



# Lecture 6: Financing the Transformation

## Episode 2: The role of carbon markets

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Episode 1: Financing the transformation: Investment requirements, financing options and investment barriers (Prof. Dr. Renate Schubert)

**Episode 2: Financing the transformation: The role of carbon markets (Dr. Daniel Klingefeld)**

Episode 3: Interview



1. You understand why a well-designed policy framework is needed for initiating the global transformation
2. You know about the essential role of carbon pricing within the policy mix
3. You can explain the functioning of price-based and quantity-based instruments for carbon pricing
4. You understand the advantages of carbon markets over carbon taxation
5. You learn about different strategies to expand carbon markets (stepwise, multi-level approach)
6. You understand why additional instruments are needed to address all barriers to the transformation



- Market failures as barriers to investment
- Instruments for managing the transformation
- The role of carbon pricing within the policy mix
- Price- vs. quantity-based instruments for carbon pricing
- Benefits of carbon markets for the transformation
- Three strategies to expand carbon markets (stepwise, multilevel approach)
- Additional instruments to support the global transformation

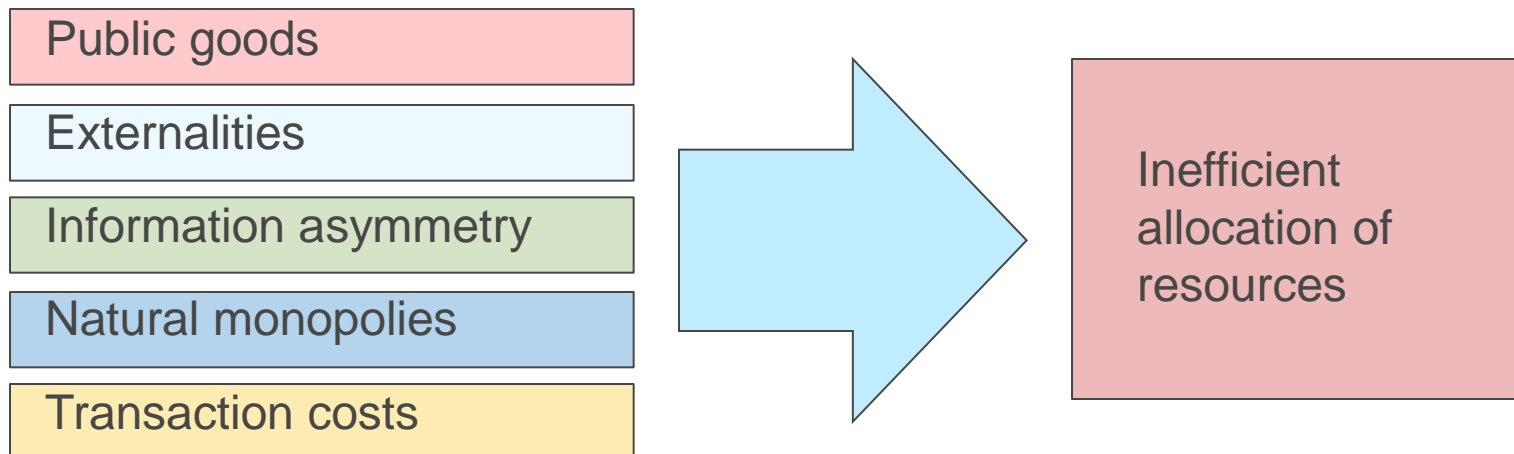


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# Market failures hamper the global transformation

- Some of the barriers to the transformation can be classified as market failures
- Market failures hamper the welfare-enhancing functioning of markets  
→ they preclude that market outcomes are optimal for the overall economy
- If market failures prevail, resources are not allocated efficiently
- Examples for market failures



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## Political and economic instruments

- In principle, four types of instruments or measures to steer the global transformation can be distinguished:

<p><b>Regulatory instruments</b></p> <p>e.g.</p> <p>Efficiency standards for vehicles, buildings or durable consumer goods</p> <p>Prescriptions or prohibitions for certain activities</p>	<p><b>Incentive instruments</b></p> <p>e.g.</p> <p>Taxes</p> <p>Subsidies</p> <p>Fiscal incentives</p> <p>User charges</p>	<p><b>Information instruments</b></p> <p>e.g.</p> <p>Voluntary agreements between governments and companies</p> <p>Information campaigns</p> <p>Product labelling</p>	<p><b>Government investment</b></p> <p>e.g.</p> <p>In public infrastructure</p> <p>In (technology) demonstration projects</p>
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Source: after WBGU, 2011

