



**University of  
Zurich** <sup>UZH</sup>



Institute of Political Science - Center for Comparative and International Studies

# **Cost-effective mitigation including negative emissions – the role of markets and MRV**

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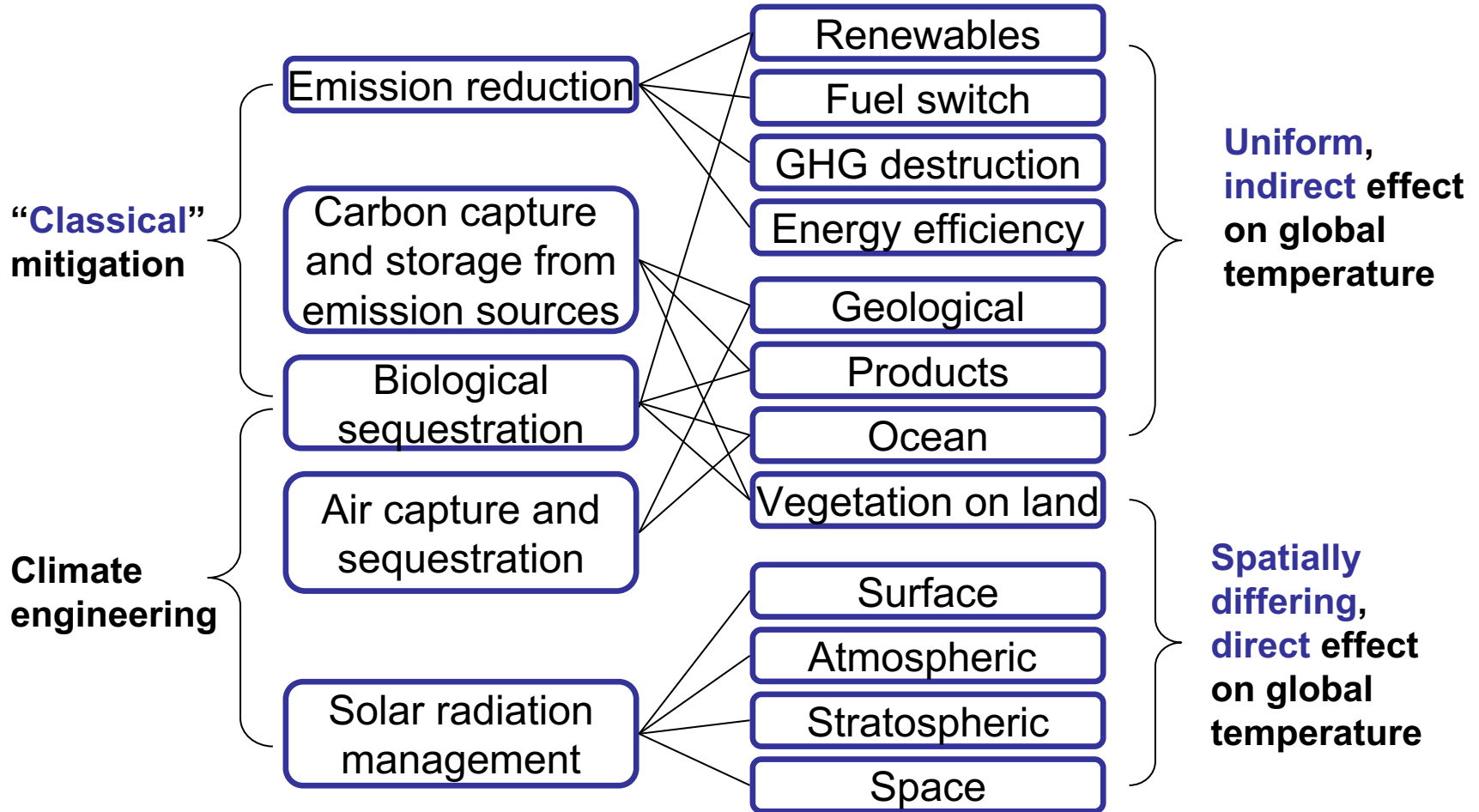
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- **Taxonomy of mitigation options**
  - **Why markets?**
  - **A universal trading unit for mitigation**
  - **Monitoring and verification**
  - **Assigning liabilities**
  - **Attractiveness of different mitigation options on the mitigation market**
  - **Market mechanisms as key tool to reach the 1.5°C target**
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Reaching the 1.5°C target requires mobilizing **all** efficient options that do **not have severe negative side effects** (=externalities)!



