



Modelling policy instruments in TIMES: interactions between the EU ETS and the FIT system for renewable electricity in Germany

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Agenda

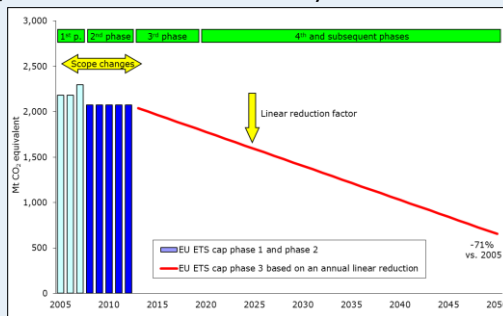
1. Introduction and background information
2. Model characteristics and methodology
3. Results of the scenario analysis
4. Conclusion



1. Introduction and background information

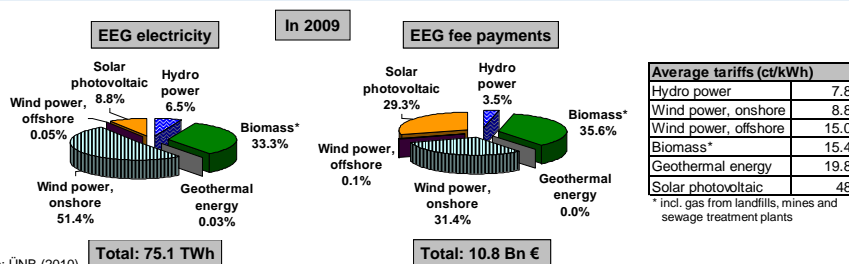
The EU Emissions Trading System (EU ETS)

- Cap and Trade system introduced in 2005 as a major pillar of the EU climate policy
- Covers nearly half of the CO₂ emissions in the European Union
- Participants: EU-27+ Iceland, Liechtenstein and Norway
- Germany responsible for almost a quarter of the ETS CO₂ emissions
- Targets in the 3rd Trading Period (2013-2020): **-21% (-34%)** compared to 2005, if overall reduction target of 20% (30%) compared to 1990



The German feed-in tariff system (FIT): EEG

- Introduced in 2000
- Tariffs depend on energy source and plant size, usually paid over a period of 20 years, subject to annual degression
- Financed through a levy on electricity prices (2011: 3.53 ct/kWh)
- 2010: 17% of gross electricity consumption in Germany covered by renewable energies (compared to 6.3% in 2000)
- Targets for Germany: 35 % (2020) & 80 % (2050) of gross electricity consumption





Possible interactions between EU ETS and FIT

- Overlapping of effects as both instruments target (amongst others) the electricity generation sector
- Additional renewable generation caused by the FIT system replaces generation based on fossil fuels → emission reduction
- **But:** due to Germany's participation in the EU ETS, FIT system does not result in an additional emission reduction on the European level;
- Free allowances are deployed elsewhere → new market equilibrium with potentially lower CO₂ prices with possible effects on the emission reduction in Germany, exchange of electricity etc.
- If emission reduction due to the FIT system is not considered a priori (before setting ETS targets) cost efficient division of targets between the ETS and the Non-ETS sectors might be affected

AIM of this analysis: Flexible representation of both instruments in a German energy system in order to evaluate the interactions between them



2. Model characteristics and methodology

The German TIMES model: TIMES-D

- Technology oriented bottom-up model with perfect foresight
- Representation of the German energy system (one region) with detailed description of the demand sectors (industry, residential, commercial/agriculture and transport), public & industrial electricity and heat production, refineries and other fuel conversion
- Inclusion of exchange processes with neighboring countries
- Potentials of renewable energy sources
- GHG: CO₂, CH₄, N₂O and pollutants: CO, NO_x, SO_x, particles
- Model horizon 2000-2050, 32 time slices



Modelling of the German FIT system

Payment side

The tariffs are modelled using the TIMES parameters for subsidies. Additional, special features of the FIT systems are taken into account:

- Annual degression rate
- Limitation of the payment period
- Tariff reduction due to inflation

