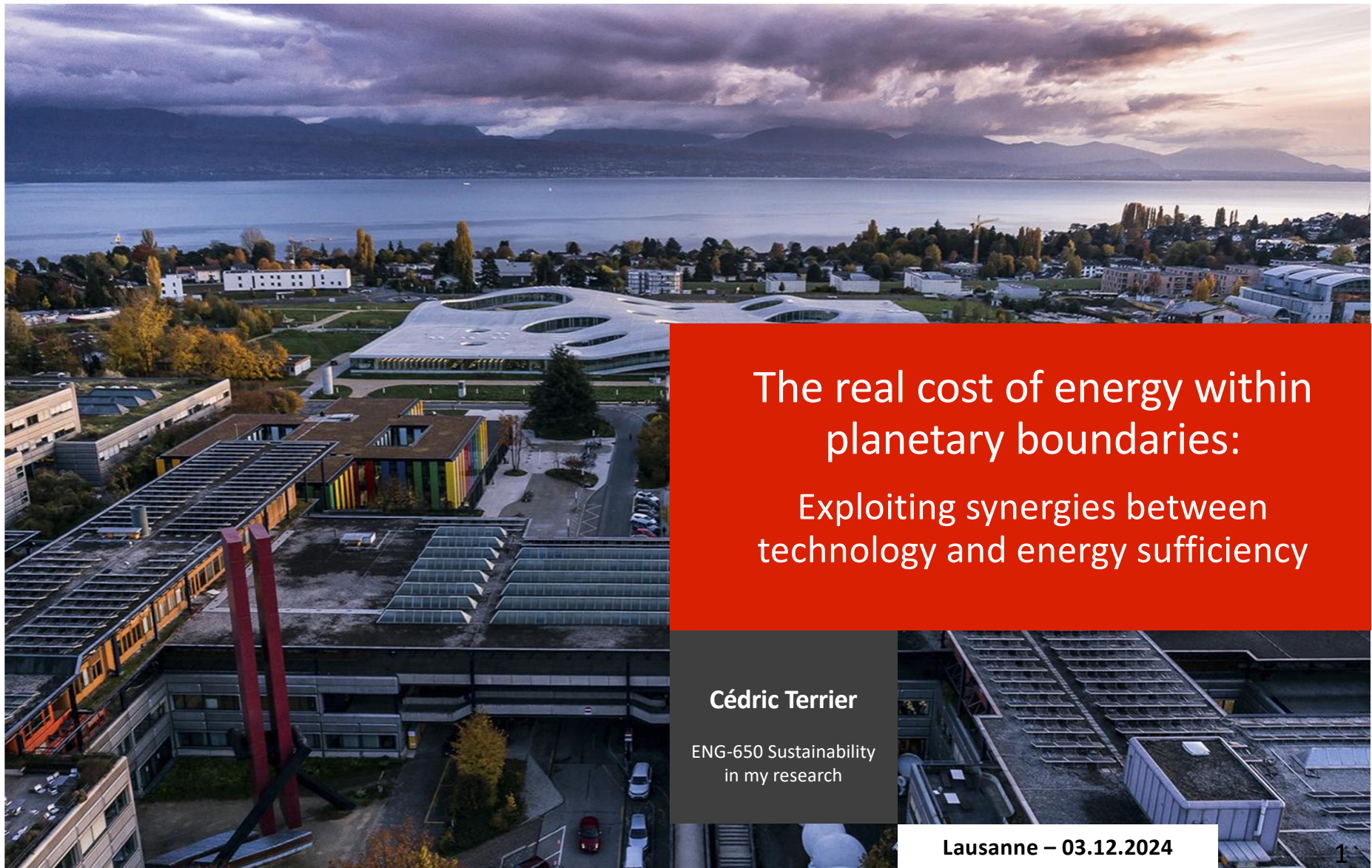


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The real cost of energy within planetary boundaries:

