Markets for pollution

Looking beyond EU-ETS

Matti Liski

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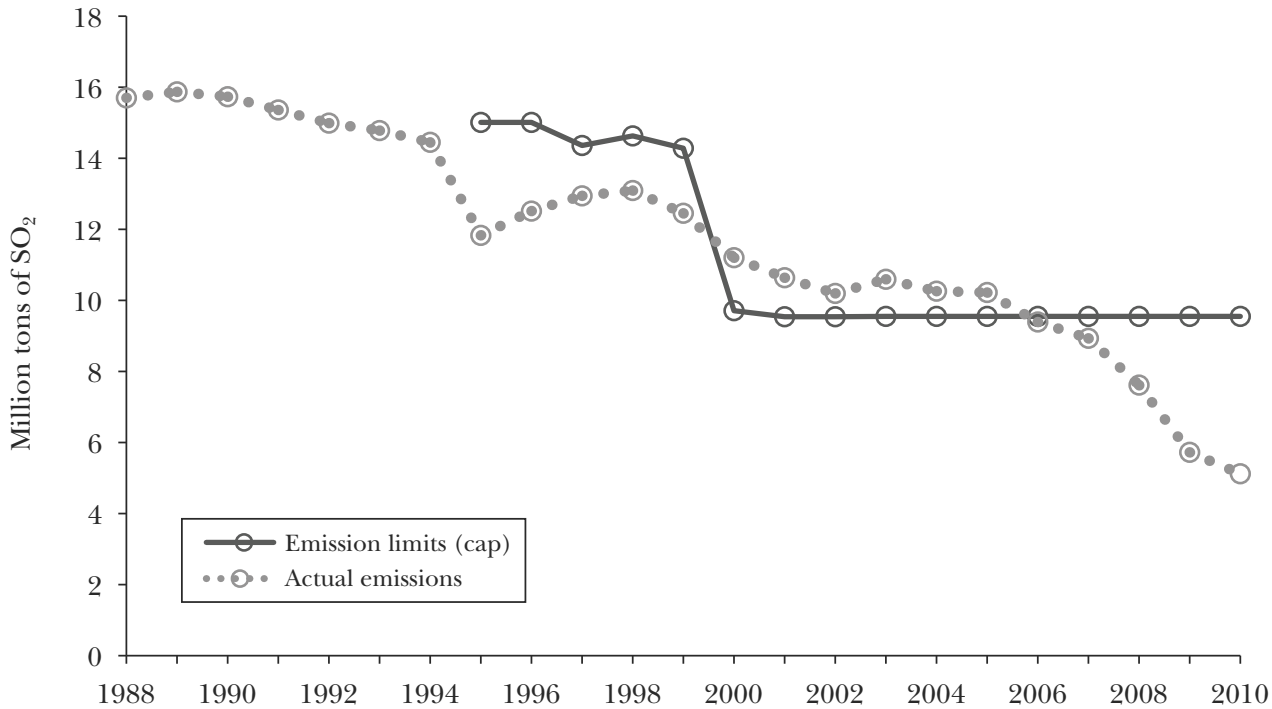
Warm-up illustration

Let us first look at the short history of the EU-ETS predecessor:
US SO_2 allowance trading system

- cap-and-trade with two phases (1995-1999, 2000-)
- coverage: electricity sector
- grandfathering of ”allowances”
  - Also: annual permit auction to facilitate entry, small fraction of the aggregate
- CEMS=continuous emissions monitoring
  - Necessary for well-defined demand
- Opt-in provisions
  - A source of cost savings but also paper reductions
- the following figures are from Schmalensee and Stavings, JEP 2013 (dropbox)

