

# Sustainable Energy Transitions at Uppsalas Universitet

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## 1 Course Info

Literature: Dustin Mulvaney - *Sustainable Energy Transitions* (2021)

## 2 Chapter 1

**Energy transitions** are socio-technical processes that reshape the nature or patterns of use of energy resources and/or technologies.

A **socio-ecological system** describes human and Earth-system interactions as dynamic, interconnected, and co-produced by nature and society.

International frameworks to evaluate and manage social and environmental challenges:

- Convention of International Trade in Endangered Species (CITES)
- Intergovernmental Panel on Climate Change (IPCC)
- Montreal Protocol to protect the ozone layer
- Agenda 21
- Sustainable Development Goals (SDG)

In the 70s, the concept of energy transition mostly referred to providing energy access to poor communities to increase their quality of life. It was also used then to refer to the growing need for coal resources in southwest USA. Today, the phrase *energy transition* refers to the move towards low-carbon economy.

Holocene - current geological epoch, refers to the last 12000 years. Contenders for the start of anthropocene epoch include the first major imprints on the atmosphere from fossil fuels – emissions of methane and carbon dioxide. Another candidate is the date that marks the start of atmospheric nuclear testing in early 50s.

International Energy Agency (IEA) (2010) suggests power demand will increase from 18 trillion watts in 2020 to somewhere between 25 and 30 trillion watts by 2050.

Starting in 2015, the world started to build more renewable energy than energy infrastructure to burn fossil energy.

**Projections** are trends taken into the future based on some existing trends or some BAU<sup>1</sup> scenario.

**Forecasts** are made by taking these projections and modifying them with assumptions about the future, such as new technologies or different rates of change.

**Primary energy sources** are the natural resources taken from the earth: coal, "wet" natural gas (wet because it contains water, methane, ethane, and other gases), petroleum, solar and wind power, uranium, and other direct sources of energy harvested.

**Final fuel products** and **energy carriers** are the energy sources that directly provide energy services.

Example final fuels: gasoline, "dry" natural gas (dry because it mostly contains methane), wood for a stove or campfire, hydrogen and electricity.

Example energy carriers: electricity, hydrogen, steam.

**Corporate Social Responsibility (CSR)** is an approach to sustainability that focuses on encouraging the private sector through voluntary standards, industry benchmarks to favour sustainable solutions under the pressure from investors and social and reputational pressure.

**Wind, Water and Sunlight (WWS)** strategies focus on replacing current energy systems with one run solely on electrification and renewables.

**Hard** and **soft** paths in energy transitions. Hard path refers to coal and nuclear power, while soft is led by renewables and appropriate technologies.

Axes of debates in energy transitions:

- apolitical
- democratic
- command and control
- global
- centralized
- private
- clean
- political
- technocratic
- market
- local
- decentralized
- public
- renewable

*Political scientist Langdon Winner argued that some forms of energy production like nuclear energy rely on authoritarian forms of social organization to protect nuclear fuel and waste (Winner*

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<sup>1</sup>business as usual

1989). *Uranium in the supply chain for nuclear fuel and plutonium in the waste (or some fuels) require militarization and heavy security as nuclear power plants because of vulnerability to melt-down accidents or occasional releases of low-level radiation. Winner argues that technologies are not neutral but can have inherent politics.*

**Rebound effect** – when energy savings resulting from savings behaviour are just spent elsewhere on energy consuming activities. A classic example from this perspective is a driver who substitutes a vehicle with a fuel-efficient version, only to reap the benefits of its lower operating expenses to commute longer and more frequently.

2000-watt society is a notion for balancing basic human needs with overconsumption. 2000-watt of power is about 48 kWh energy per day.

Energy demand globally is still increasing.

World population in 1990 was 5.3 billion and annual electricity consumption per person 2.07 MWh per person. By 2015, population was 5.3 billion and energy consumption 3.05 MWh.

China:

- 19% of world's population
- in 2013, 50% of world's coal consumption was China
- leads in wind power
- added a lot of solar (for 3 consecutive years added more than US in total through all years)

Giorgios Kallis is the leading thinker and writer on the question of de-growth. Degrowth thinkers look for steady-state energy systems and economies instead of fixating on increasing GDP.

*Entropy laws mean that conversions of energy result in less useful work available with each conversion. This is why the laws of thermodynamics dictate that the end of the universe will be a cosmic heat death. The total amount of energy will be the same as it always has, but none of it will be available to do work.*