Exploiting synergies between technology and energy sufficiency

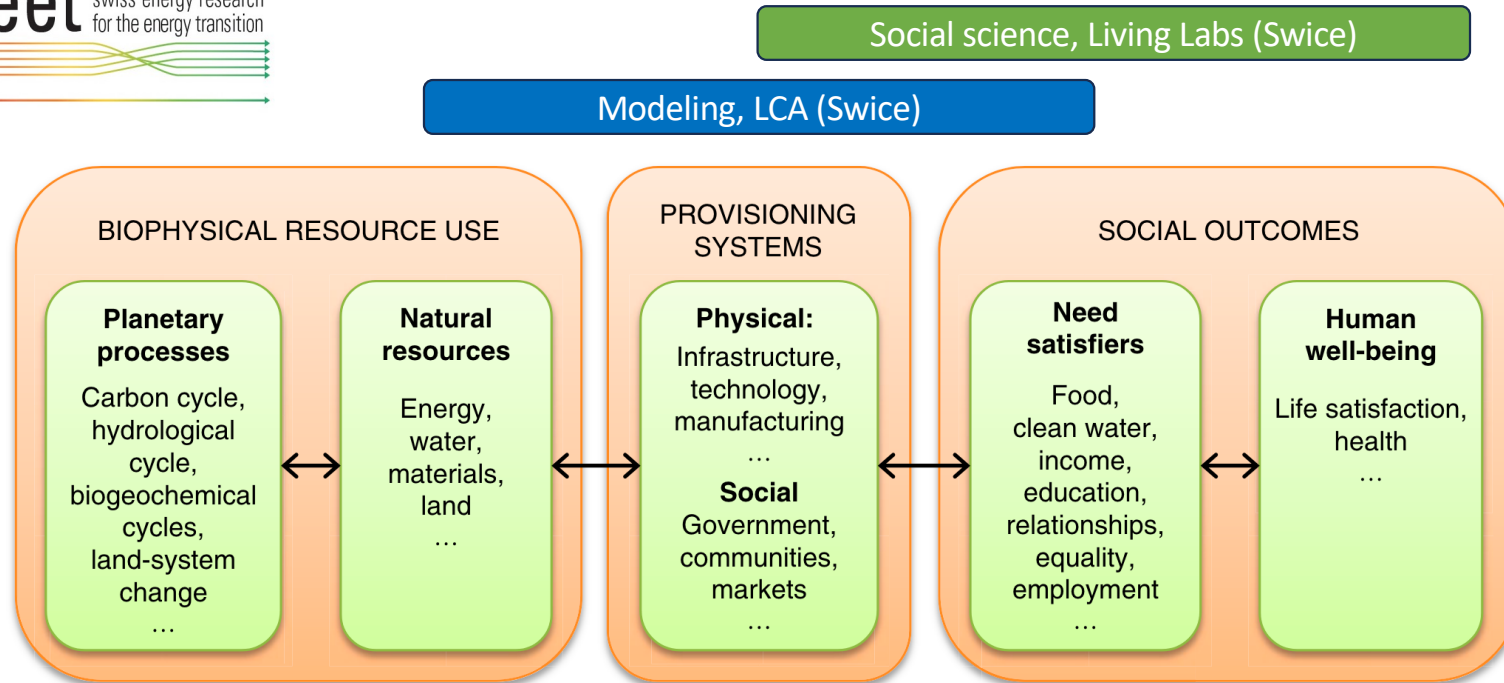
Cédric Terrier

ENG-650 Sustainability
in my research

Lausanne – 03.12.2024

Introduction: How do we satisfy our needs for well-being?

2



Analytic framework showing the link between planetary processes, provisioning system, satisfiers and human well-being [1].