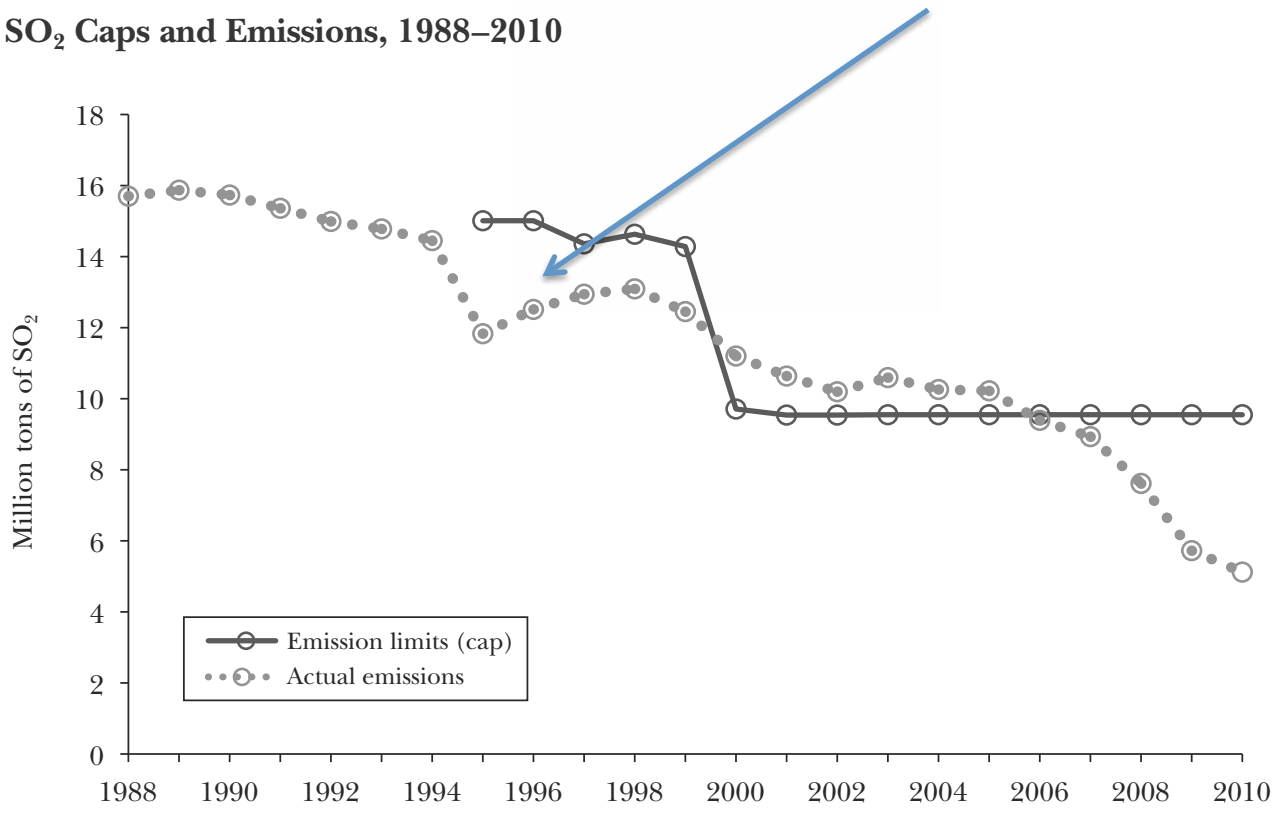
Supply and demand over time:

SO_2 Caps and Emissions, 1988–2010



Source: Ellerman (2003); US Environmental Protection Agency (2012).
Notes: The emission limits shown for the period 1995–1999 are equal to the Phase 1 units' cap plus Phase 2 units' emissions. Actual emissions shown for all years are the sum of emissions from Phase 1 and Phase 2 units.