- **Political opposition** against costly mitigation (or mitigation perceived to be costly) is **strong!**
    - Governments have **fallen** due to such opposition (Australia, Canada, Norway)
    - Governments that earlier were **pushing for ambitious mitigation policies** have shied away from measures that may be seen as too costly (Germany, Japan)
  - The **top-down** international climate policy regime of the Kyoto Protocol has been replaced by a (mostly) **bottom-up** system under the Paris Agreement
    - No possibilities for sanctions, everything is **voluntary**
  - Markets allow to mobilize the **cheapest** mitigation options and thus **reduce political opposition** against mitigation
    - **Exception: Countries with strong protectionist / populist tendencies**
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$W/m^2$

- We want to limit **temperature increase**
- Temperature increases when the solar **radiation retained by Earth increases** (= **radiative forcing**)
- Radiative forcing is measured in  $W/m^2$  area
- Since 1750, radiative forcing due to greenhouse gas emissions has reached  **$2.3 W/m^2$**  (IPCC WG I 2007)
- Mitigation **reduces** radiative forcing
  - **All** mitigation options that do **not generate significant negative externalities** should be eligible for market mechanisms
- So,  $W/m^2$  should theoretically be an ideal trading unit for **mitigation markets**



- **W/m<sup>2</sup>** is a “**flow**” unit, not a “**stock unit**”
  - **Emissions reduction/sequestration** generates a flow of radiative forcing units **until the end of life of the greenhouse gas in the atmosphere**
  - Emission reductions/sequestration needs to be converted into trading units using an **agreed conversion factor**
  - Certain types of **solar radiation management (SRM)** only generate trading units as long as **actively kept up**
  - Given SRM is only generating effects in **certain areas**, its generation of trading units needs to be **discounted** with the **share of the Earth’s area actually covered**
  - “**Exchange rates**” between GHGs will change
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- For **emission reductions** nothing will change
    - Ensure that **seepage/leakage from CCS** is addressed
  - For **SRM** measurement on **different spatial scales** is required
    - Surface albedo changes: measurement of albedo of **significant sample of project area**
    - Atmospheric and stratospheric albedo changes, space-based SRM: **Satellite measurement** of albedo
  - **Challenges**
    - **Accuracy** of satellite measurement
    - **Costs** of satellite measurement
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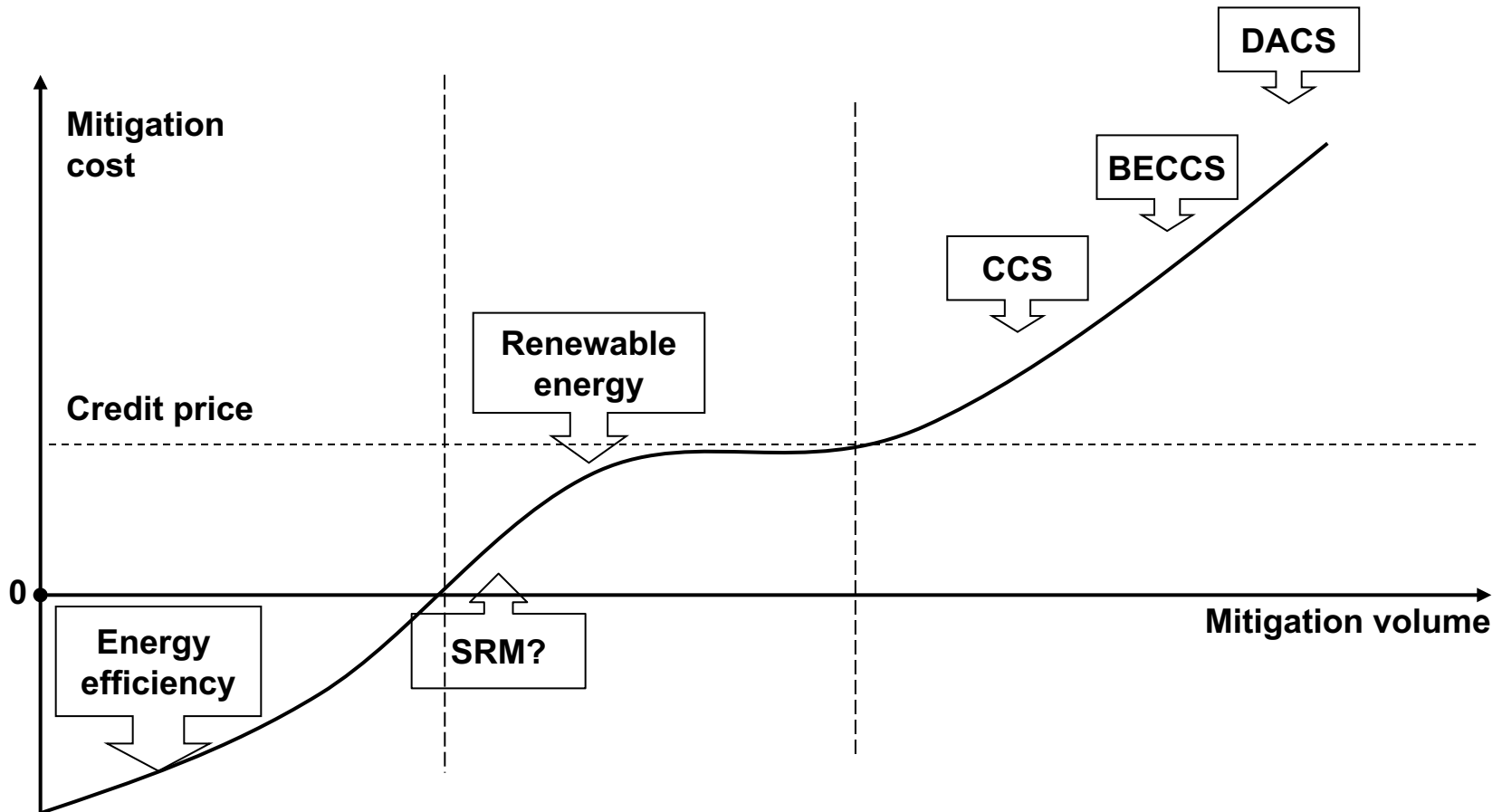