[1] Daniel W. O'Neill, *A good life for all within planetary boundaries*, Nature sustainability, 2018

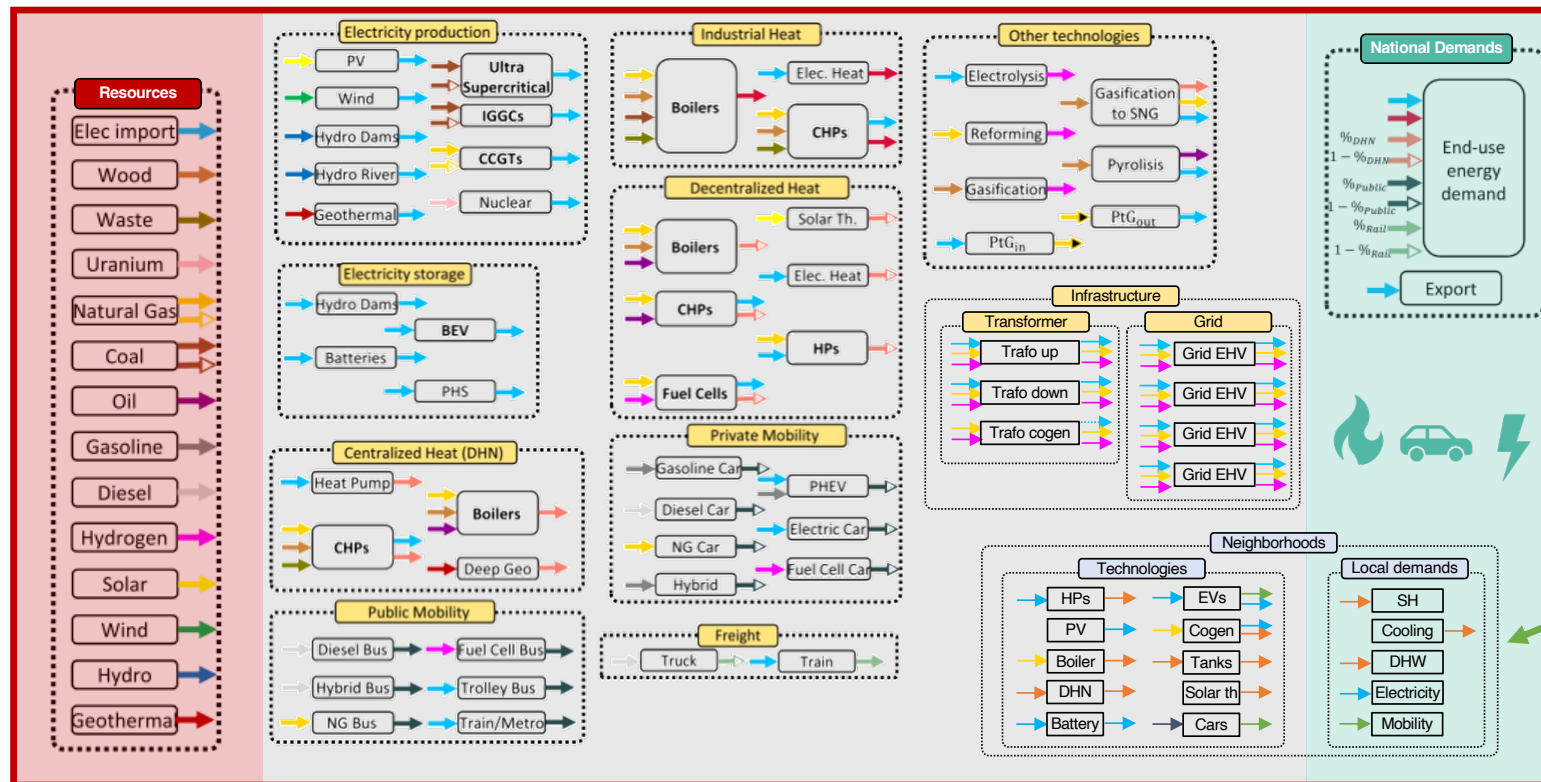
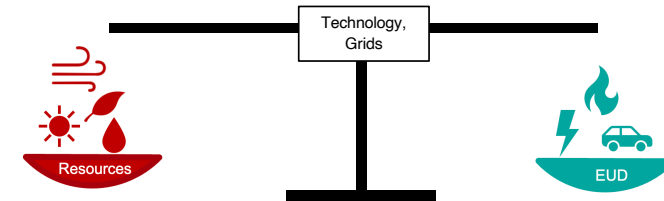
3