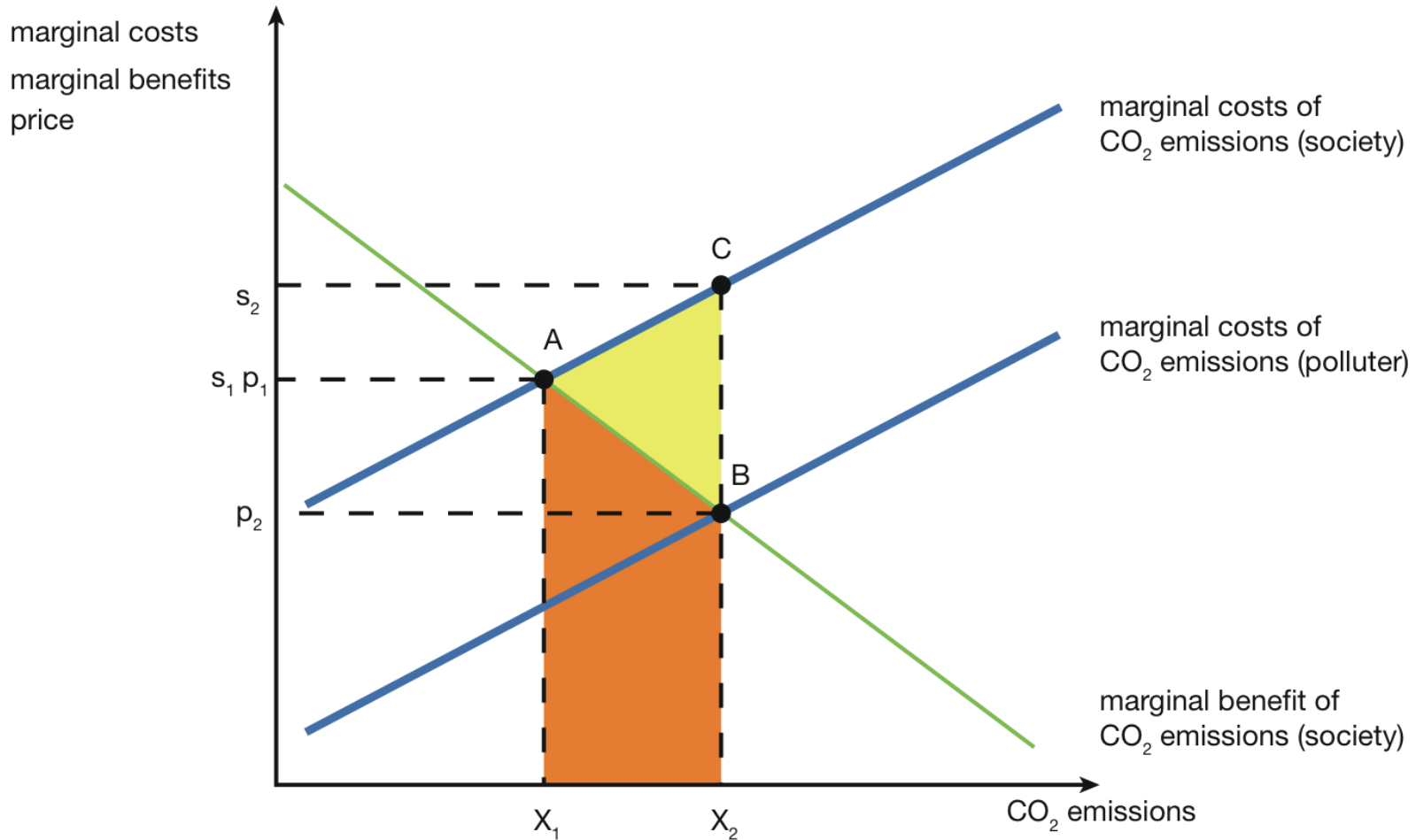




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# The problem: Externalities from fossil fuel consumption



Source: Illustration following Sterner (2003)