Savings: emissions<supply



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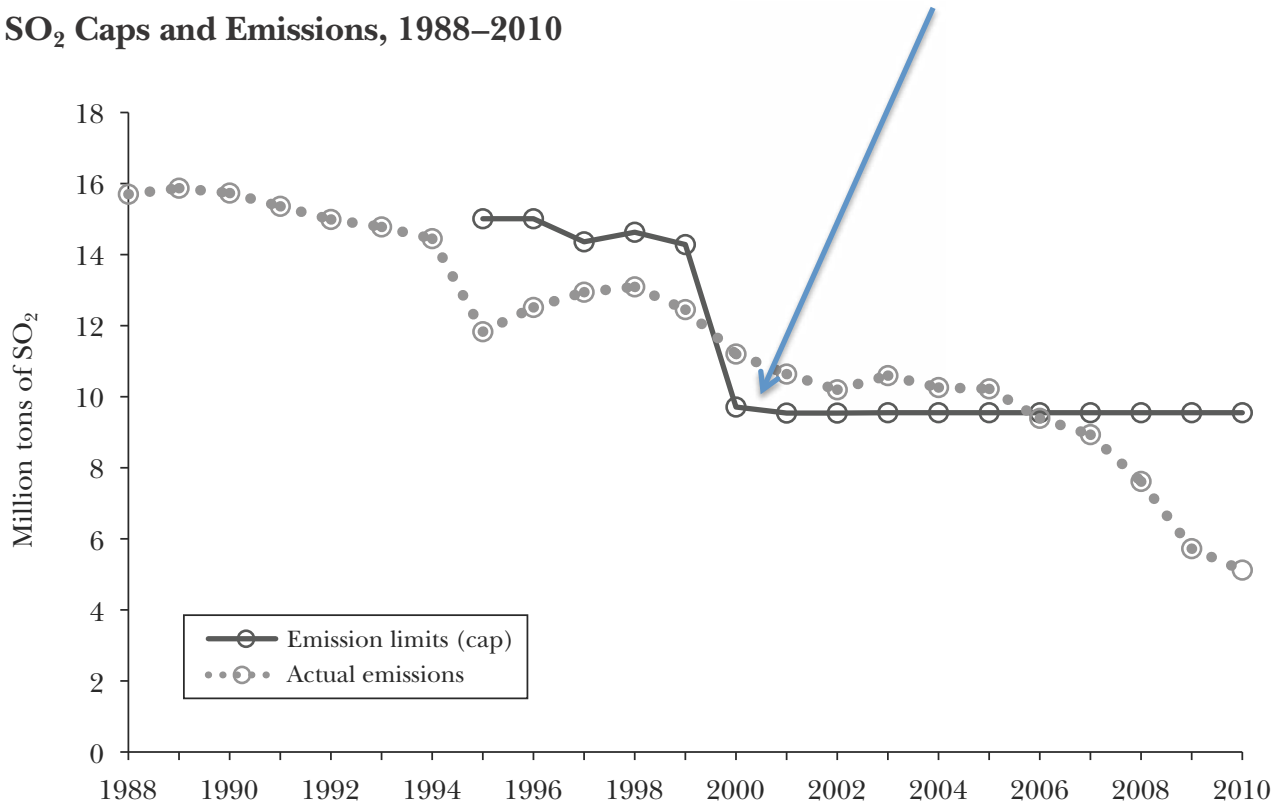
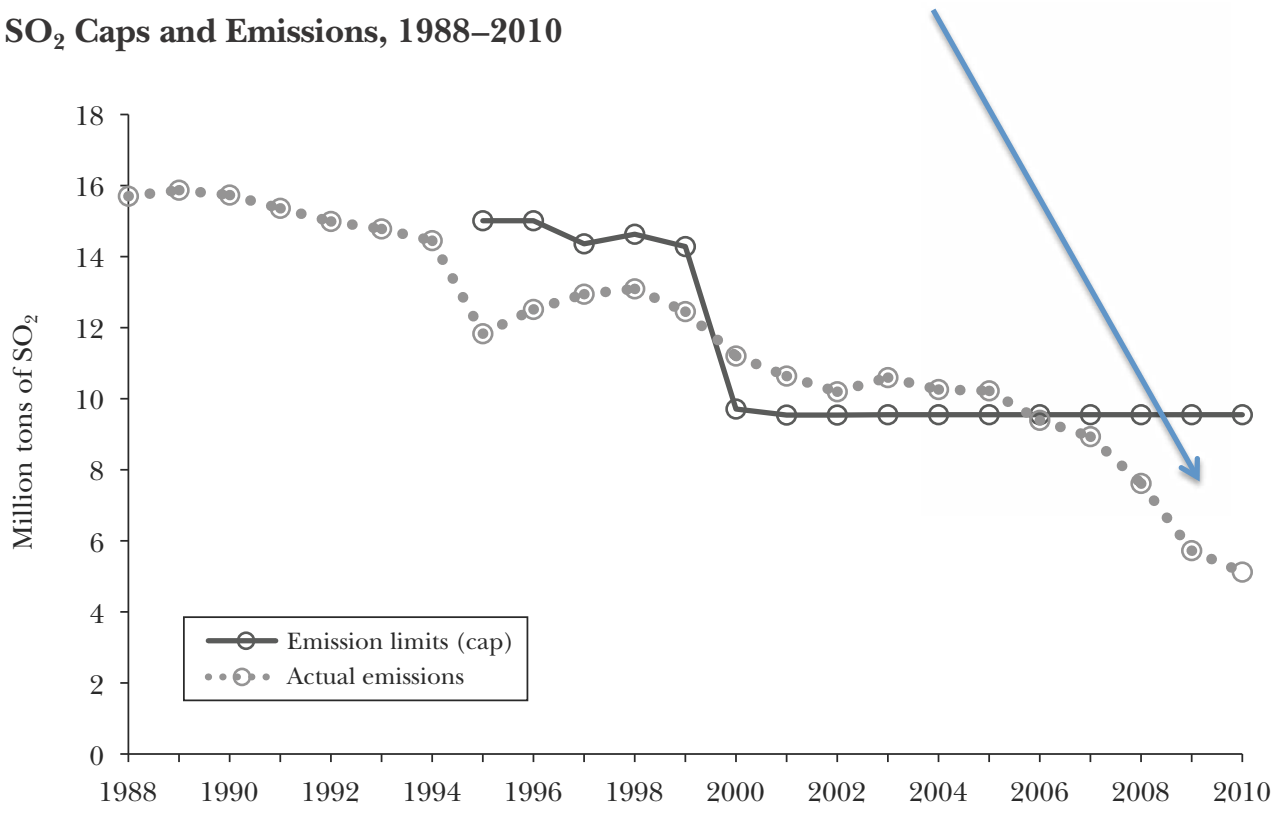
Draw-down: emissions>supply