Methodology: energy system modeling

Mass and energy balance

- Demand / Supply
- Resources and imports
- Technologies / Infrastructure

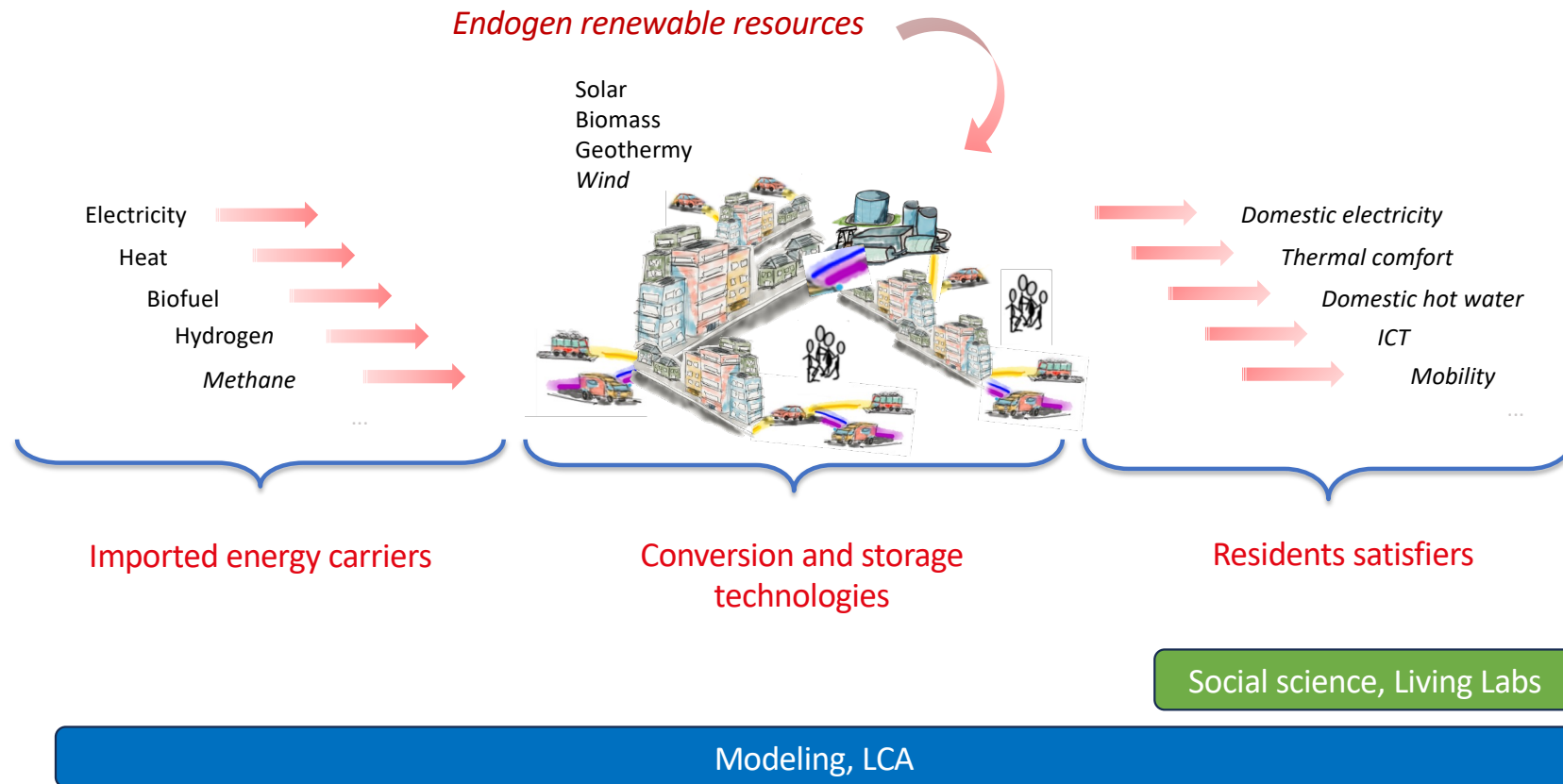


Downscaled
Planetary
boundary

Sufficiency
measures

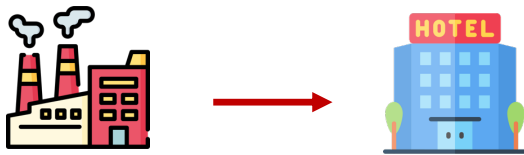
How energy sufficiency help staying within safe operating zone?

5



What is the real cost of energy consumption?

Market price $\neq$ real price



