Emission Trading System

Origin, development and current situation in EU/AT

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Content

- Emissions trading
- Kyoto Protocol
- EU Emission Trading System

Emissions trading

Emission trading

- Pollution as a negative externality
  - Economic activity that affects a third party negatively
- Put a price on carbon
- Provide an economic incentive to reduce emissions, beginning with the lowest-cost opportunities

- Three alternatives:
  - Carbon tax
  - Cap-and-trade
  - Command-and-control regulation

Carbon tax

- Two alternatives:
  - Surcharge on the carbon content of fossil fuels that aims to discourage their use and thereby reduce CO_2 emissions
  - Direct tax on CO_2
- Incentive-based regulation
- Price control instrument
  - Price of carbon is set and the market determines the quantity emitted
  - Magnitude of the tax depend on how sensitive the supply of emissions is to the price

Cap-and-trade

- Quantity control instrument
  - Maximum (cap) on total amount of GHG that can be emitted by all participating installations
  - Allowances for emissions are then auctioned off or allocated for free
  - Allowances can subsequently be traded
- Quantity is set and the market determines the price
- Incentive-based regulation

Command-and-control regulation

- System of regulation that prescribes emission limits and compliance methods on a facility-by-facility or source-by-source basis
- Less flexible
- Example: performance standard
  - Sets emissions goal for each polluter that is fixed
  - Burden of reducing pollution cannot be shifted to the firms that can achieve it more cheaply
  - Not so cost effective
  - Production costs would rise and a proportion of such higher cost will be passed through to the end consumer

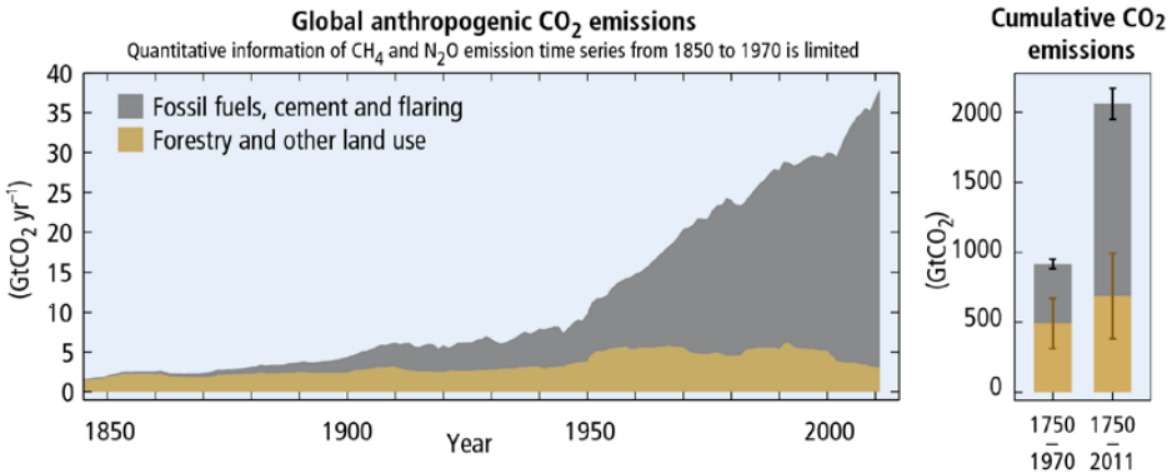
Kyoto Protocol

Development

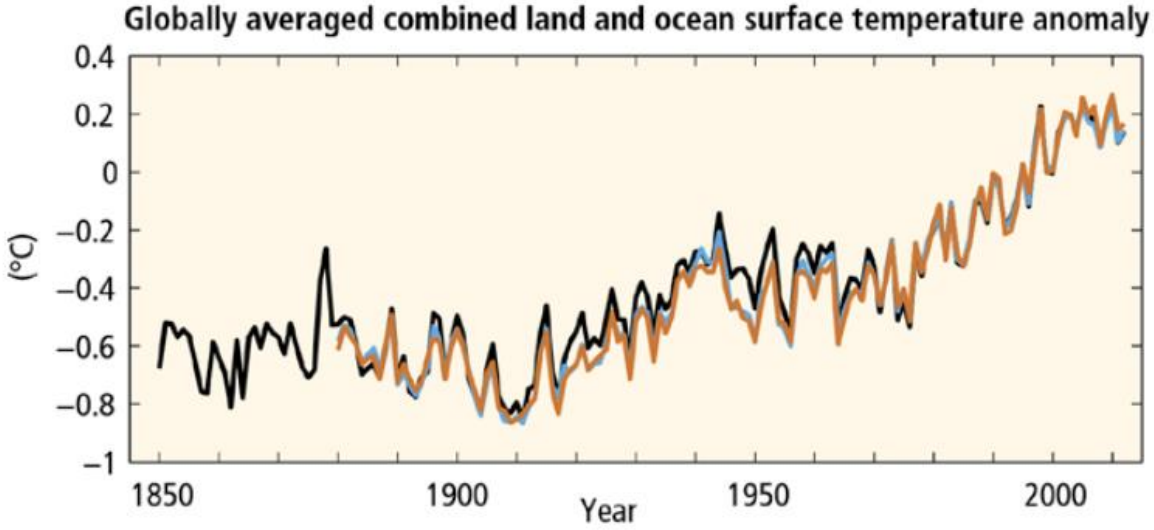
- Assessment report of IPCC in 1990 determined a strong correlation between human activities and climate change
- United Nations Framework Convention on Climate Change (UNFCCC) [UN 1992/article 2] defines:

> *"The ultimate objective of this Convention […] is to achieve […]* ***stabilization of greenhouse gas concentrations*** *in the atmosphere at a level that would* ***prevent dangerous anthropogenic interference*** *with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner."*

Anthropogenic influence



CO_2 emissions over the last 160 years



Land und sea surface-temperature over the last 160 years

Quelle: IPCC fifth assessment report

Kyoto Protocol

- International agreement
- Adopted in Kyoto (Japan) in 1997
- Entered into force in 2005
- Commits its Parties by setting internationally binding emission reduction targets
  - Reduce GHG-emissions to an average of 5% against 1990 levels
  - Higher burden on developed countries
  - Common but differentiated responsibilities
- First commitment period: 2008 to 2012
  - 37 industrialized countries and EU

Kyoto Protocol

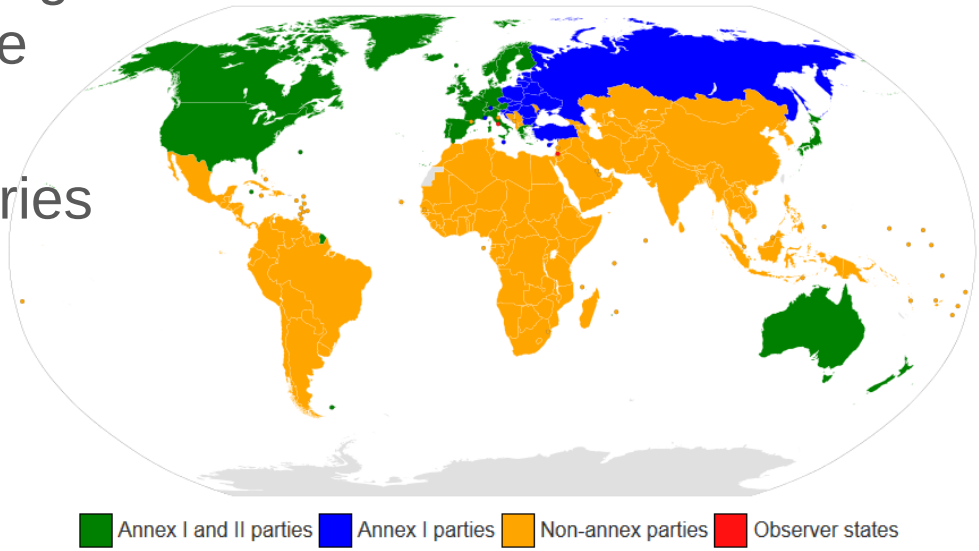
- Second commitment period: 2012-2020
- Adoptions in 2012:
  - New commitments for Annex I Parties (reduce GHG emissions by at least 18% below 1990 levels until 2020
  - Revised list of GHG to be reported on by Parties in the 2nd period
- Different composition of Parties
- “Kyoto gases” are defined: CO_2, CH_4, N_2O, HFC, PFC, SF_6