Demand side

$$EEG \text{ apportionment} = (\emptyset - EEG \text{ tariff} - \emptyset - \text{wholesale electricity price}) * EEG \text{ quota}$$

- depends on model results
- **Iterative process** of several model runs to adjust FIT payments and the FIT apportionment to one another

Cf. Götz, Blesl, Fahl, Voß (IEW 2011)



Modelling of the EU ETS in TIMES-D

Problem: *Model region (Germany) does not coincide with trading region (EU-27+ Iceland, Liechtenstein and Norway)*

Possible modeling approaches

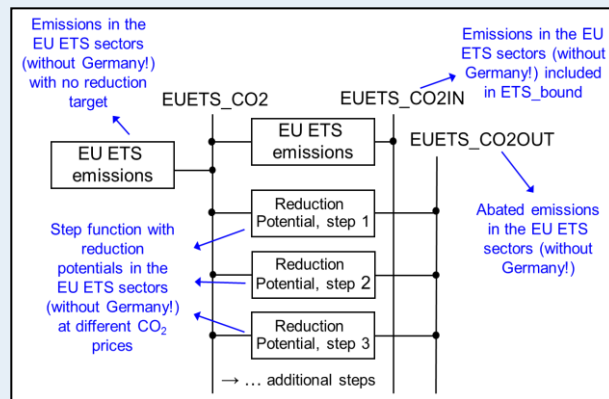
- **Using a fixed emission reduction path for Germany**
 - ☞ CO₂ price is determined endogenously
 - ☞ Trading system is neglected, fixed CO₂ reduction in Germany
 - **Using fixed CO₂ prices**
 - ☞ Emission reduction in Germany is determined endogenously
 - ☞ Influence of Germany on the CO₂ price is neglected
- **New methodological approach is needed**



Solution: step function with reduction potentials

Emissions in the EU ETS sectors (without Germany) are introduced in the German model

→ overall bound on ETS emissions (Germany and Rest of EU-27)



→ Cost potential curve for emission reduction in EU ETS sectors (without Germany), explicit modelling in Germany

How to construct this cost potential curve?



→ Using results from an European energy system model:

The European TIMES model: TIMES PanEU

- 30 region model (EU 27 + IS, NO, CH) [named EU-27+3]
- Detailed electricity exchange capacities based on ETSO and EC
- Country specific CO₂ storage options
- Model horizon 2000-2050, 12 time slices

Construction of the cost potential curve

- Running several scenarios in TIMES PanEU with different CO₂ prices
- results in CO₂ reduction potentials at different price levels
- electricity imports (and prices) are bound to the different steps in the cost potential curve

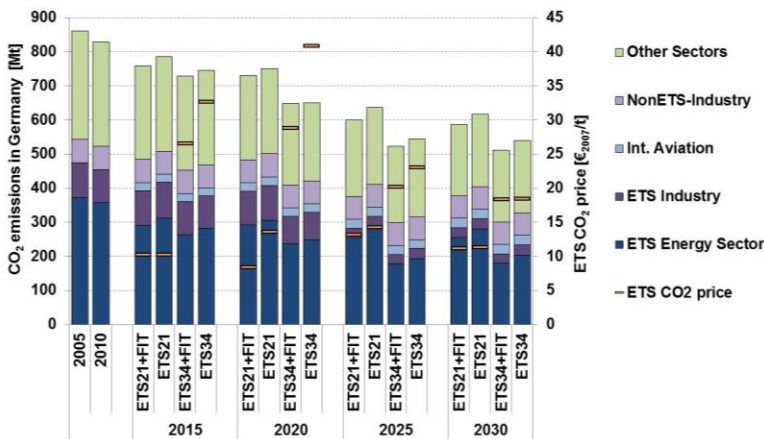
3. Scenario analysis: Overview

Variation of

- ETS emission reduction targets
- Integration of the FIT system for renewable electricity

	ETS target	FIT
ETS21+FIT	Reduction of 21% until 2020 compared to 2005; 1.74% p.a. afterwards	YES
ETS21		NO
ETS34+FIT	Reduction of 34% until 2020 compared to 2005; 1.74% p.a. afterwards	YES
ETS34		NO
FIT_only	-	YES