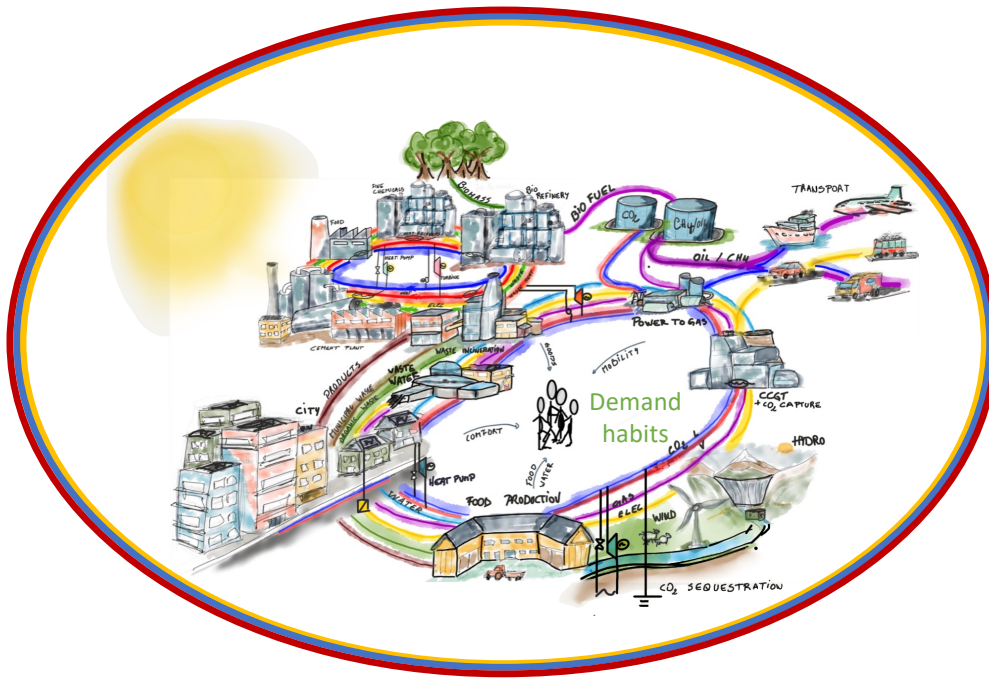
Externalities from
industry on hotel

- Use taxes to internalize externalities (increase market price to real price)
- Difficulty to quantify

Shadow cost is affected by:

- Market failure
- Resource scarcity
- Market prices and discount rate
- Environmental impacts
- Policy
- Technology innovation
- Actors interests

What is the real cost of energy consumption?