## The solution: Putting a price on CO<sub>2</sub> emissions

- By putting a price on CO<sub>2</sub> emissions, externalities of fossil fuel combustion can be internalized
- The price of one unit of CO<sub>2</sub> emissions should reflect damages to society from an extra unit of emissions → **social cost of carbon**
- Taking the price of CO<sub>2</sub> emissions into account: private costs of consuming one unit of fossil fuels include social costs
- As a consequence, consumption of fossil fuels reduces to the socially optimal amount → market failure is eliminated

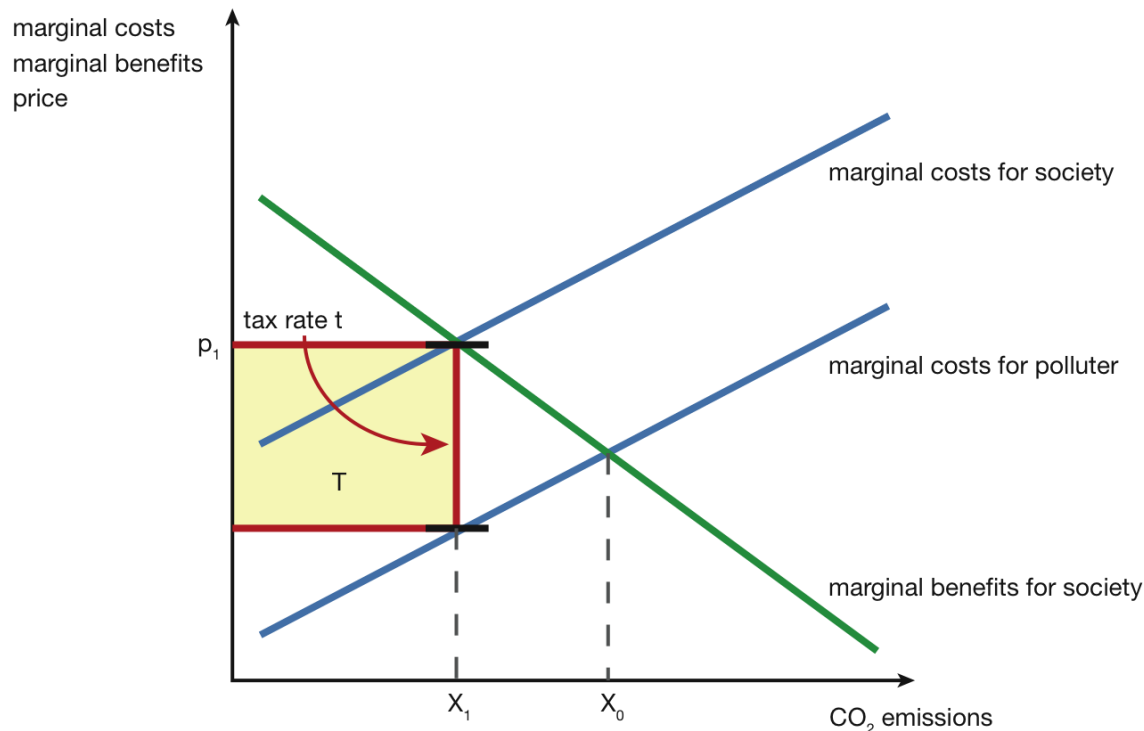


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- Conclusions



## Carbon pricing with a CO<sub>2</sub> tax

- Carbon tax puts a fixed price on CO<sub>2</sub> emissions
- Polluters have to pay this tax per unit of emissions
- Tax generates additional cost for fossil fuel consumption  
→ changes in production and consumption decisions

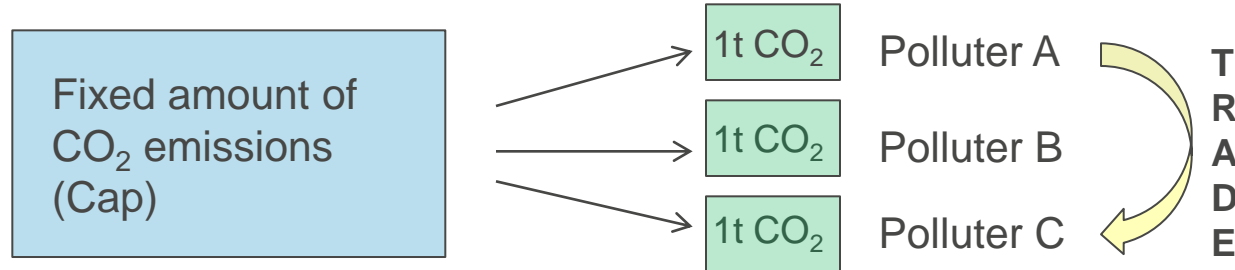


Source: Illustration following Sterner (2003)



