ENG-410 Energy supply, economics and transition
Sascha NICK, Wed 02+09.04.2025
Moodle

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Wed 02.04.2025, 08:15-10:00, sascha.nick@epfl.ch
Energy, Human Needs and Wellbeing

1. **Sustainability and Wellbeing**
   - (Reminder) Planetary boundaries: stockholmresilience.org, 2023 Science Advances, 2015 Science, 2009 Nature; control variables for climate and biodiversity
   - Biodiversity (threats: habitat loss, overexploitation, pollution, invasive species, climate change) and ecosystem services (provisioning, regulating, supporting, cultural): WWF Living Planet, LPR 2024
   - Satisfy today's needs without endangering future generations' needs
     - = satisfy today's needs within PB
     - = much lower energy + material flows, perhaps -30% to -50% by 2050
     - = complete refocus of all productive activities to satisfy human needs
   - "Strong" vs. "Weak" sustainability
2. **Human Needs and Sufficiency**
   - Essential distinction between needs (finite), satisfiers (culturally specific), and desires (potentially infinite)
   - (please forget Maslow's "A Theory of Human Motivation", 1943, and the fake pyramid)
   - Manfred Max-Neef's Fundamental human needs, Human Scale Development, 1991: (video)
     - Needs are universal, finite, classifiable, and satiable
     - Subsistence, Protection, Affection, Understanding, Participation, Idleness, Creation, Identity, Freedom
     - Satisfiers: destroyers, pseudo-satisfiers, inhibitors, simple satisfiers, synergistic satisfiers
   - Len Doyal, Ian Gough: "A Theory of Human Need", 1991, p.170, Climate change and sustainable welfare: the centrality of human needs, 2015
     - Participation (minimally impaired social participation) requires physical health, mental health, autonomy of agency
     - Liberation (critical participation in chosen form of life) requires critical autonomy
     - More conceptual than Max-Neef, contains similar elements, organized differently
   - Operationalizing sufficiency: satisfier orders and levels of provisioning (2019 paper)
     - Socio-technical provisioning systems: ex. redesigning cities, repurposing buildings and neighborhoods, rethinking services, reorganizing working time.
     - Socially and culturally built activities: ex. cars become culturally toxic, identity and meaning is linked to human relationships.

        - Energy and material services: ex. video-conferencing.
        - Specific product or technology: ex. smaller and lighter car.
3. **Understanding the "optimal" size of the economy**
    - The exponential function: Impossible Hamster, rule of 70
    - "Impossible decoupling"
        - Relative decoupling is common but far from universal (ex. material flows)
        - Absolute decoupling on a worldwide basis is extremely rare (ex. CFC/HFC, wild fishery catch) / Tim Jackson "Prosperity without growth", pp. 47-57, Chapter 5, "The Myth of Decoupling"
        - To be effective, absolute decoupling would need to be impossibly high: "The Myth of Decoupling", p.55, CO2/GDP 130 times, 2007-2050 (Tim Jackson)
    - Energy: DLS Rao & Min 2017, Grubler et al 2018, JMH et al 2020
    - **Energy requirements for securing wellbeing in Switzerland and the space for affluence and inequality**, Nature Communications 2025
    - Materials: circularity-gap.world
        - Which material flows are problematic? Why?
    - Food production
4. **Biodiversity and Climate Action, towards Universal Wellbeing**
    - **Solution as mindset**, not a thing or technology: go.epfl.ch/change
    - Covid-19: opportunity to rethink / loss of incumbent credibility
    - Climate action / Net zero / Swiss Negative Emissions Fund
    - Towards True Climate Neutrality for Global Aviation: A Negative Emissions Fund for Airlines
    - Deliberative democracy / The Academic Citizens' Assembly
5. **Renewable Energy and Biodiversity in Switzerland**
    - RE-BD AR2024. Accelerating renewable energy development while enhancing biodiversity protection in Switzerland, go.epfl.ch/re-bd
    - Executive Summary, 4p., https://doi.org/10.5075/epfl.20.500.14299/241757
    - Presentation

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Limits to using markets as energy allocation mechanism

1. Understanding "Energy, Human Needs and Wellbeing" (review lecture on wellbeing and energy)
2. **Identifying the top challenges in energy governance**
    - Exit fossil fuels, rapidly (IPCC (SPM.4, p.19), death rates, PM2.5, Guardian)
    - Develop clean energy (PV, wind) (Jacobson, Breyer)
    - Ensure energy use for synergistic satisfiers
    - Ensure universal access (SDG7)
3. **Energy system objectives 2024**
    - Primary goal: Investor return (Energy Charter Treaty, The Guardian, UK leaves ECT, UE energy and trade committees vote for ECT exit; Yamina Saheb UNIL video 02-2023)
    - Secondary goals: Efficiency, Employment, Cheap energy
4. (Reminder) **Characteristics of markets**
    - A market economy is a system in which resources are allocated, and production and consumption decisions made, based on supply and demand, using price as a primary signal.
    - A market failure is an inefficient / suboptimal collective outcome based on individuals behaving (individually) rationally.
    - Market failures are ubiquitous, and fall into several categories: non-provision of public goods, externalities, overexploitation / tragedy of the commons, information asymmetry, "sticky" wages and prices, power asymmetry, exclusion, low resilience, system collapse. These failures are described in "Market Failures, Public Goods, and Externalities" on econlib.org (follow the links for details).
    - Limiting the size of a free market is very tricky, requiring instruments like Cap & Trade or taxes:
        - Cap & Trade is very difficult in real life… see Annie Leonard's 9' video "The Story of Cap & Trade"
        - Taxes: low leverage point, needs to be very high to be effective, and constantly adjusted
    - If a free market has been limited in size, prices will increase, excluding many people, further increasing inequality.
    - Link to: growth, PB, decarbonization, decoupling, IPAT, Kaya, rebound, "myth of growth"
5. **Fundamental limitations of markets**
    - There is no "built-in" market mechanism to limit the aggregate energy use, or even more importantly aggregate entropy. Staying within PB is a public good; so is clean air & water.
    - There is no market mechanism to ensure universal access, or any decent level of energy services (DLS / DLE).
    - There is no market mechanism to ensure priority is given to "useful" activities, i.e. synergistic satisfiers. There is no reason for the most useful

activities to be the most profitable.
    - The main lever of markets, price, is a very low leverage point in systems theory (the lowest, #12 of 12). This requires a very strong intervention (such a very high CO2 tax). This is politically difficult, and generates instability and volatility (when combining a low leverage point with very high intervention pressure).
    - The price cannot simultaneously be low (for universal access) and high (to limit CO2).
    - In the absence of absolute decoupling, limiting energy limits the size of the whole economy. Markets are embedded within institutions focused on continued growth, actively opposing such an outcome.
    - Markets grow by creating potentially unlimited desires, not taking into account human needs (finite, universal, classifiable). This generates growth in material flows and energy use, the opposite of what we need to stay within PB.
    - As a resource becomes more scarce due to depletion, its price rises, generally increasing the profitability of extracting more (negative consequence). The possible positive consequence of scarcity, substitution, generally has a longer time horizon, and may not happen at all, especially with lock-in.
    - Additionally, due to power imbalance today's energy markets are strongly distorted in favor of fossil fuels: subsidies, lock-ins, societal organization, legislation.
6. **Conclusion**: a pure market energy governance will fail to deliver universal access to energy services within planetary boundaries. This does not imply we cannot use markets at all, rather hybrid solutions are called for. Such governance could combine quotas, regulated markets, internalization of external costs, and differentiation according to who uses energy and for what purpose.