Emissions reduction targets

Country	Target (1990- 2008/2012)
EU-15, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland	-8%
US (indicated its intention not to ratify)	-7%
Canada (withdraw in 2012), Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0
Norway	+1%
Australia	+8%
Iceland	+10%

Classification of Parties

- *Annex I countries:* 43 Parties, industrialized (developed) countries and economics in transition (EITs)
- *Annex II countries:* 24 Parties, OECD members, required to provide financial and technical support to EITs and developing countries to assist them in reducing their GHG emissions and manage impacts of climate change
- *Non-Annex:* mostly low income developing countries
- *Annex B:* countries with emission reduction commitments



Source:https://commons.wikimedia.org/wiki/File:UNFCCC_parties.svg#/media/File:UNFCCC_parties.svg

Mitigation and adaption

Climate change mitigation

- Actions to limit the magnitude or rate of long-term climate change
- Reduce human (anthropogenic) emissions of GHG
- Increase the capacity of carbon sinks (e.g. through reforestation)
- Switch to low-carbon energy sources, expand forests and other sinks, energy efficiency (insulation of buildings)

Climate change adaption

- Manage impacts of climate change
- Reduce vulnerability of social and biological systems to climate change and offset the effects of global warming
- Local planning (local land use, municipal planning)
- Agricultural production (altering of rainfall patterns, drought tolerant crop varieties, rainwater storage)

Mechanisms

- Countries must meet their targets primarily through national measures
- Three additional market-based mechanisms (“GHG exchange program”)
  - International emissions trading
  - Clean Development Mechanism (CDM)
  - Joint implementation (JI)

AAUs.. Assigned Amount Units

International Emissions Trading

- Enables trade between Annex-B states
  - Countries that have emission units to spare – emissions permitted them bot not “used” – can sell this excess capacity to countries that are over their reduction targets
  - Trading unit = AAU (Assigned amount units), 1 AAU = 1t CO_2 reduced
- Market clearing price results from offer and demand
- Economical principle „Cap and Trade“
  - Aggregated cap on all sources is established
  - Cap = total amount of certain GHG that can be emitted
  - Is reduced over time → total emissions fall
  - Emission allowances can be traded

Cap and Trade

Without Emission trading
Historical CO_2 output

With Emission trading

allowed CO_2 emissions with CO_2 certificates

Real CO_2 output

Facility A invested in a new technology, reduction in CO_2 emissions;

Facility B didn't invest, no reduction in CO_2 emissions

Trade

Compensation
1000 t CO2 were saved with Cap and Trade at a given time

Source:http://www.dehst.de/DE/Emissionshandel/Grundlagen/grundlagen_node.html

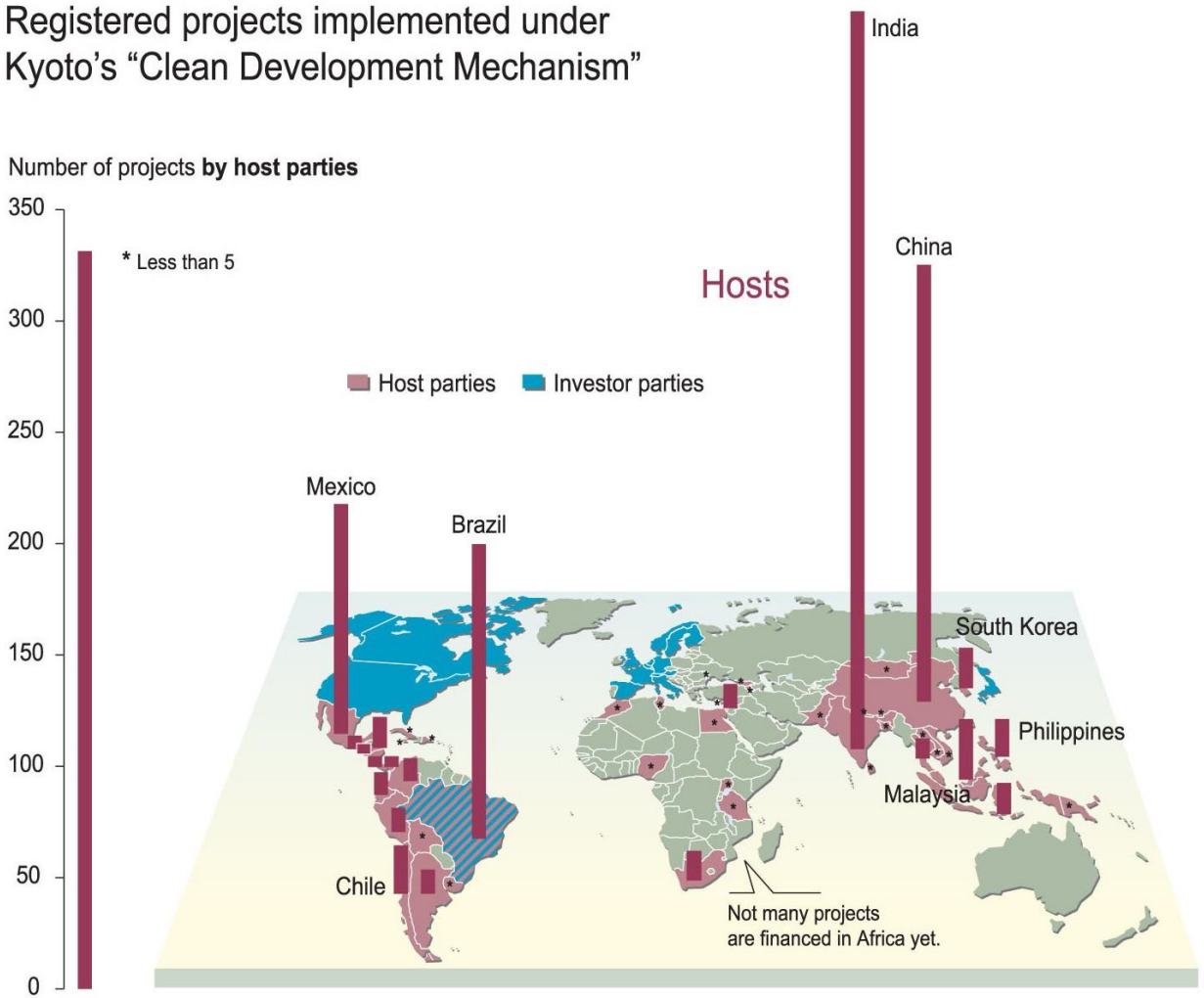
Clean Development Mechanism

- Emission reduction between Annex I and Non-Annex I countries
- Allows a country with an emission reduction commitment to implement emission reduction project in developing countries
- Goal: technology transfer and development, mitigates local pollution
- Decrease emissions in investor country and support host country in a sustainable development
- Examples: rural electrification project using solar panels, installation of more energy-efficient boilers, afforestation & green cover
- Investor country receives saleable Certified Emission Reduction (CER), 1 CER = 1 t CO_2