Source: Ellerman (2003); US Environmental Protection Agency (2012).
Notes: The emission limits shown for the period 1995–1999 are equal to the Phase 1 units' cap plus Phase 2 units' emissions. Actual emissions shown for all years are the sum of emissions from Phase 1 and Phase 2 units.

But this was not expected!



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The dynamics of emissions trading: How to make sense of the above design?

- q, total emissions
- u, baseline (unrestricted emissions)
- $a = u - q$, reductions (abatement)
- $c_i(a_i)$, firm level costs ($i = 1, ..., N$). Costs may change over time, $c_i'(a_{i,t}) = MC_{i,t}$, marginal cost at t.

Spatial efficiency of emissions trading:

- $p = MC_{i,t}$ for all i at given time t
- price of emissions equals marginal costs across firms. Any deviation implies a room for an efficiency improvement.

Dynamic efficiency of emissions trading:

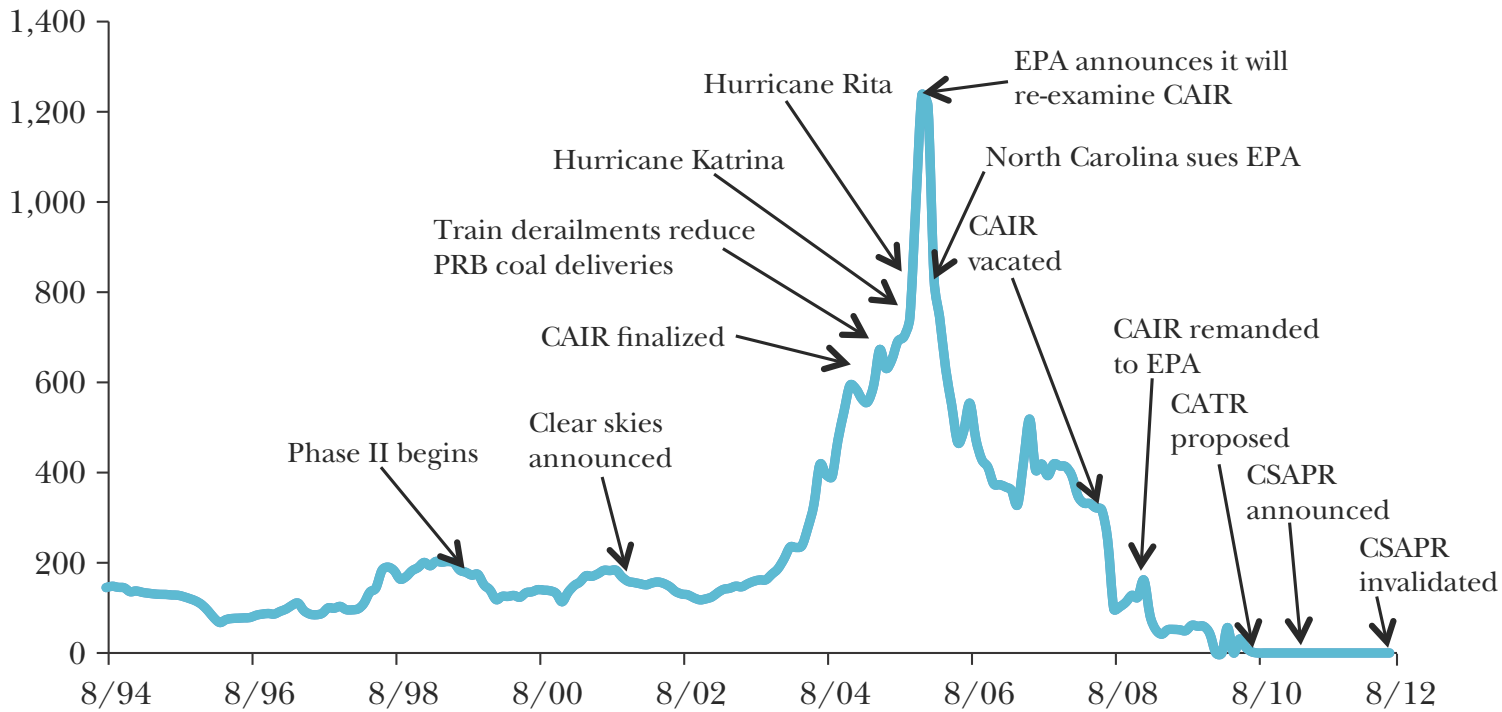
- $p_t \geqslant p_{t+1}/(1+r)$, where r is the discount rate

Reasoning:

- A_t, total allocation of permits at time t.
- $q_t = A_t \Rightarrow p_t > p_{t+1}/(1+r)$. For example, the current cap tighter than the future so all permits are used.
- $q_t < A_t \Rightarrow p_t = p_{t+1}/(1+r)$. Saving for the future. But then:
- $MC_{i,t} = MC_{i,t+1}/(1+r)$, the marginal costs are equalized also over time when there is saving

Overlapping regulations ended the effective life of the program

SO_2 Allowance Prices and the Regulatory Environment, 1994–2012
(1995 dollars per ton)



Source: Data on spot prices compiled by Power & Energy Analytic Resources (PEAR) Inc. from Cantor Fitzgerald until September 11, 2001, and from ICAP United thereafter.
Notes: CAIR is "Clean Air Interstate Rule." CATR is "Clean Air Transport Rule." CSAPR is "Cross-State Air Pollution Rule."