➤ Cost increase = dual value or marginal cost

Ex: cost for the system to prevent 1 ton $\text{CO}_{2,\text{eq}}$ being emitted
 $\neq$ social cost of $\text{CO}_{2,\text{eq}}$ due to environmental hazards

- Market failure
- Resource scarcity
- Market prices and discount rate
- Environmental impacts
- Policy
- Technology innovation
- Actors interests

No energy imports

➤ Cost increase

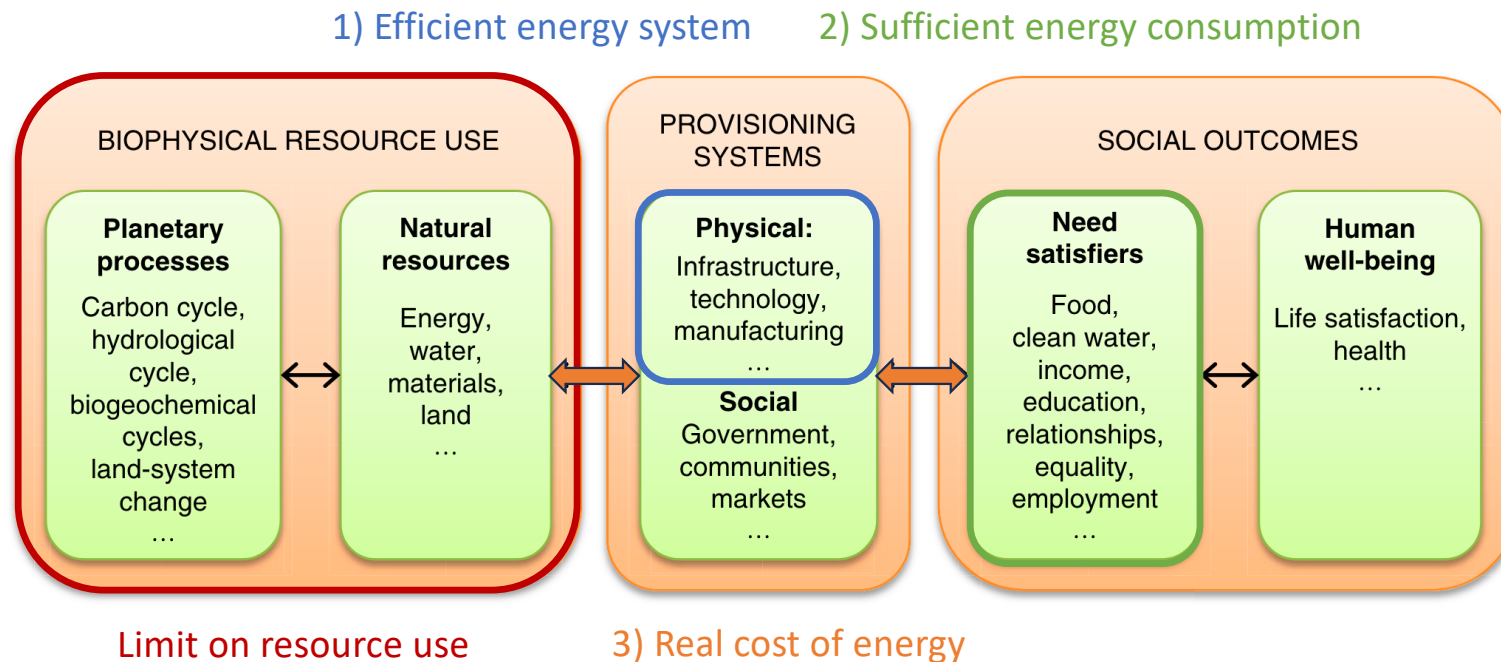
High interest rates

➤ Cost increase

No CO_{2,eq} emissions

➤ Cost increase

Conclusion



- ➡ How energy efficiency and sufficiency mitigate environmental impacts?
- ➡ How is the shadow cost of energy impacted by efficiency and sufficiency?

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Thank
you!

Cédric Terrier