Clean Development Mechanism

Source: http://de.slideshare.net/harshayadav/clean-development-mechanism-basics

Clean Development Mechanism

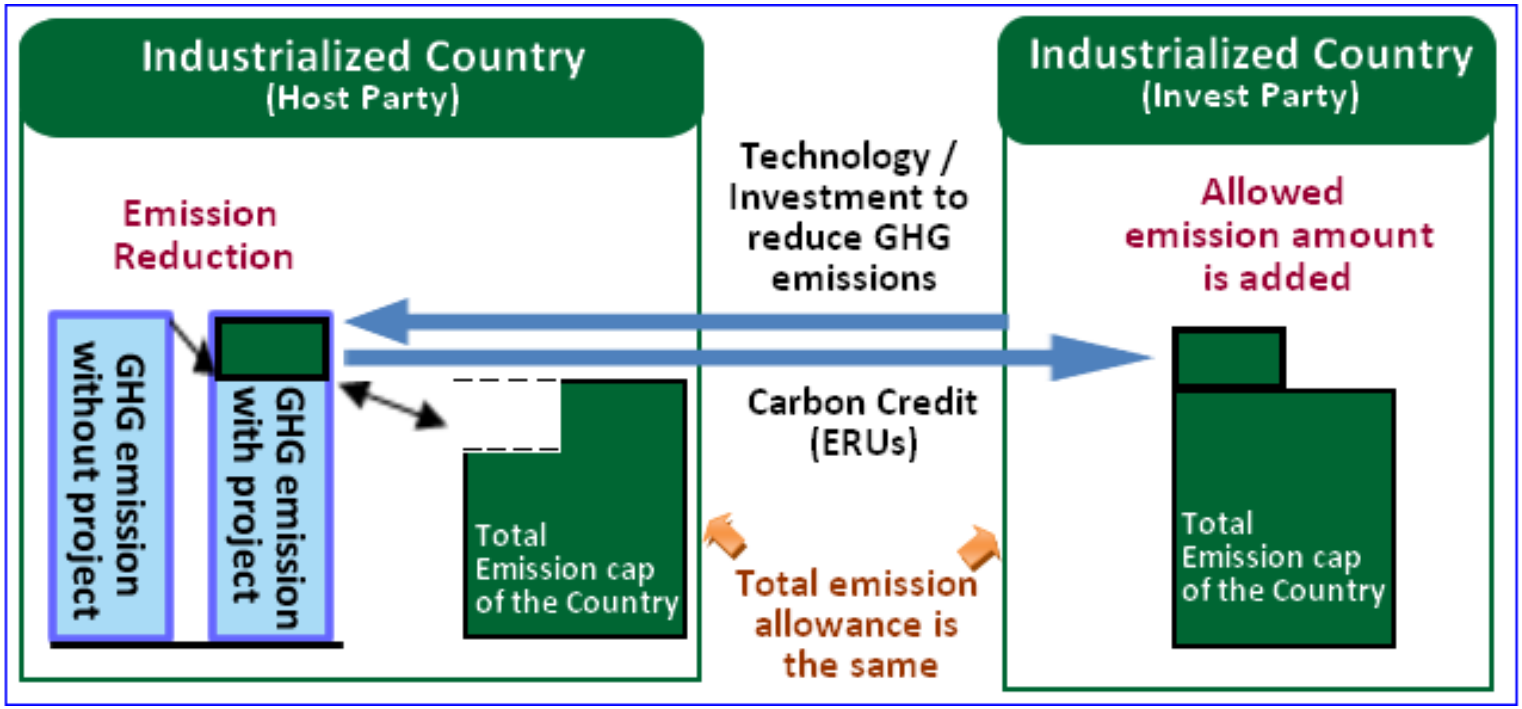


Source: http://www.climaticoanalysis.org/post/cdm-review-yes-we-should%E2%80%A6/

Joint implementation

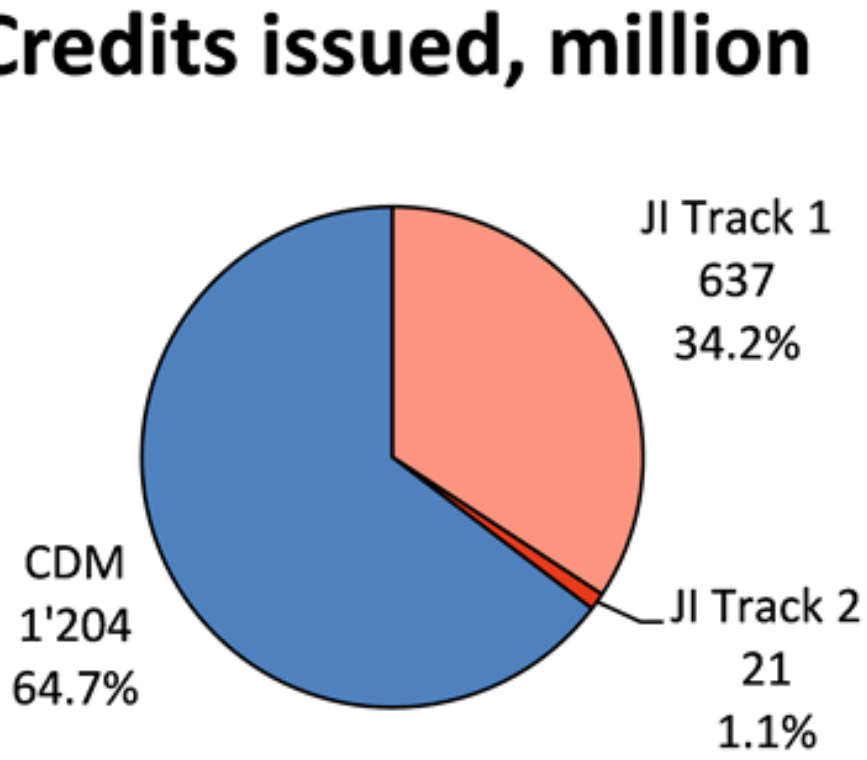
- Emission reduction between Annex I countries
- By implementing an emission reduction measure in the host country, the investor country receives emission allowances
- Emission allowances move from the host country to the investor country
- Investing country receives Emission Reduction Unit (ERU), 1 ERU = 1 t CO_2