## Carbon pricing with tradeable permits

- Definition of fixed amount of CO<sub>2</sub> emissions that can be released into the atmosphere
- Polluters have to buy a permit for every unit of emissions they release
- Number of permits is limited by the fixed amount of emissions (cap)

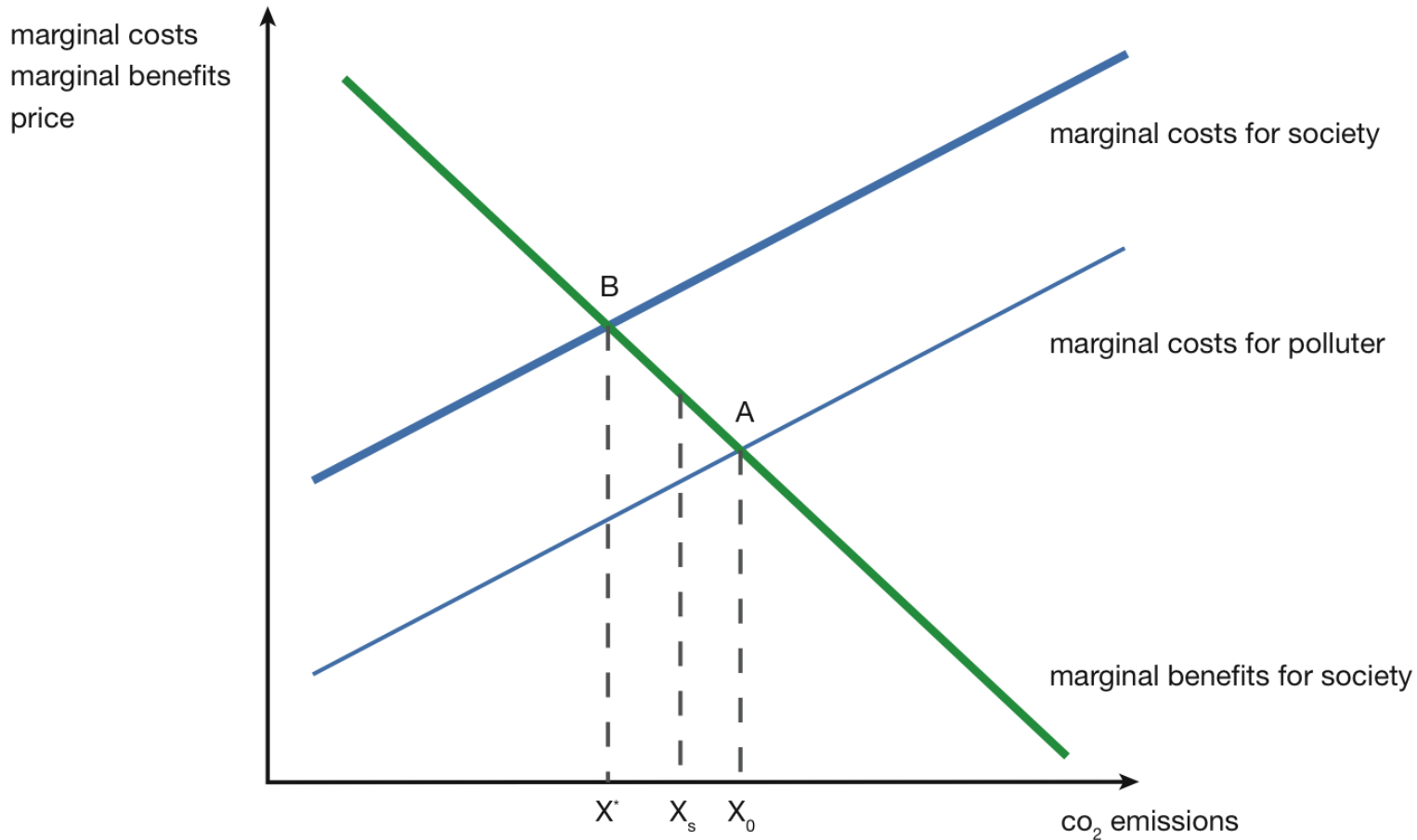


- Permits are traded on the market → prices formed by supply and demand
- Price of the permits or emission certificates generates additional cost for fossil fuel consumption → changes in production and consumption decisions

