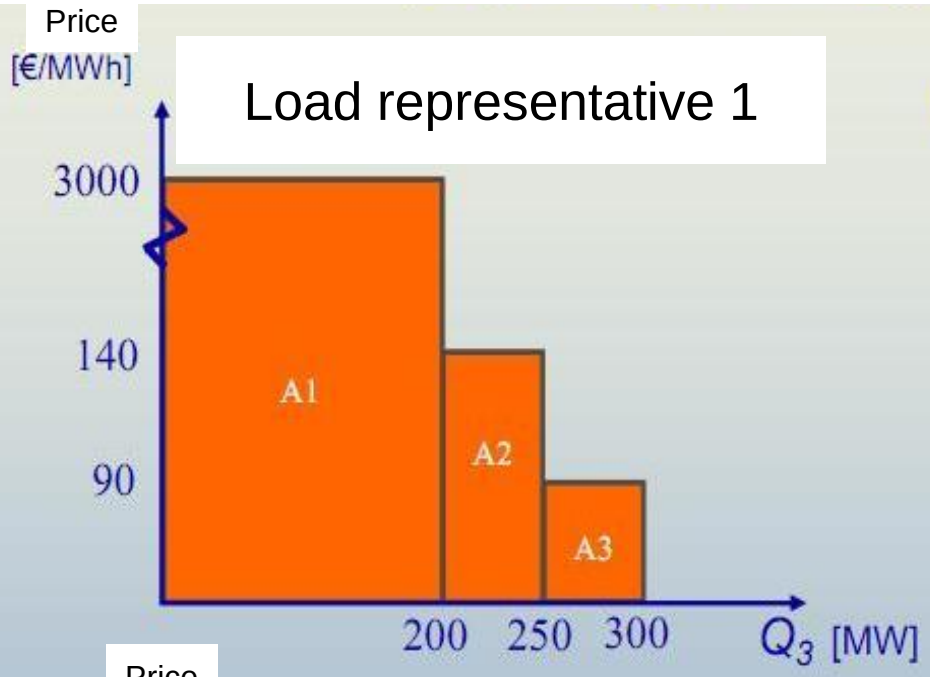
# Supply curve

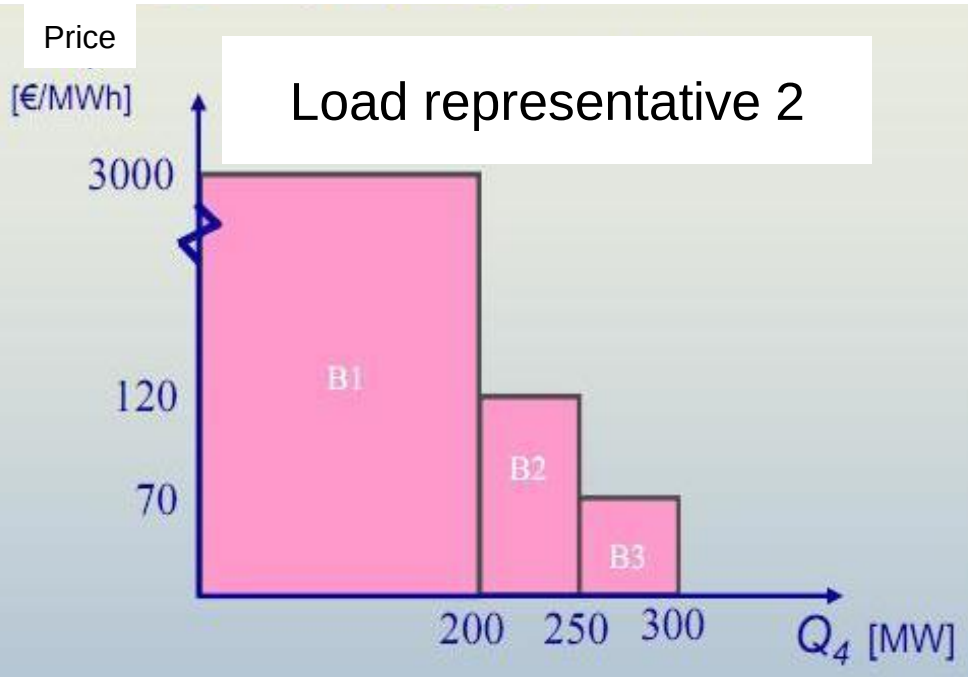


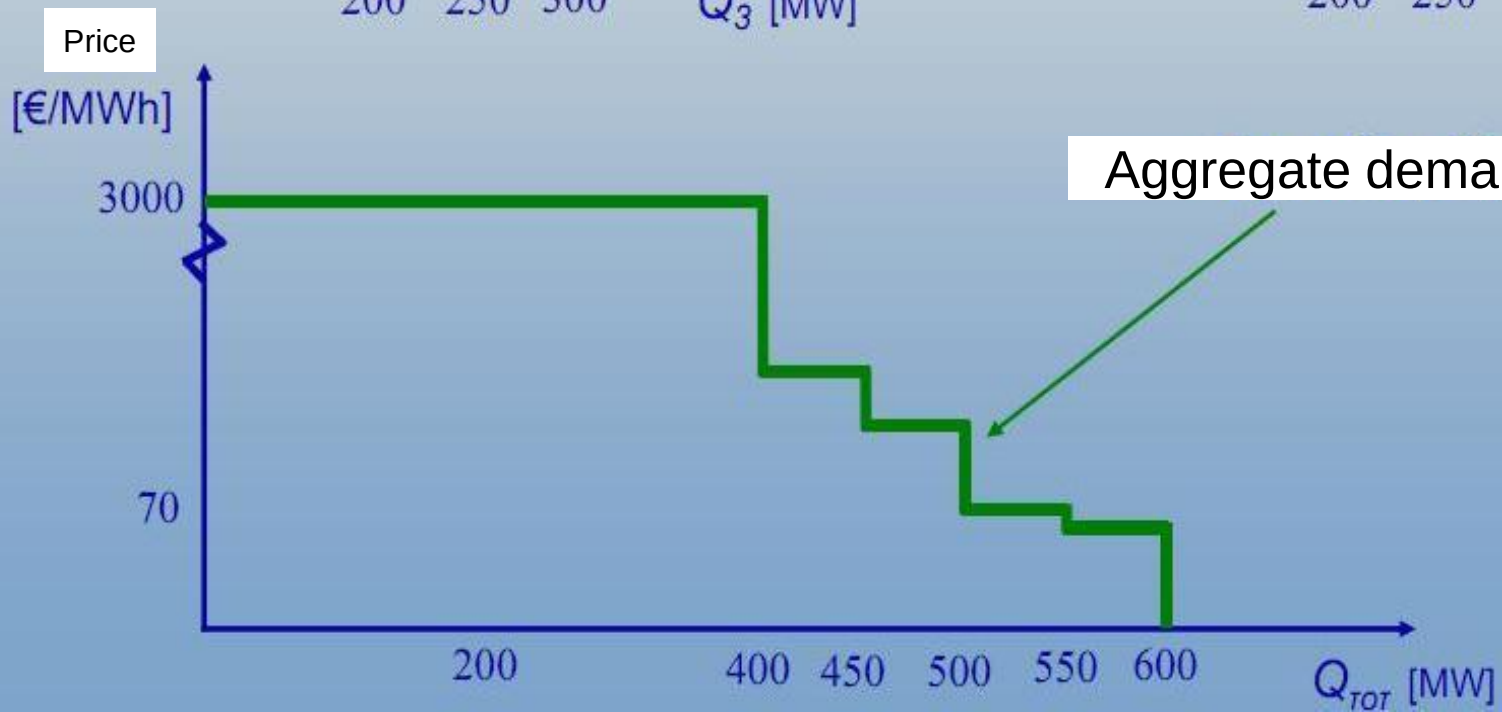



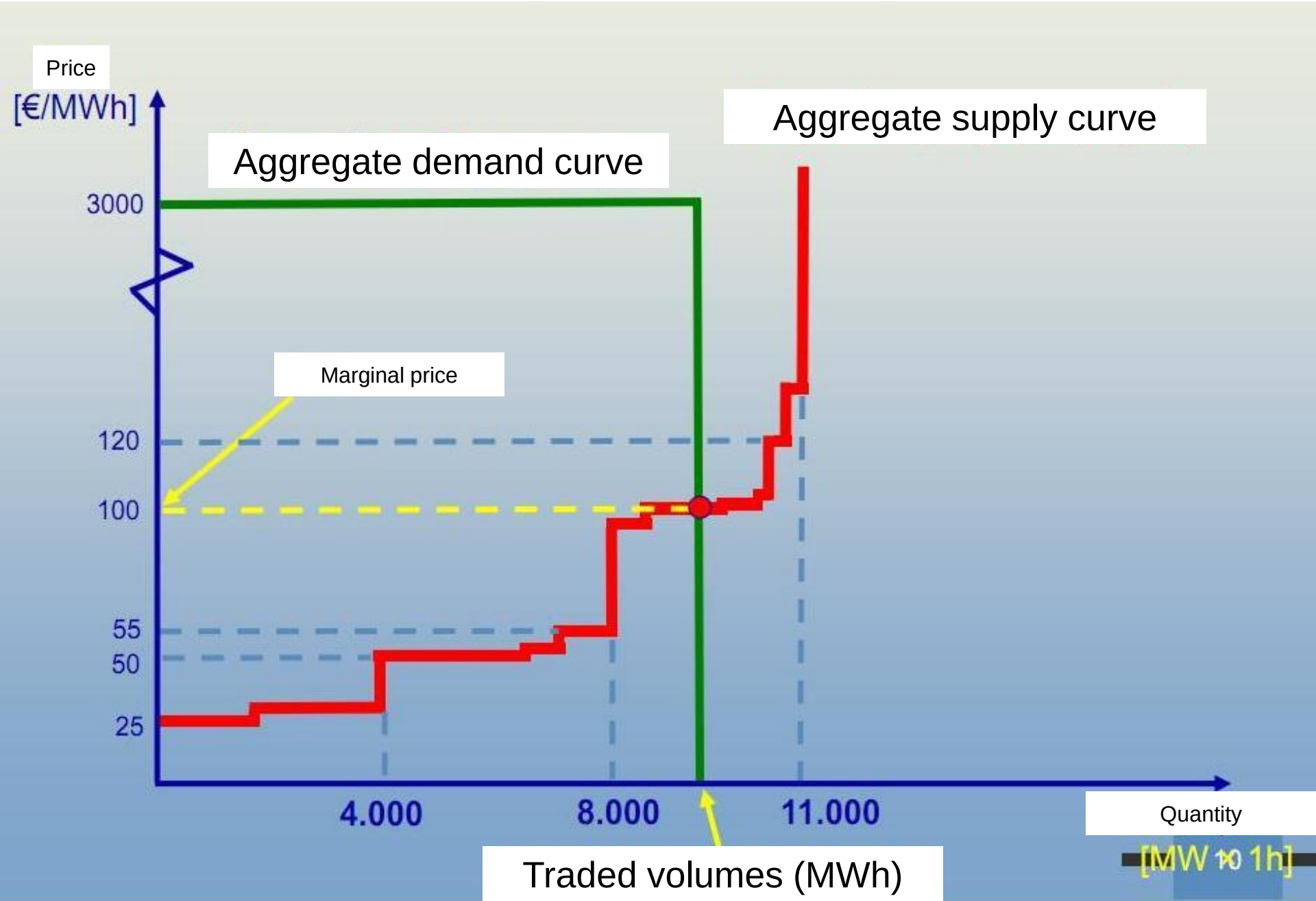
# Demand curve



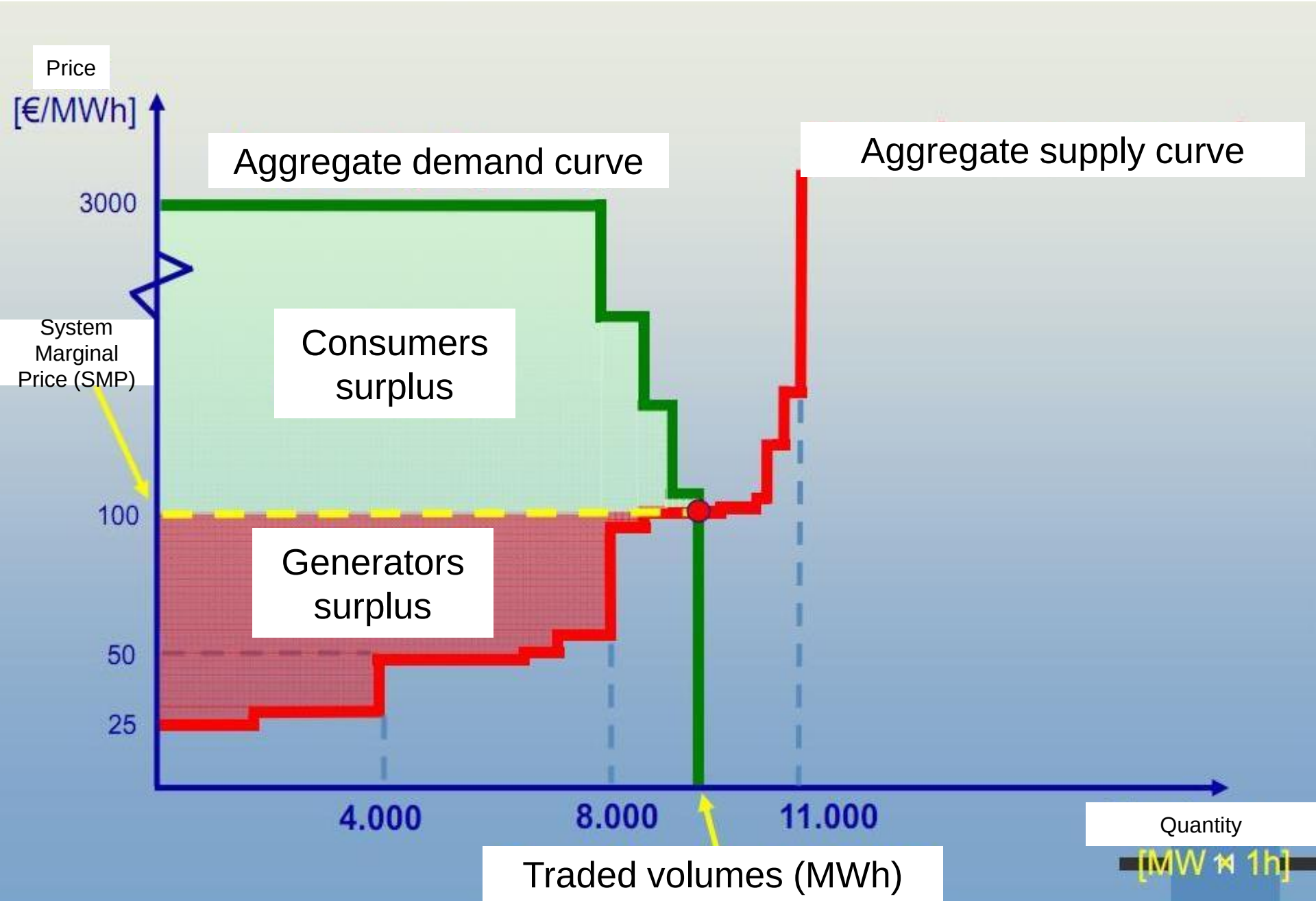



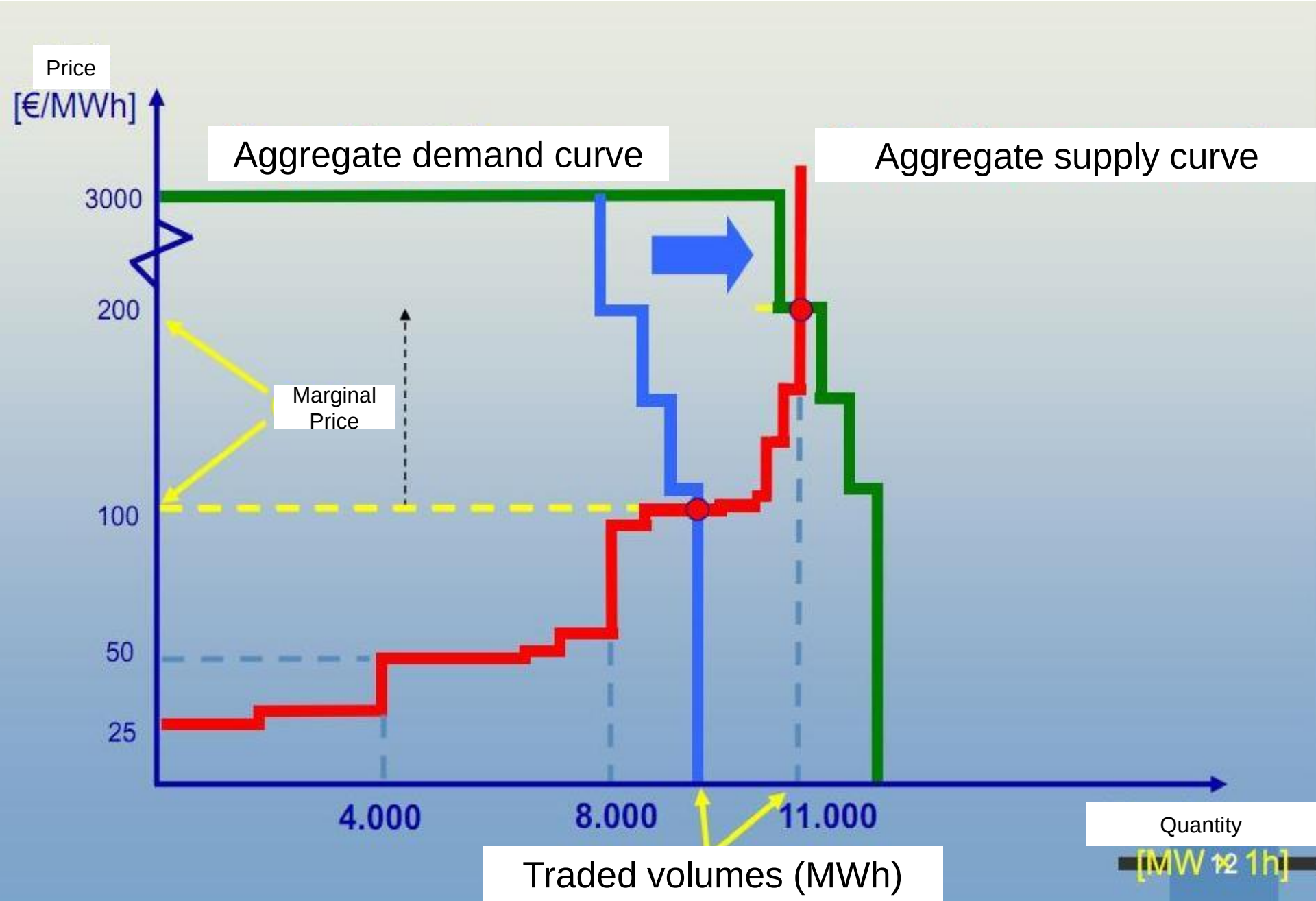
# Supply and Demand curves



# Equilibrium point



# Effect of demand increase on price



# External environmental cost

# External environmental cost

**What is External Environmental Cost / Benefit?**

- The cost / benefit to society of (re) use of environmental resources (environmental cost / benefit) and
- Not included in market mechanisms (external cost / benefit)

# Internalizing environmental cost

- **Environmental pollution,**
- **Climate change,**
- **The development of environmental sensitivity**
- **The progress of environmental technology**

**...**


motivate policy makers, the scientific community and the economy to develop policies / systems to **internalize environmental costs into market mechanisms.**

# External Environmental Cost Management Systems / Policies

The main external environmental cost management systems / policies are:

- Introducing **Maximum Cap on Pollution and Trade**
  - It partially covers the **lack of ownership rights in environmental resources**

- **Green Taxation** (eg Environmental / Energy Taxes or Carbon Tax)
  - It strengthens the **competitiveness of cleaner forms of energy**

- **Green Legislation** (eg Montreal Protocol, Green and White Certificates, Energy Certification, Energy Labeling, Prohibition of Technologies ...)
  - It strengthens new technologies and prohibits the use of substances / technologies

- **Green Incentives** (eg Grants, Transfer of Technology / Know-how, Tax Relief ...)
  - It strengthens new clean technologies