Joint implementation



Source: http://www.climatechange.lk/DNA/kyoto_protocol.html

Joint implementation



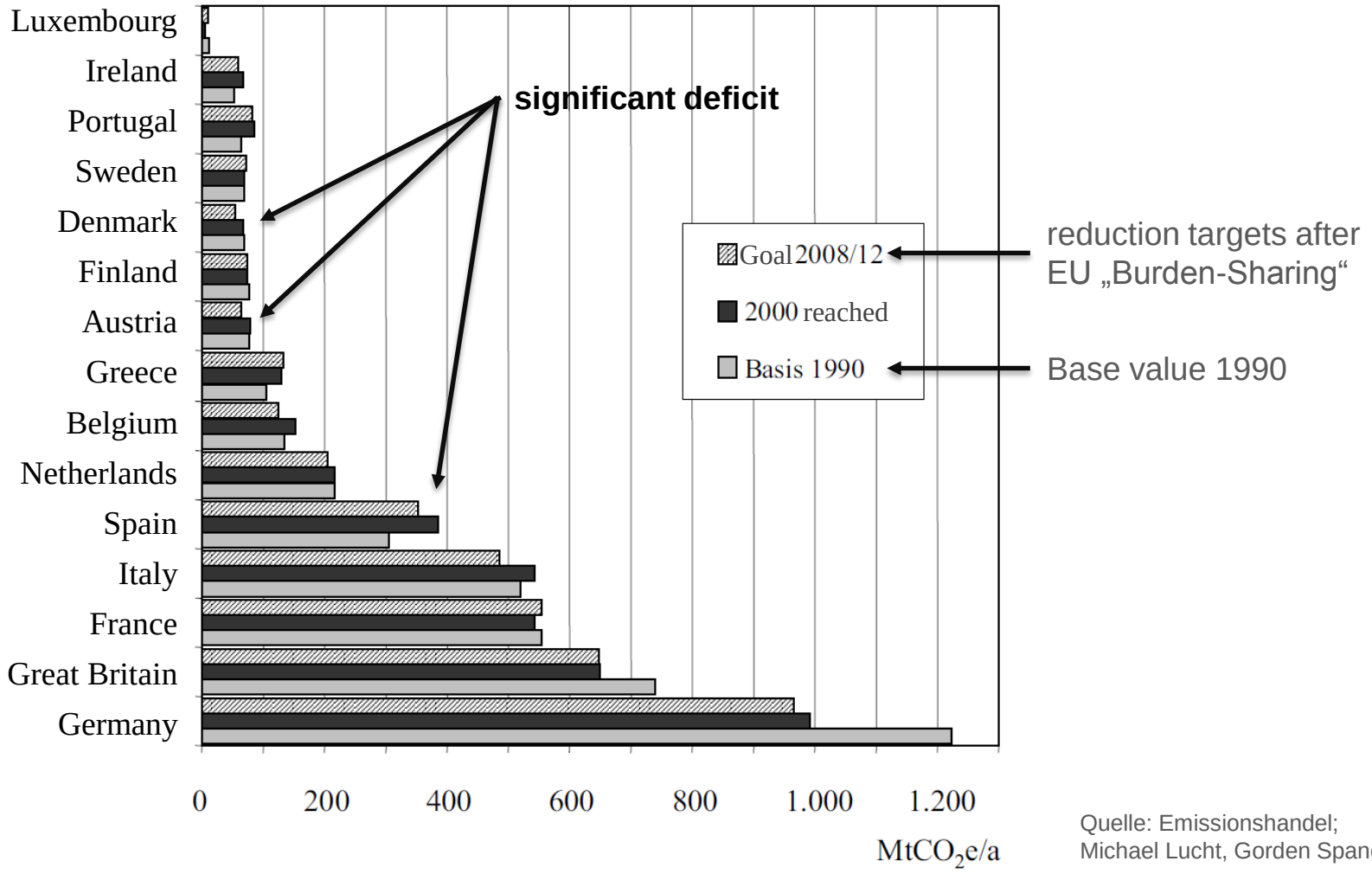
Source: http://carbonmarketwatch.org/joint-implementation-cdms-little-brother-grew-up-to-be-big-and-nasty/

Problems (I)

- Conflicts with the „Umbrella-group“
  - Climate change actions affects economic growth, because China/India/South Korea are not participating in the Kyoto-Protocol

- EU takes pioneering role and adopts the **„Burden-Sharing-Agreement“**
  - Redistribute the sum of their original reduction targets inside the group
  - Takes member states’ individual conditions into account (e.g. GHG emissions, mitigation possibilities, level of economic development)

EU-targets after Burden-Sharing-Agreement



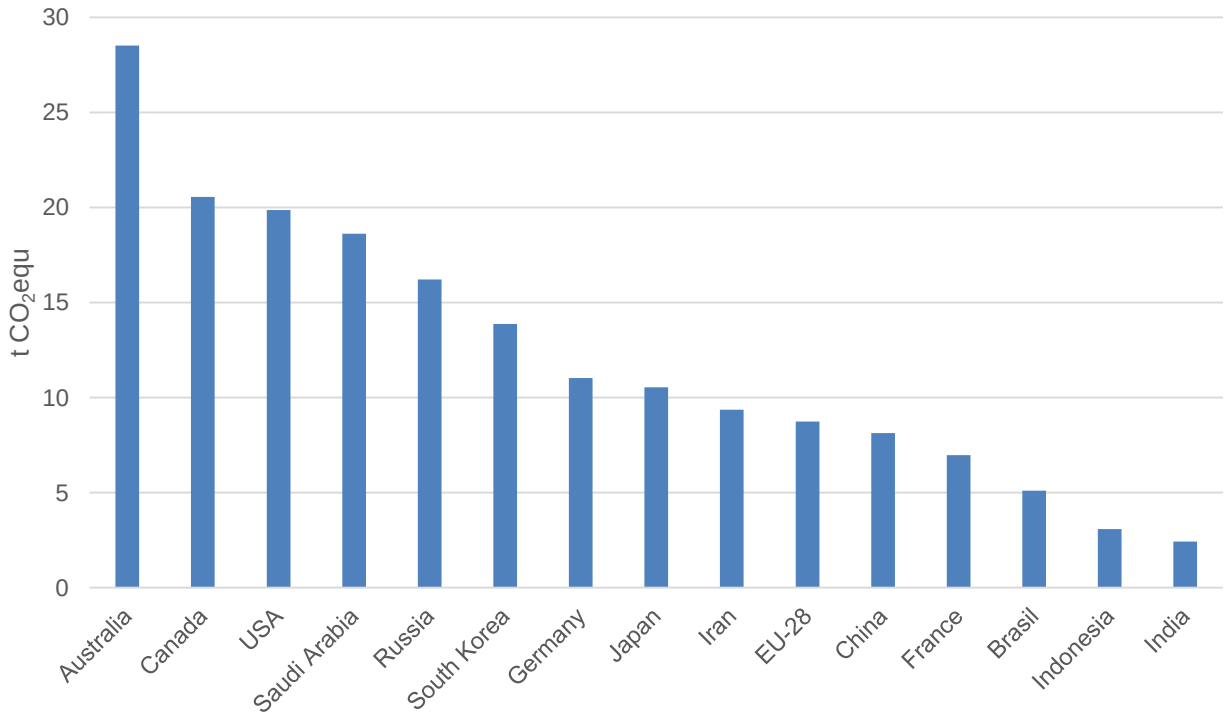
Quelle: Emissionshandel; Michael Lucht, Gorden Spangardt

Problems (II)

- No incentive (no reward) for conservation or preservation (e.g. protection of existing forests)
- No reduction obligation for undeveloped countries
- China
  - World's second largest emitter (behind USA)
  - Agreed to continue its attempts to reducing population instead, arguing that emissions are directly proportional to population
- USA
  - Responsible for approx. 25% of global GHG emissions
  - Never ratified the protocol (despite being one of it's strongest early supporters)
  - Bush Administration believed it gave undeveloped nations an economic advantage