Source: WBGU



# Carbon pricing with tradeable permits

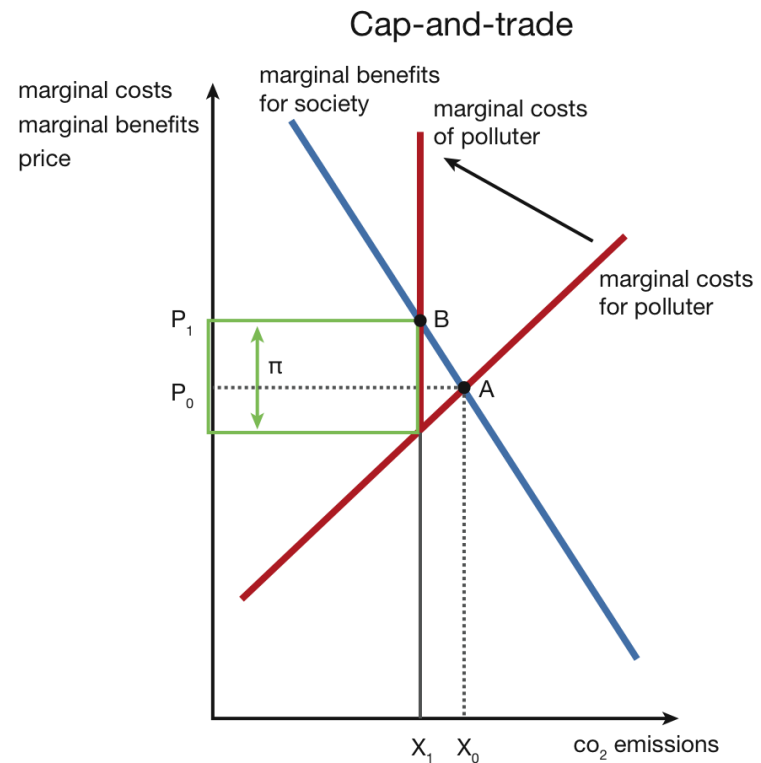
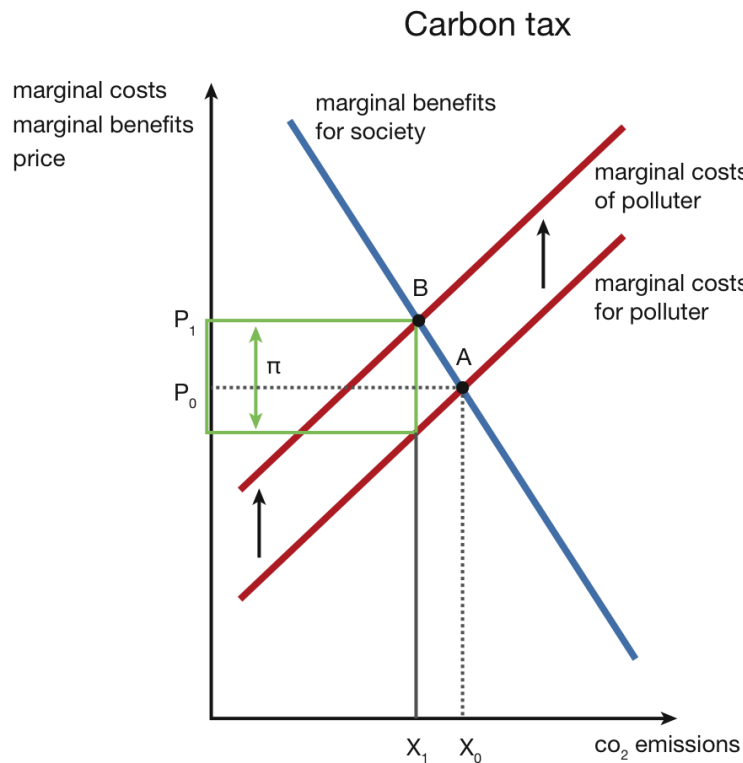