- For **reversal** of emissions sequestration through NETs
    - See EU and CDM **regulations on CCS**
  - For **externalities**
    - Indirect effects of “**response measure**” type
      - **Price effects** on **fossil fuel** and **food** markets (BECCS)
    - **Direct** damages
      - Geological sequestration: **sudden release**
      - SRM: Changes in **climate patterns** (loss of monsoon)
      - **Ozone layer** damage
  - **Challenges**
    - **Attribution** of externalities in the (very) **long term**
    - **Buyer vs seller liability**
    - **Enforcement of liability-related claims**
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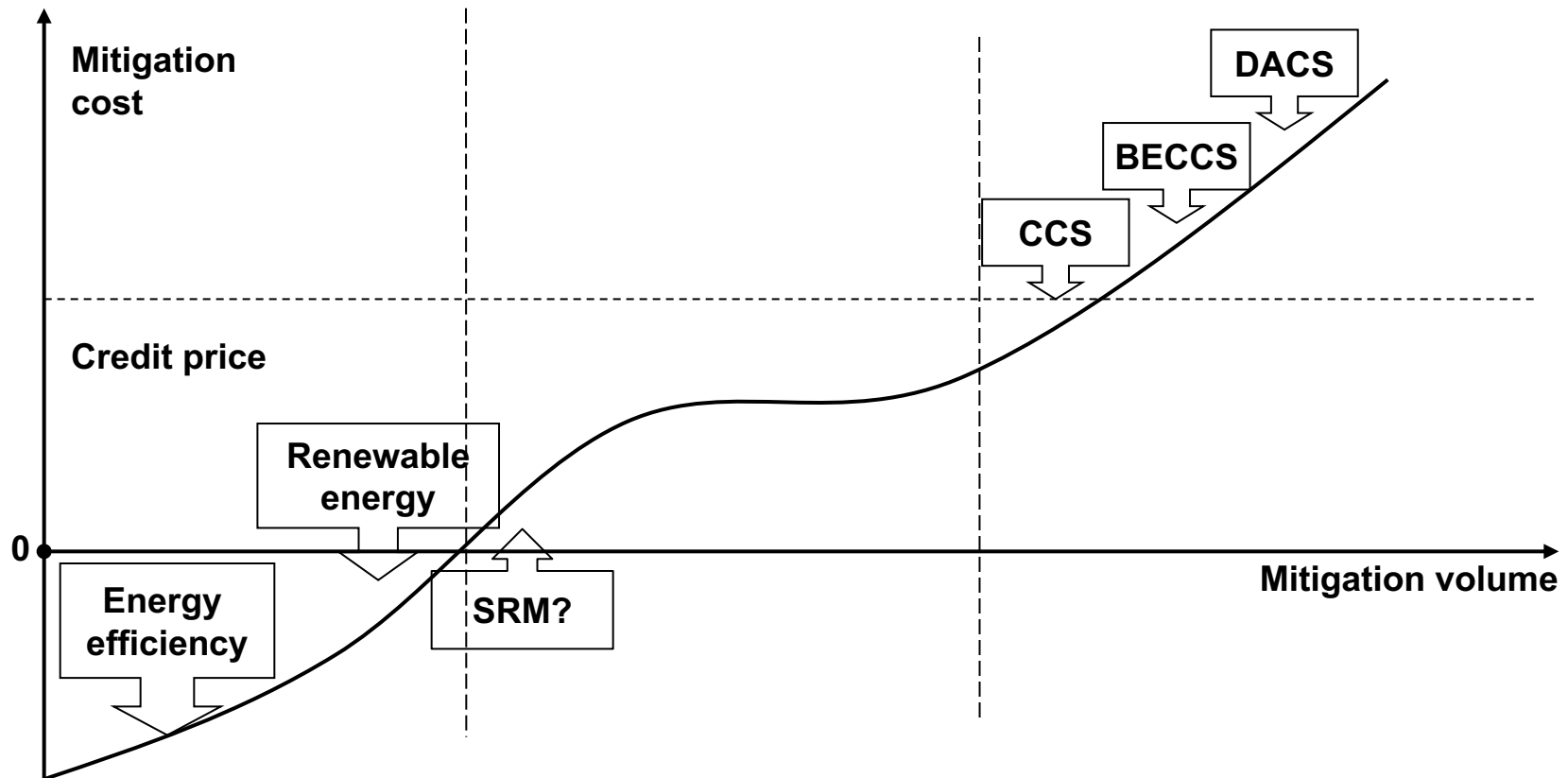