Current situation

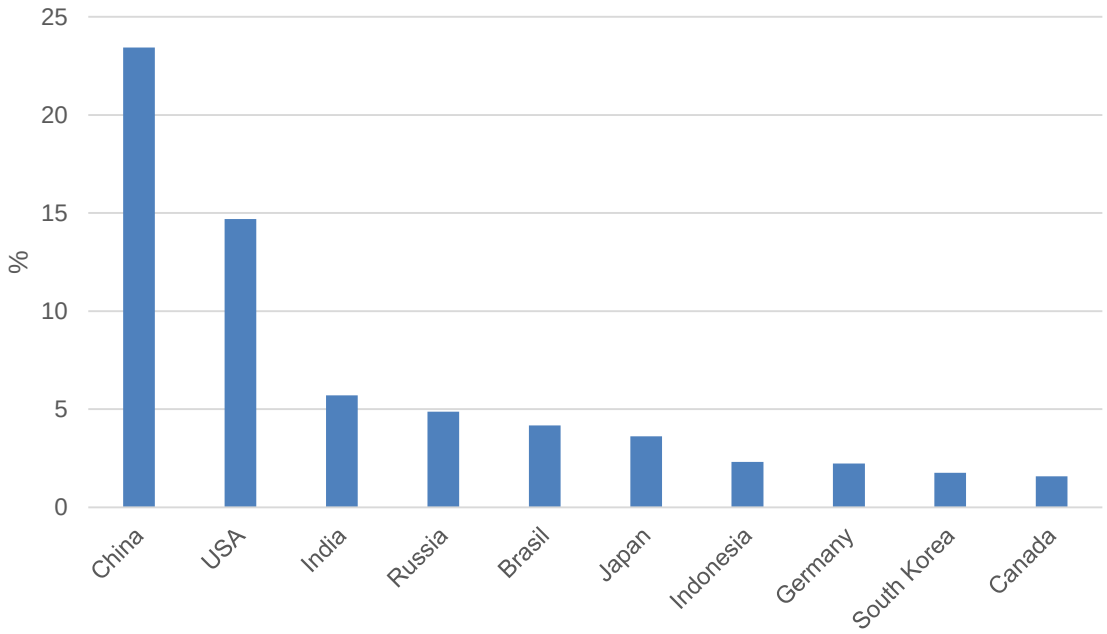
Per capita GHG emissions for selected countries Worldwide, 2012



Source: wri.org

Current situation

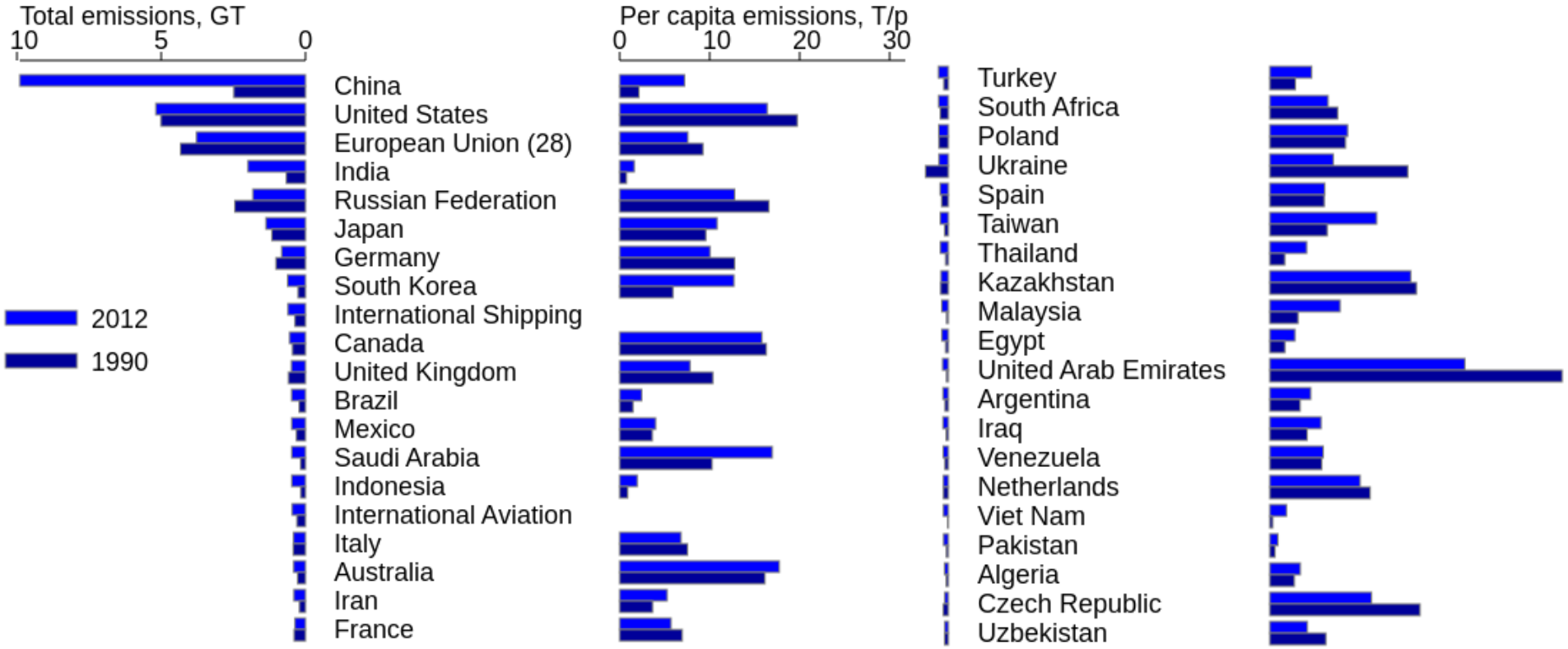
Top 10 ranking: countries with the highest CO_2 emissions Worldwide, 2014



Source: wri.org

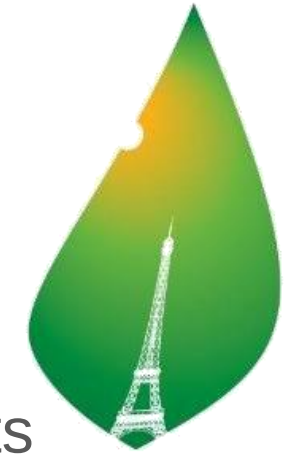
CO_2 emissions in 1990 and 2012

Top 40 CO_2 emitting countries, incl. per capita figures



Source: "Co2-1990-2012" https://commons.wikimedia.org/wiki/File:Co2-1990-2012.svg#/media/File:Co2-1990-2012.svg

COP 21



- UNFCCC 2015 (COP 21)
- 30th November – 12th December 2015 in Paris
- Extended by one day due to controversial points
- Objective: binding and universal agreement on climate, from all the nations on the world
- Follow-up of the Kyoto Protocol

PARIS2015
CONFÉRENCE DES NATIONS UNIES SUR LES CHANGEMENTS CLIMATIQUES
COP21·CMP11

- Reduce anthropogenic GHG emissions to limit global temperature increase to 2°C (preferably: 1,5°C) above pre-industrial levels
- To reach this ambitious goal:
  - Between 2045 and 2060 GHG emissions have to be zero!