Meanwhile in Europe...

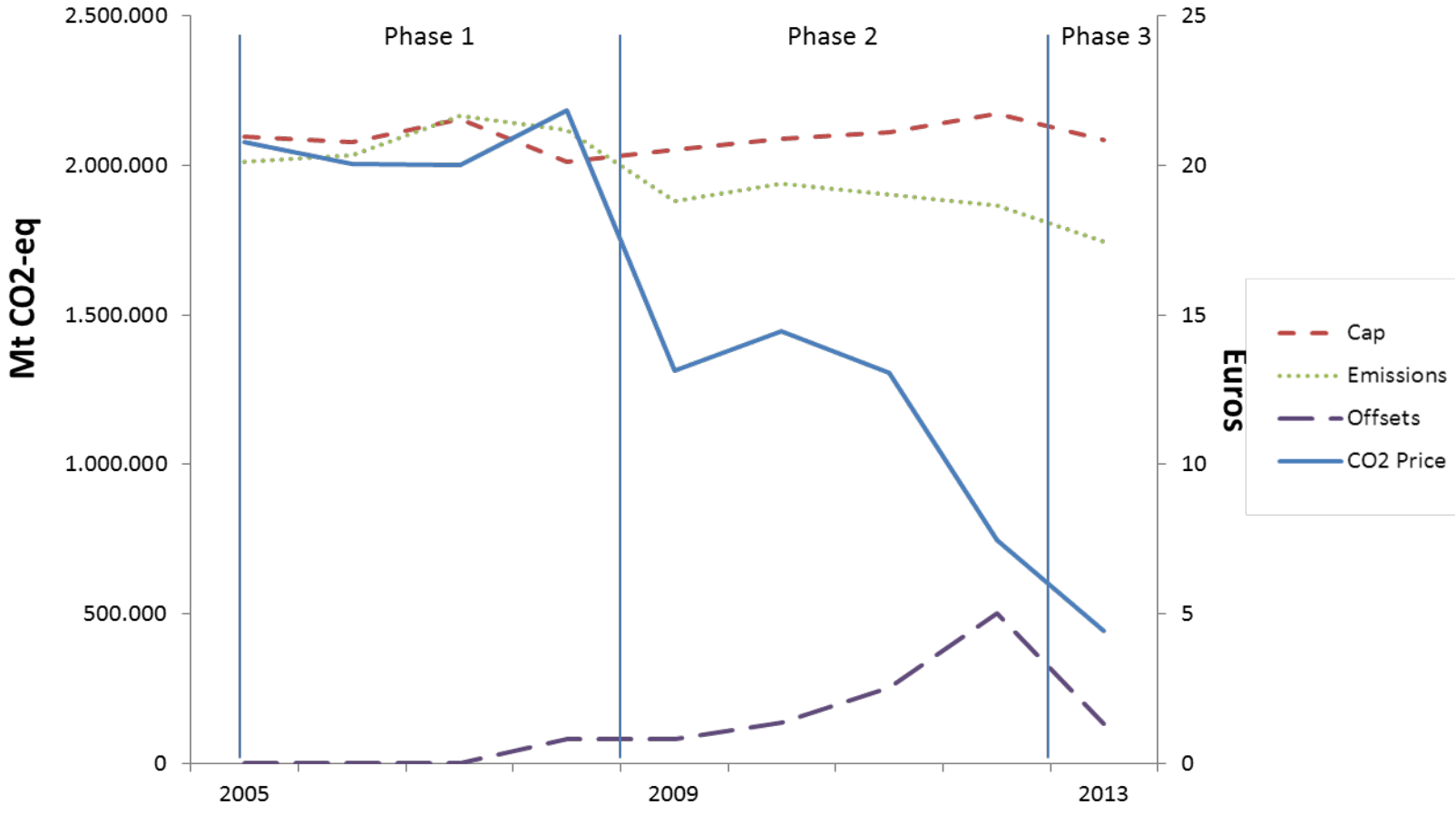


Figure 1: Historical developments of EU ETS annual cap (Cap), annual verified emissions from sources covered by the EU ETS (Emissions), annual offsets surrendered for compliance (Offsets) and average December future prices (CO_2 price).