# External Environmental Cost Management Systems / Policies

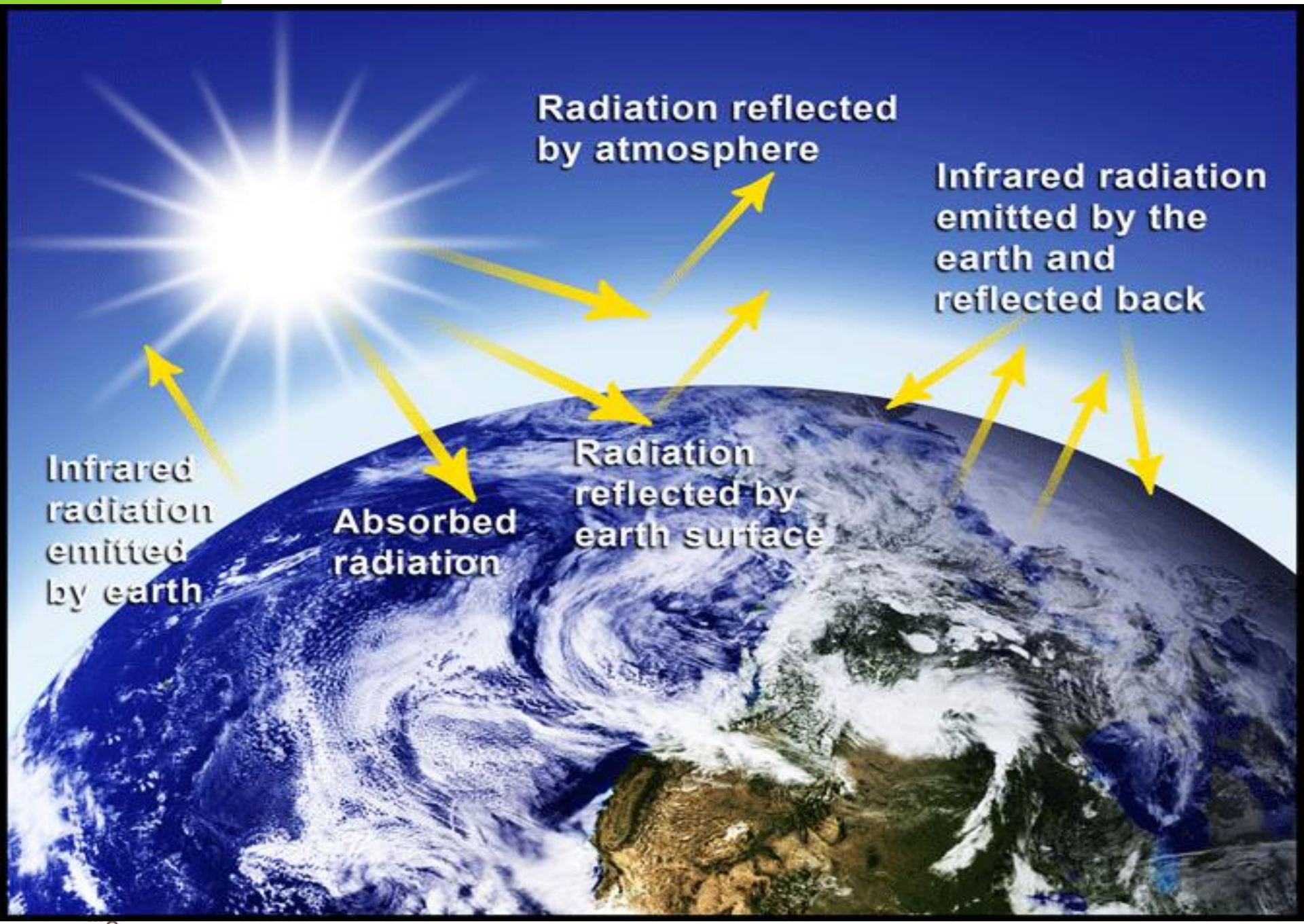

**These policies aim to integrate the <u>environmental or (wider) social cost of natural resources into the market</u>**


# Crucial query:

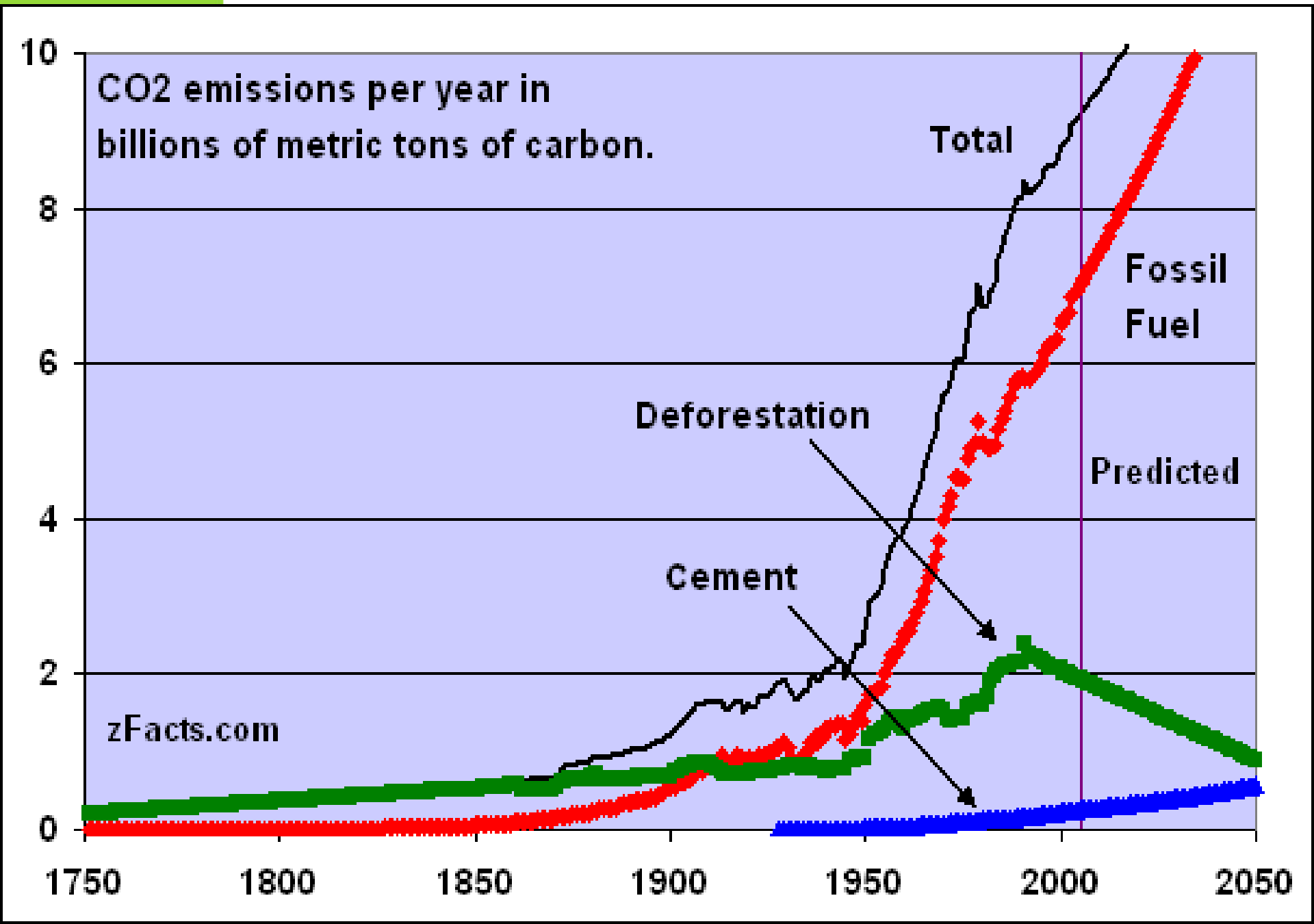
# Is Climate Change happening?