COP 21

- 195 member states have to ratify the protocol
- Treaty is binding according to international law
- **BUT:** No penalties if violation of the treaty
- Key role of China and the USA, by far the two largest national emitters
- Support less strong financially states with 100 bio $/a starting with 2020 until 2025 for adaption and mitigation measures

COP 21

Critical voices

- The basic problem, that fossil fuels are too cheap and do not reflect scarcity, was not addressed
- Too less financial support for developing nations
- No consideration of aviation and shipping
- No binding CO2 reduction commitments for each country
- No penalties for violation

EU Emission Trading System

EU-ETS

- General information
- Phase I
- Phase II
- Results of the first two periods
- Phase III

NAP.. National allocation plan

General information (I)

- Directive 2003/87/EC of the European Parliament and the Council
- Establish a scheme for greenhouse gas emission allowance trading within the EU
- „Cap-and-Trade“ (same used for international ETS)
- Start: 01.01.2005
- Includes all six GHG (“Kyoto gases”) and considers credits from JI- and CDM-Projects
- 45% of total GHG emissions from EU countries are covered (excl. transportation, private households, agriculture)

EUAs.. EU Allowances

General information (III)

- Operating license of every plant within the EU-ETS is extended by the allowance to emit GHG
- Monitoring and reporting obligation for all plants (Monitoring Guidelines)
- Financial penalties for not fulfilling reduction targets
- Every state is responsible for the distribution of the certificates to the national facilities
- National Allocation Plans (NAP)
  - includes total quantity and rules for distribution for each state
- Total quantity of certificates has to be in accordance with the reduction targets of the respective state

NAP.. National allocation plan

Alternatives for industry

- Without capital investments
  - Reduce output
- With capital investments
  - Increase factor productivity (especially energy)
- Shifting production
  - Carbon leakage in countries with no or comparable low emission constraints
- Purchase of emission allowances

- Decision criteria: least cost option

1st trading period

- 2005-2007
- Issue of allowances: at least 95% for free, max. 5% via auctions (AT: 100% free)
- Emission business as usual: 34,84 Mio t/a
- Reduction targets acc. to climate strategy until 2010
- 33,19 Mio t/a allowances per year

- Allocation of emission allowances acc. to **Grandfathering**
- **Free reserve** for new market participants and plant expansions are allocated acc. to “first come, first serve”

Allocation 1st trading period

Calculation of the total quantity of certificates for a sector:

Free Allocation$_{Sector}$ = ($\Sigma_{Industry}$ BaU$_{Industry}$ – climate protection contribution) · reserve factor$_{Sector}$

Sector/individual industry	Business-as-usual value	Climate protection contribution 05-07	Reserve factor (-)	Sector number 05-07 incl. reserve	Allocation 05-07
Energy	**13.57**	**1.05**	**0.99**	**12.52**	**12.40**
Industry	**21.27**	**0.60**	**0.99**	**20.67**	**20.46**
– Iron and steel industry (voestalpine)		*0.30*	*0.99*		*11.36*
– Other industries		*0.30*	*0.99*		*9.10*
Total	**34.84**			**33.19**	**32.86**

BaU = Business as Usual
Source: National allocation plan of Austria 2004 according to § 11 EZG

1st trading period

Included industries:

Sector	Industries
Energy	Electricity District heating Mineral oil refining
Industry	Iron and steel industry(voestalpine) Other iron and steel industries Cement industry Paper industry Chemicals industry Lime industry Refractory products Brick-making industry Food industry Glass industry Wood industry Mechanical and structural steel engineering, metal products, motor vehicle, nonferrous metal and electronics industries Other mineral products/construction industry Textile industry

88% of all emissions included

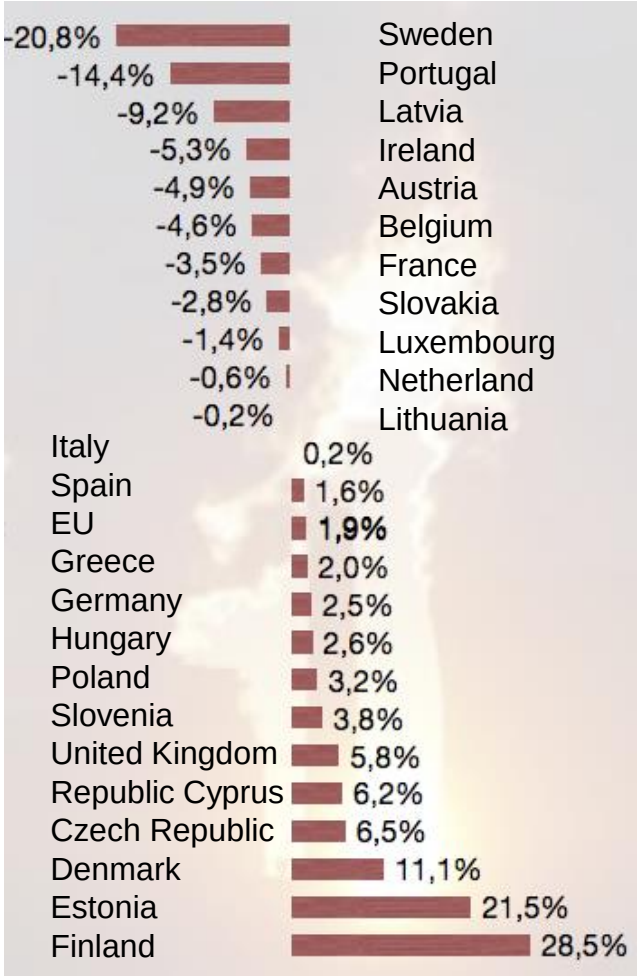
81% of all emissions included

Source: National allocation plan of Austria 2004 according to § 11 EZG

Change in emissions of GHG

Emissions included in the EU-ETS

1st trading period (2005-2007)



Source:https://commons.wikimedia.org/wiki/File:Emissionen_des_ETSektors_w%C3%A4hrend_der_ersten_Handelsphase_in_t_CO2.png#/media/File:Emissionen_des_ETS-Sektors_w%C3%A4hrend_der_ersten_Handelsphase_in_t_CO2.png

Price development of emission allowances

- Huge over-allocation of emission allowances
- 2.150 mio emission allowances issued per year
  - 2005: 2.012 mio t needed
  - 2006: 2.034 mio t needed
  - 2007: 2.050 mio t needed

Source: https://commons.wikimedia.org/wiki/File:EUA_price_2005-2007.png#/media/File:EUA_price_2005-2007.png

2nd trading period

- 2008-2012
  - Coincides with the 1st commitment period of the Kyoto Protocol, on which emissions reduction targets are based on
  - Kyoto targets should be reached
- New participants
  - Rumania, Bulgaria, Island, Norway, Liechtenstein
- Available emission allowances for EU: 2,08 bio t CO_2/a ("under-supply" of 40 mio t CO_2 (-1,9%) compared to 2005)
- Issue of allowances: at least 90% for free
- 30,3 Mio t/a are allocated for free to existing assets
- Scarcity should emerge

2nd trading period

Changes

- Missing emission allowances can be compensated by CDM and JI projects
- More plants are included (e.g. cracking in chemistry plants, 52 mio t CO_2/a)
- 10% (instead of 5% in 1st trading period) of all available emission allowances can be auctioned
  - Austria: 1,2%
  - Germany: 8,8%