- **Definition of trading unit**
    - Discussion of characteristics of **ITMOs under Paris Mechanisms (Art. 6 PA)** provide an opportunity
      - Degree of **international oversight** is contested
  - **Conversion rates** of emission reductions
    - Discussion about “**common metrics**” under PA
  - **Liability** rules for direct damages/externalities
    - Short vs long term
  - **UNFCCC Mitigation Supervisory Board**
    - **Could be based on Art. 6.4 PA supervisory body**
    - **Checks coverage of liability**
    - **Supervises application of MRV rules**
    - **Control of single state / subnational action**
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- **NETs** currently have **very high costs** and are not attractive
- **SRM** costs remain to be assessed robustly but likely to be **low**



- Renewables to become business as usual
- NET costs to come down but still likely to be above market price



- Focus on **most cost-effective** mitigation options due to **bottom-up** nature of international climate policy system
  - Otherwise, **political opposition** against mitigation will triumph
- **Market mechanisms** can **mobilize** such options
  - Shown by **rapid mitigation** achieved through CDM
- Ideally, a **common mitigation unit** defined in terms of radiative forcing ( $\text{W/m}^2$ ) would be used by the market
- **International oversight** of market mechanisms required to
  - Ensure **additionality** of mitigation receiving credits
  - Ensure **robust and credible MRV**
  - **Prevent negative externalities through liability rules**
    - BECCS: food prices, SRM: climate patterns ...
- **NETs** like BECCS and DAC are **unlikely to be attractive** for the market in the **short term**
  - Long term cost reductions may make them attractive



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**Thank you!**

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