# Is it related to CO2?

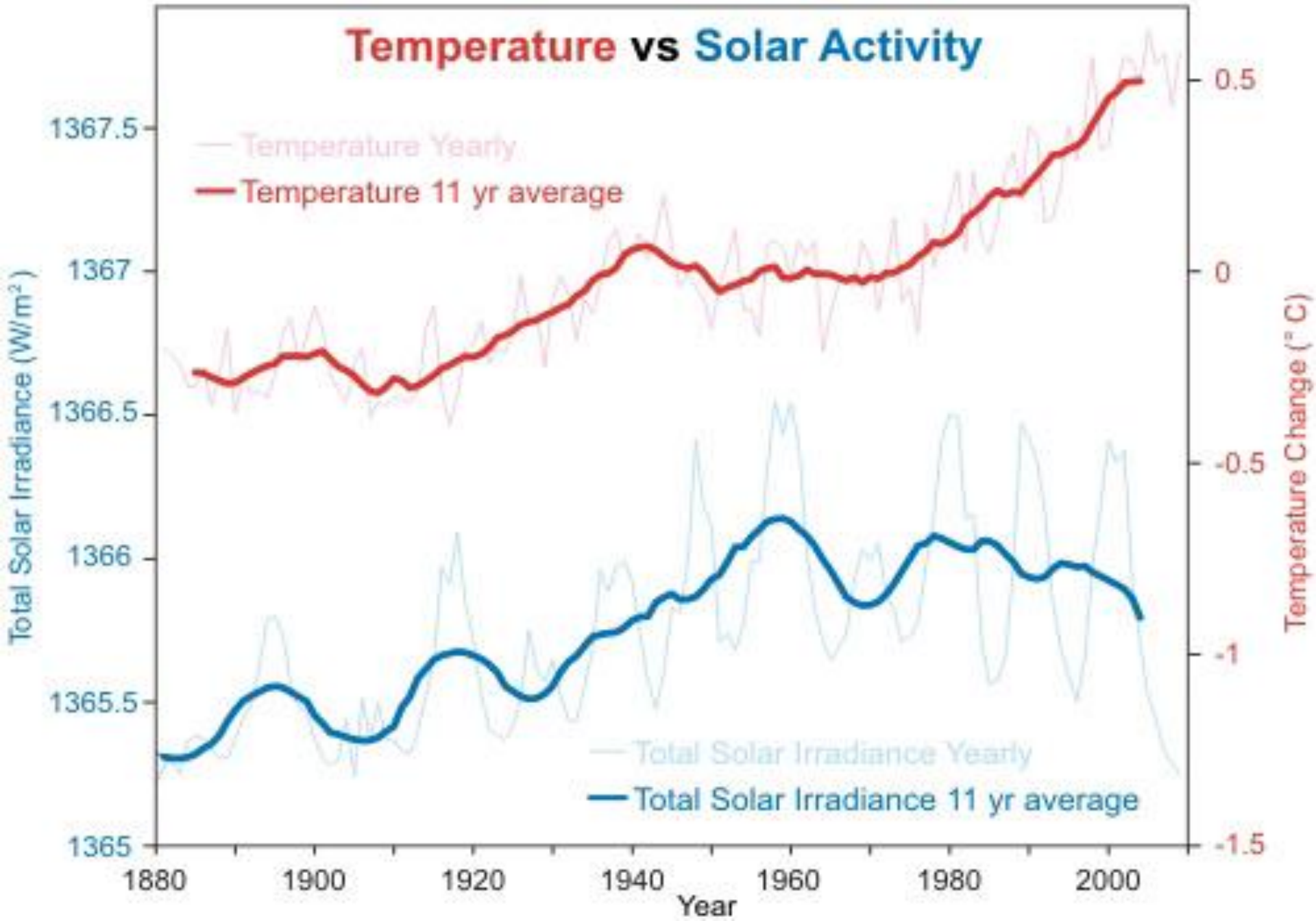
# Greenhouse effect



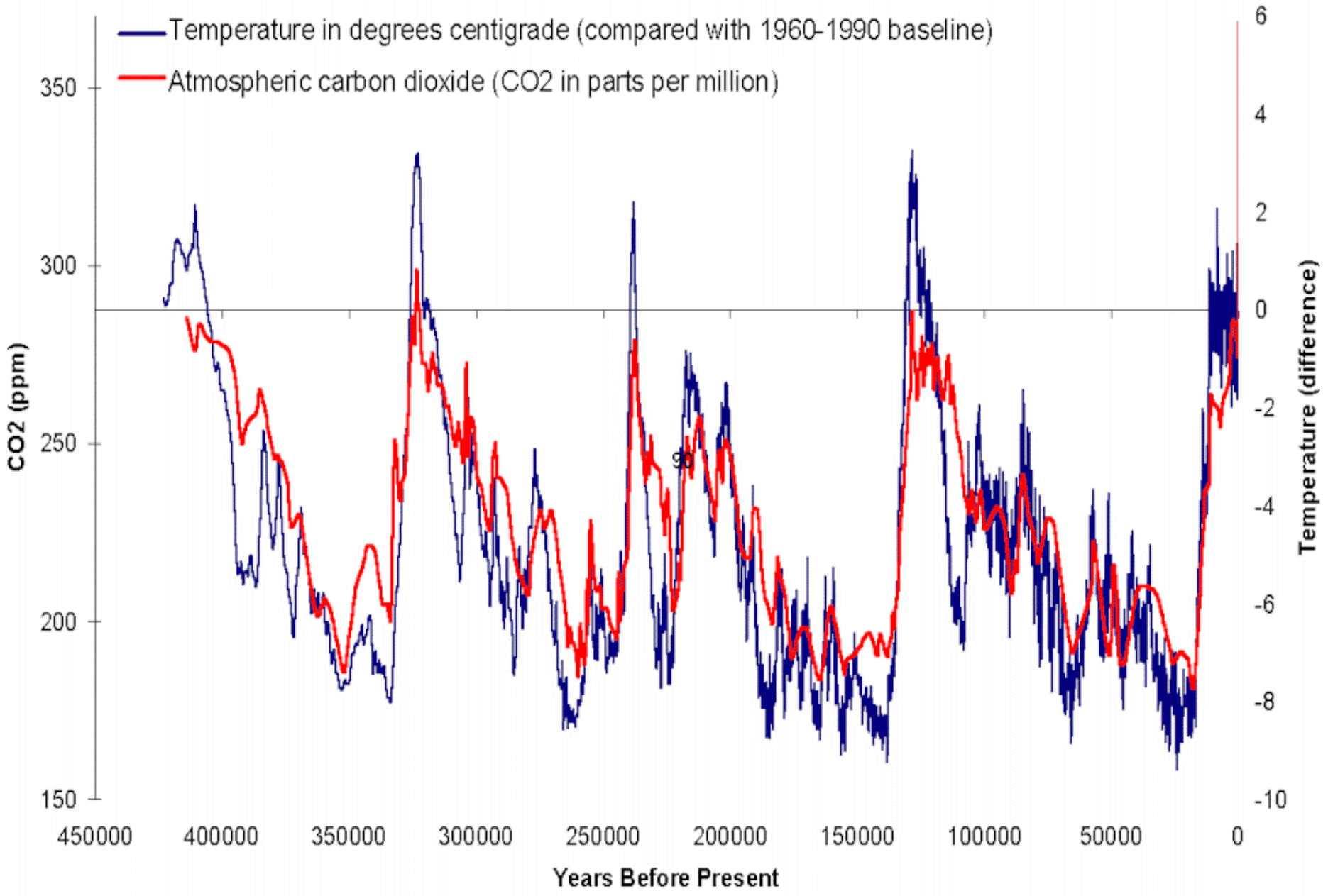
# Global CO2 emissions



# Solar activity effect



# Temperature and CO2 emissions



# Climate Change

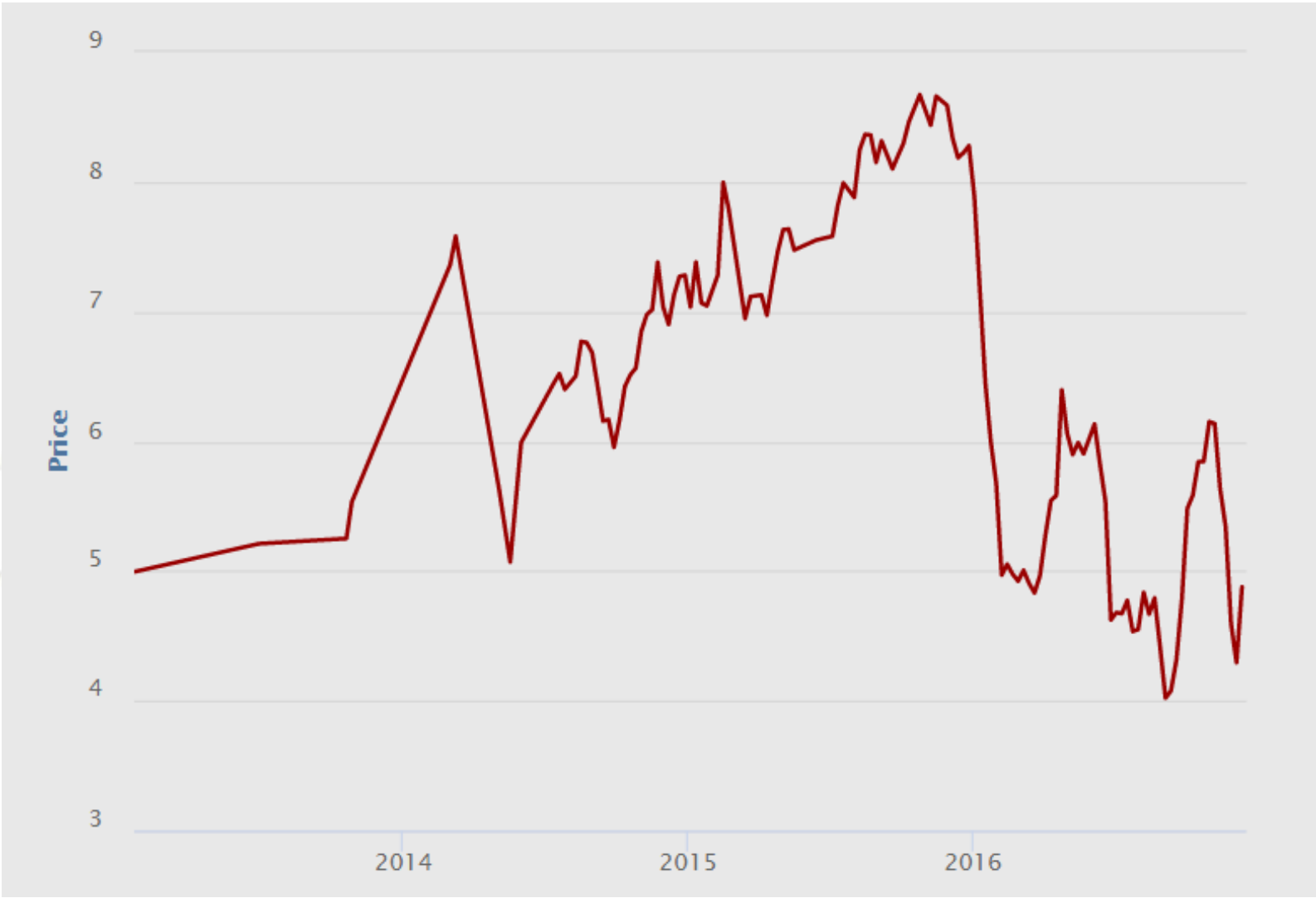

- **Climate change exists**, as evidenced by the statistically higher occurrence of extreme phenomena, acidification