Conclusion of the 1st and 2nd period

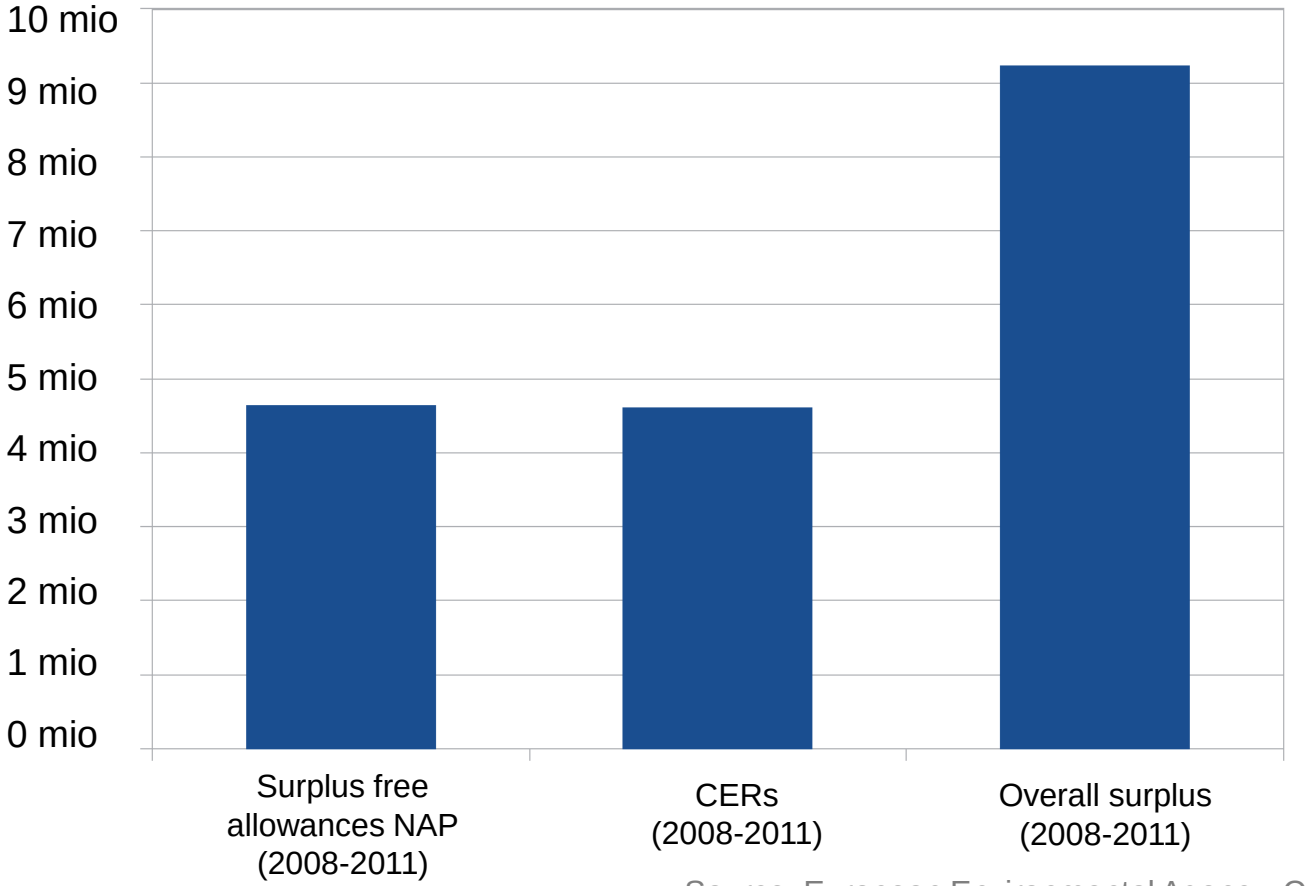
- Too much certificates in most EU countries
  - Germany: 21,3 mio emission allowances excess (over-allocation)
  - Reasons: implementation of ETS very quickly, too less information regarding detailed emission data, lobbying (e.g. high influence of energy sector)

- **Windfall profits:** additional profits for electric utilities by increasing electricity tariffs due to emission trading in spite of the free allocation of emission allowances

- Flexible reserve was too small for the power plants constructed in the 2nd period

Conclusion of the 1st and 2nd period

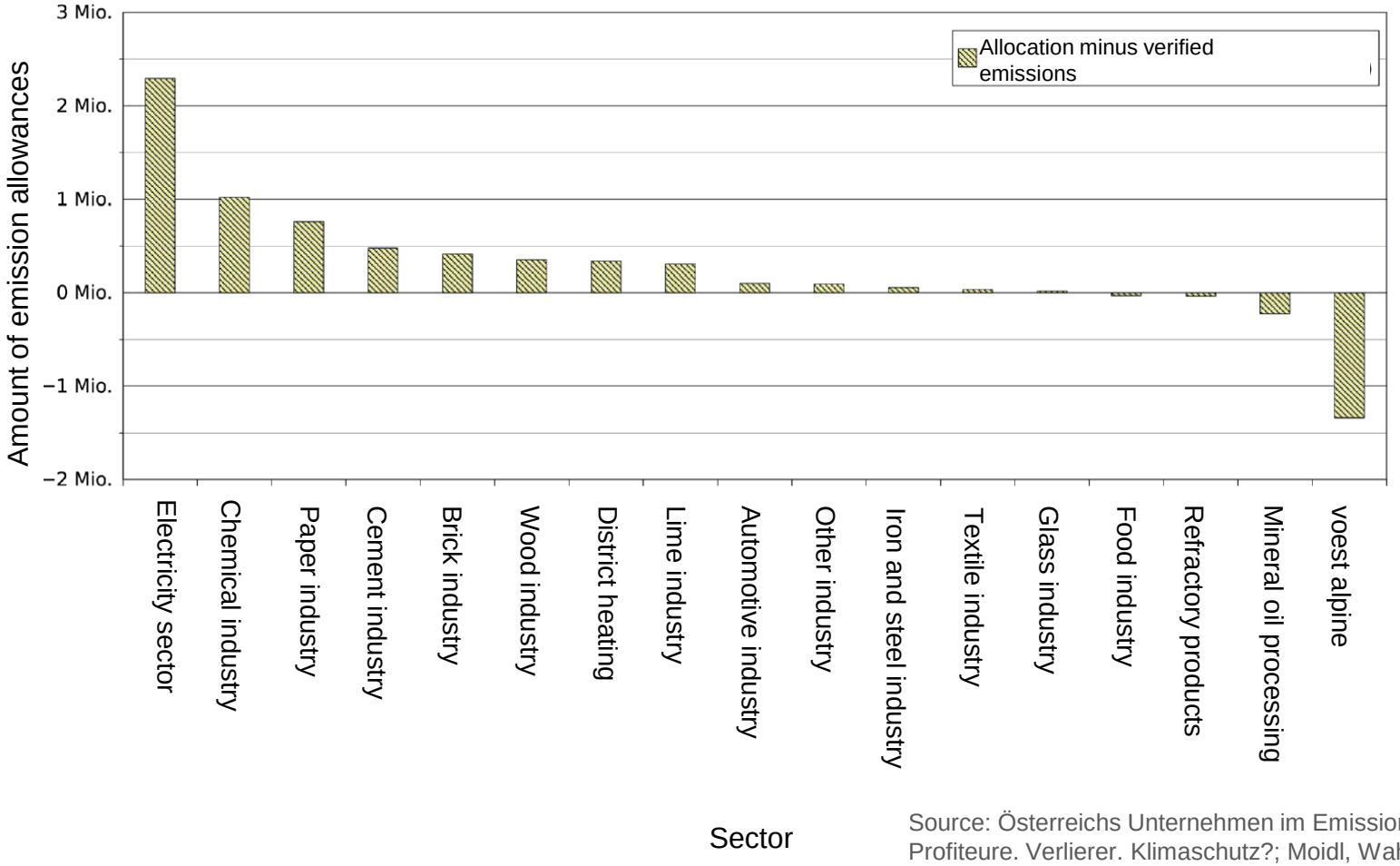
2011: Too much emission allowances in Austria



Source: European Environmental Agency, CITL Daten

Conclusion of the first and second period

The top profiteers of the ETS in AUT (2008-2011)