Lessons from the SO_2 program

- program created by a federal law (CAAA) – stability and predictability much higher than in the EU ETS
- the experience is not encouraging for the EU ETS
  - yet, the program created significant cost savings and investments
  - problems were unanticipated
- but for the EU ETS: the problems are not anticipated, they are already here!

Suggested remedies

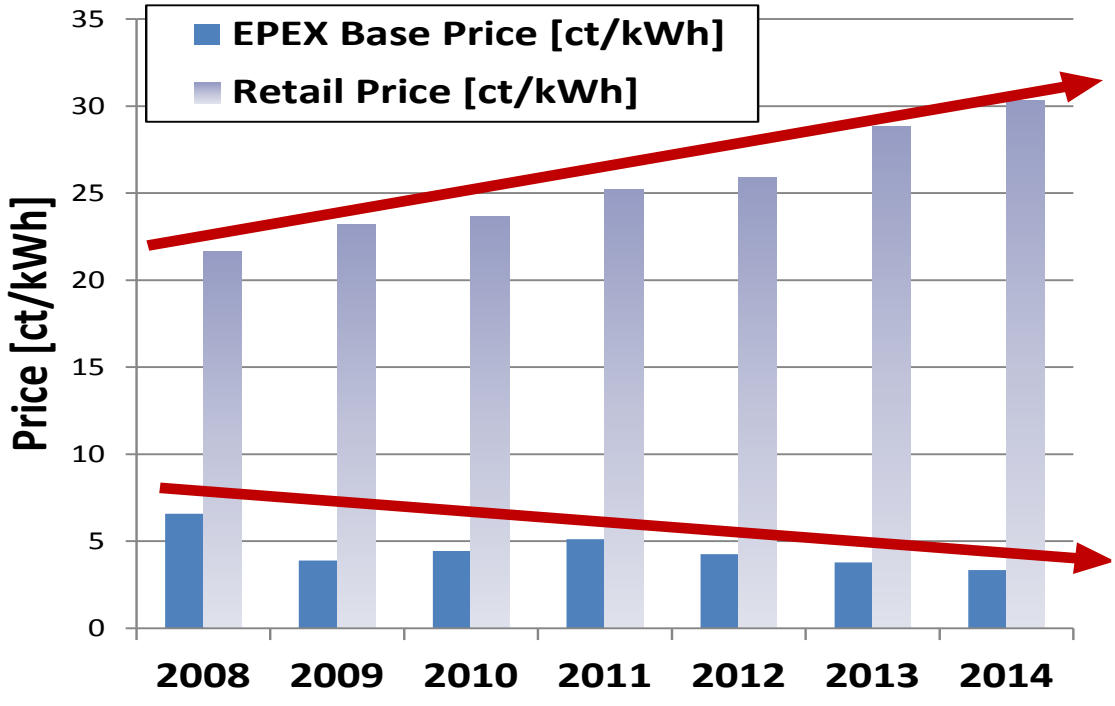
- Price collar
  - a hybrid instrument: emissions trading with price limits
  - provides a safety-valve in booms and also price discovery in recessions
- theoretically very good but works in practice only if:
  1. overlapping regulations can be ruled out
  2. politicians can commit to it

Concluding remarks

It is useful ask: why is it that the policy-makers introduce overlapping regulations?

- Subsidizing renewables is not the ideal solution but it may be the only solution that is both politically and economically feasible
  - politically: subsidies lower the wholesale electricity price, rather than increase it
  - economically: compensation to investments is front loaded, rather than backloaded
- The development can have profound implications for the European energy market integration.

The German experience: consumer and producer prices



Source: EEX data, BDEW data