of the oceans, faster global warming and faster change of microclimate

- Increasing **anthropogenic greenhouse gas emissions accelerates climate change**, but the direct correlation between CO2 and climate change is precarious as it is a more complex problem

- Historically there have been times when CO2 has caused temperature rise but also vice versa

- Consequently, linking climate change to **CO2** should be seen as a **mechanism for integrating environmental costs into the global economy**

# Emission rights (EUA) in EEX

# Methodologies for environmental cost assessment

**Methodologies for assessing environmental costs:**

– **Life Cycle Analysis**
  - embedded energy in products

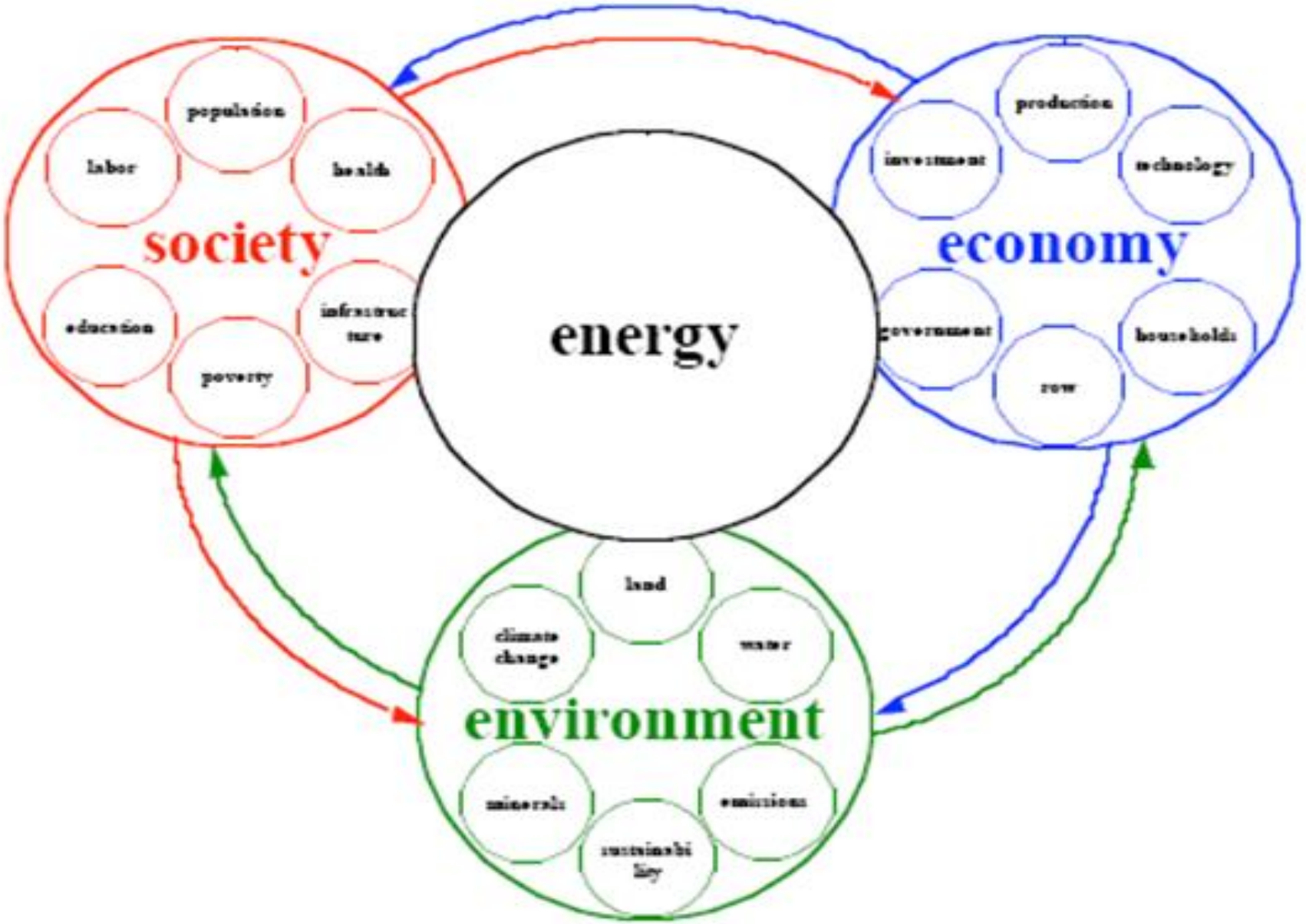
– **Quantified methodologies**(π.χ. ExternE)