Source: Österreichs Unternehmen im Emissionshandel - Profiteure. Verlierer. Klimaschutz?; Moidl, Wahlmüller

Verbund AG

- 2,2 mio additional emission allowances needed

  = 50% of the overall demand for additional allowances
- From 2008-2011 emissions were 25% above the allocated amount
- Old coal-fired power plants Mellach and Dürnrohr: high emissions
- New gas-fired power plant Mellach profits by the flexible reserve
- Between 2008 and 2011 Verbund was the electric utility in Austria with the highest CO_2 emissions (image: hydropower company)

3rd trading period

- A single EU-wide cap on emissions instead of national caps
- Cap 2013: 2,04 bio t CO2
  - Decreased annually by 1.74%, starting with 2014
- Target 2020: emission reduction by 79% compared to 2005
- Allocation based on **benchmarks**: emission allowances are allocated according to pre-defined emission values for the production of single products (based on BAT)
  - Production of 1kg cement: 766 g CO2
  - Production of 1 kg steel: 1328 g CO2
  - For higher amounts of CO2 emission allowances have to be purchased

3rd trading period

- More sectors and gasses are included (e.g. commercial aviation)
- **Auctioning** instead of free allocation
  - 2013: 20% of allowances auctioned
  - Until 2020: 60% should be auctioned
  - After 2020: 100% should be auctioned
- **Electric utilities:** no free allocation since 2013
  - Excluded: East European Member States (70% free allocated)
- Free certificates 2013 in AUT: ca. 23,98 mio

3rd trading period

Reward environmentally friendly companies:

- Energy intensive companies that are among the **10% most environmentally friendly companies** in their industry, are rewarded with **free emission allowances**.

Export-oriented companies:

- Free emission allowances for export-oriented companies, whose **production costs** would **rise by more than 5%** due to emission trading and achieve **more than 10%** of their revenue due to **export** outside the EU.

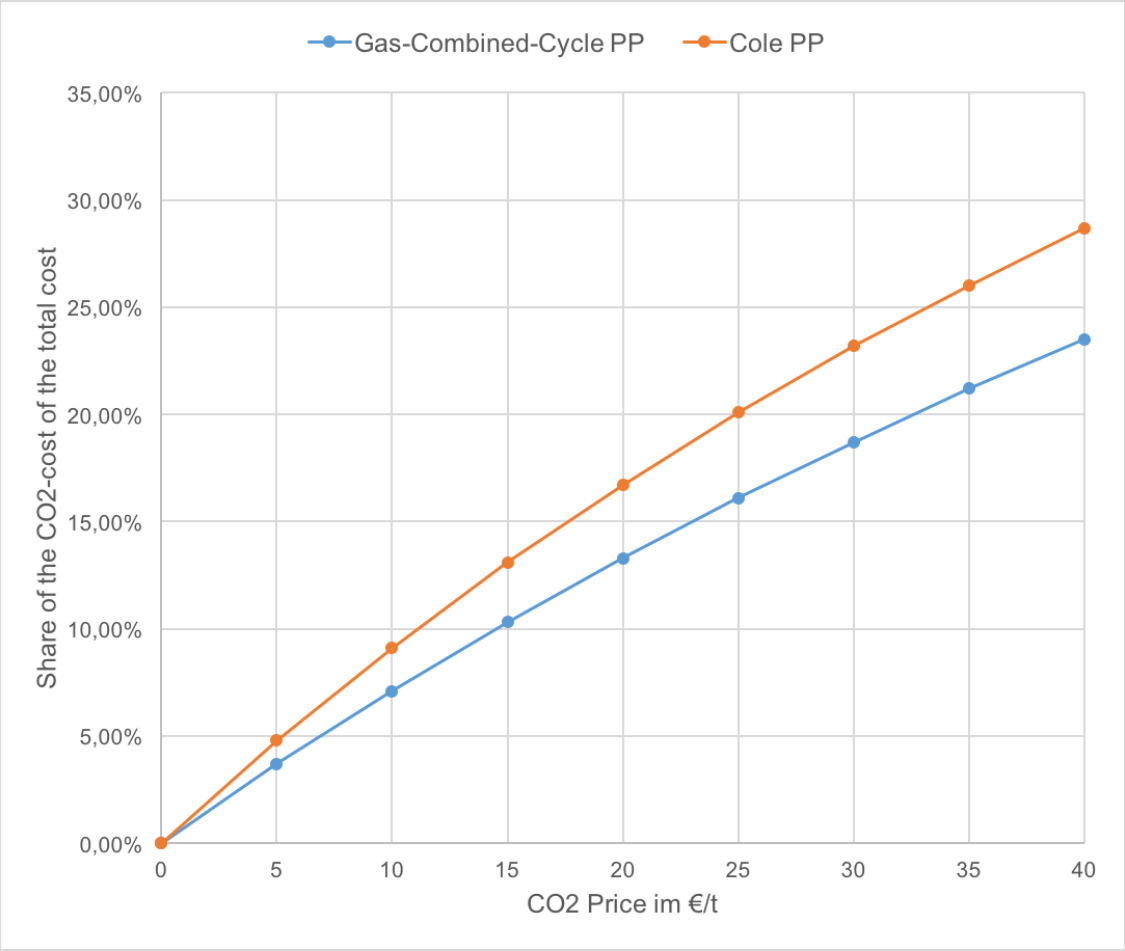
3rd trading period: Sectors

- Carbon dioxide (CO_2)
  - Power and heat generation (Firing installations with a furnace thermal capacity > 20 MW)
  - Energy-intensive industries including oil refineries, steel works, production of iron, aluminum, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids, bulk organic chemicals
  - Commercial aviation
- Nitrous oxide (N_2O)
  - Production of nitric, adipic, glyoxal and glyoxlic acids
- Perfluorcarbons (PFCs)
  - Aluminum production

Price development

Source: www.finanzen.net

Emission Trading Scheme



4th trading period

- Phase 4: 2021-2030
- Proposal to revise EU-ETS for the period after 2020
- Presented in July 2015
- Goal: Increase the speed of emissions cuts
  - Sectors covered by the ETS have to reduce their emissions by 43% compared to 2005
  - Overall number of emission allowances declines at an annual rate of 2,2% from 2021 onwards (currently: 1,74%)
  - Additional reduction of 556 mio t (equiv. To the annual emissions of the UK)

Better targeted carbon leakage rules

- Revising the system of free allocation to focus on **sectors at highest risk** of relocating their production outside the EU (~ **50** sectors)
- A considerable number of free allowances set aside for **new and growing installations**
- More flexible rules to better align the amount of free allowances with production figures
  - ~ **6.3 billion allowances** will be allocated for free to companies over the period 2021-2030 (worth EUR 160 billion)
- **Update** of **benchmarks** to reflect technological advances since 2008

Funding for innovation and modernisation

- Support mechanisms to help industry and power sectors meet innovation and investment challenges of the transition to a low-carbon economy
- Two new funds:
  - **Innovation Fund**
    - Extending existing support for the demonstration of innovative technologies to breakthrough innovation in industry
  - **Modernisation Fund**
    - Facilitating investments in modernizing the power sector and wider energy systems
    - Boosting energy efficiency in 10 lower-income Member States

Links EU ETS

- http://ec.europa.eu/clima/policies/ets/index_en.htm
- www.pointcarbon.com
- www.camco-international.com
- www.chicagoclimateexchange.com
- www.eu-emissionshandel.at

Thank you for your attention!

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