Source: Illustration following Sterner (2003)



## Equivalence of both instruments

- In principle, a carbon tax and a cap-and-trade system can lead to equivalent outcomes



Source: Illustration following Sterner (2003)





## Advantages and disadvantages of both instruments

- CO<sub>2</sub> tax



Fixed price → gives companies and consumers certainty about costs of emitting one unit of CO<sub>2</sub>



Uncertainty about emission reductions → tax needs to be adjusted in trial-and-error process

- Cap-and-trade system



Fixed quantity → high ecological effectiveness



Uncertainty about carbon price → reduced certainty about costs of emitting one unit of CO<sub>2</sub> → reduced incentives to invest in carbon-neutral technologies



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### WBGU favors a global carbon market

- High ecological effectiveness of carbon markets → WBGU favors a global carbon market instead of a global CO<sub>2</sub> tax
- Decision based on WBGU's guard rail approach → goal: limit anthropogenic intervention in nature
- Advantage of emissions trading over taxation at the global level → only one market place needs to be established, rather than a global fiscal authority

Carbon markets enhance financing of low-carbon investment in two ways:

- Steering investments towards low-carbon technologies
- Providing revenues from the sale of permits which can be used for promoting investment



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## (1) Developing the EU Emissions Trading System

- European Union set up a EU-wide emissions trading scheme in 2005
- Restrictions on emissions from around 10,000 installations across the EU
- All energy intensive sectors covered
- EU ETS can be example for other countries and should be continued and developed further
  - Administration should be made less complex
  - Cap on emissions should be more ambitious
  - Readjustment of the amount of allowances should be considered
  - Pricing should be extended to all fossil CO<sub>2</sub> sources



### (2) Linking national emissions trading systems

- Parallel to developing the EU ETS, links for international cooperation should be sought
- Aim: tap the benefits of the trading mechanism → increasing the scope of the market = higher potential for cost-efficient mitigation
- Options for stepwise introduction of emissions trading schemes
  - Sectoral or tiered approaches (e.g. only in the energy sector)
  - Relative targets (efficiency targets) instead of absolute targets
  - Linking of several national emissions trading systems

All strategies should have the ultimate goal in mind: to have a joint cross-national emissions cap and a global trading scheme



### (3) Establishing a global emissions trading scheme

- Advantages of a global emissions trading scheme
  - Cost-efficiency of mitigation is fully guaranteed
  - Significant global emission reductions can be achieved
- Huge political effort and extraordinary international cooperation needed
- The EU, other industrialized countries willing to cooperate and the so called BASIC countries (Brazil, South Africa, India, China) could negotiate an allocation of emissions rights together with an efficient trading mechanism
- Pioneer coalitions could lead the way



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# Instruments complementing carbon pricing

- Carbon pricing is the essential instrument in order to foster investment in the energy transformation
- Further market failures require further instruments, e.g.
  - **Barriers to market entry** → technology-specific support (e.g. feed-in tariffs for renewable energy) or industry-wide standards
  - **Electricity grids as natural monopolies** → grid regulation
  - **Knowledge spillovers in research & development** → government R&D support and government demonstration projects

Only the simultaneous use of various instruments will initiate the systemic and fundamental changes needed for the global energy transformation



## Exercises for self study

1. Explain why a policy framework for initiating the global transformation is needed.
2. What are the types of instruments that can be used for managing the transformation?
3. What role can carbon markets play within the policy mix?
4. Why is it necessary to complement carbon markets with additional instruments to foster investment in low carbon technologies?



### Basic reading:

- WBGU (2011): World in Transition: A Social Contract for Sustainability, chapters 5.2 and 7.3.2. Berlin. [www.wbgu.de](http://www.wbgu.de)

### Further reading:

- Edenhofer, O. et al. (2009): The Economics of Decarbonisation. Report of the RECIPE Project. Potsdam: Potsdam Institute for Climate Impact Research.
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- Weitzman, M. L. (1974): Prices versus quantities. Review of Economic Studies 41 (4), 477–491.



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