**Determination of significance / weight of environmental factors (eg citizens' preferences questionnaires ...)**

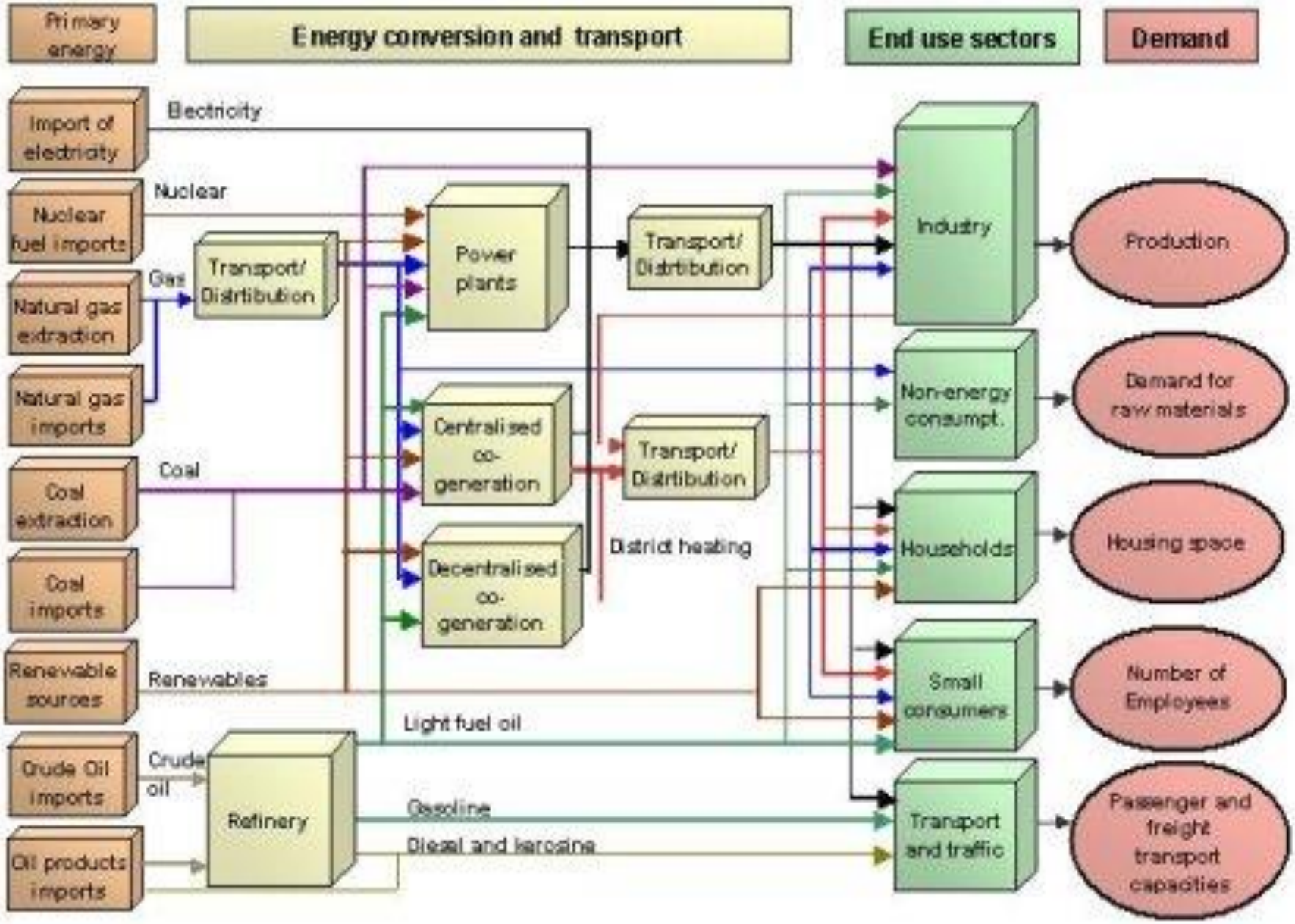
– **Complex models**
  - **Economy-Energy-Environment (E3) models,**
  - **Macro-economic (top-down) models,**
  - **Technical (bottom-up) models,**
  - **integrated assessment models**
  - **Econometric models, Statistical models**
  - **Optimization models**
  - **Multicriteria analysis**
  - **Neural networks**
  - **Game theory...**

The above methodologies may be either **complementary or different theoretical approaches**.

# Economy-Energy-Environ. Models



# Engineering models



# Integrated Assessment Models