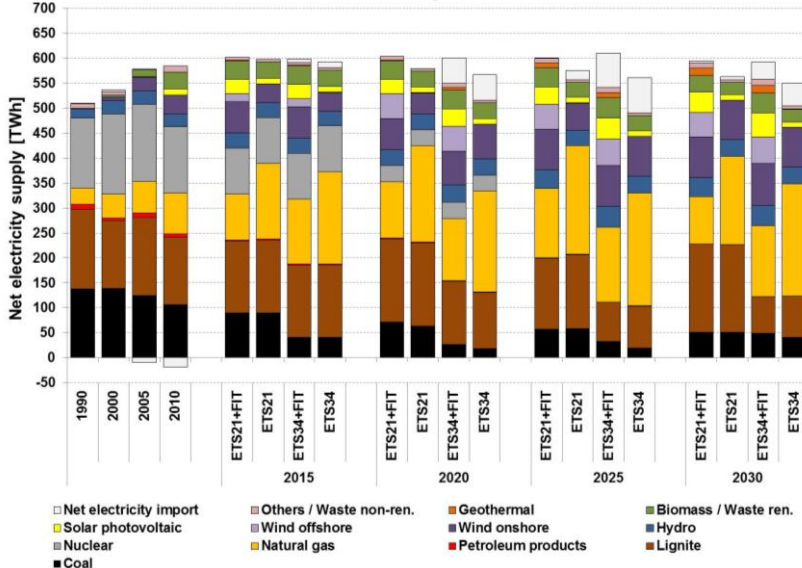
Results (1): CO₂ emissions



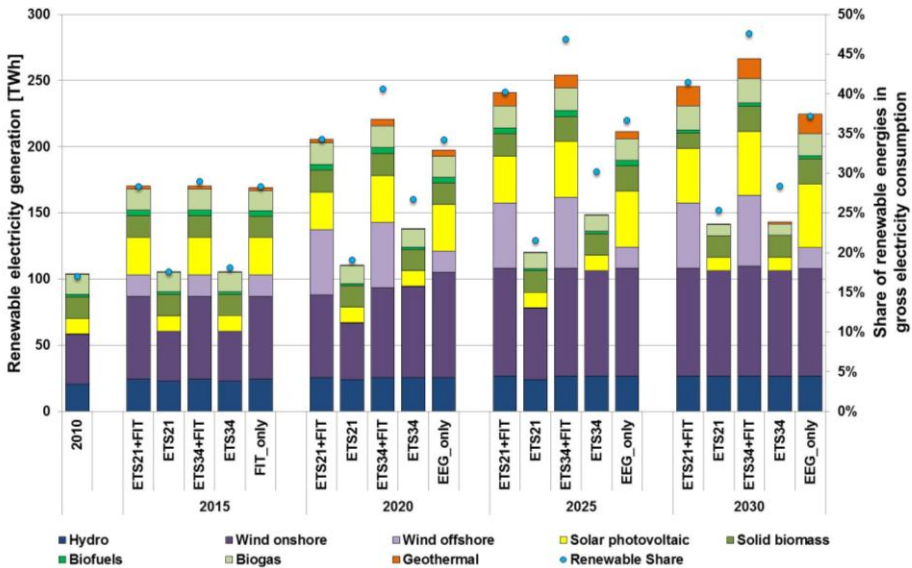
Burden sharing in 2020 (CO₂ reduction in the ETS sector compared to 2005):

	ETS21+FIT	ETS21	ETS34+FIT	ETS34
Germany	-23,7%	-20,4%	-38,2%	-35,9%
Rest of ETS participants	-20,2%	-21,3%	-31,7%	-33,7%
Total	-21%	-21%	-34%	-34%

Results (2): Electricity generation in Germany



Results (3): Renewable electricity in Germany





4. Conclusion

Interactions between EU ETS and FIT

- With the FIT system for renewable electricity, CO₂ emissions in Germany are generally lower than without
- But: on the European level, emission reduction remains unchanged due to the fixed cap in the Emissions Trading System
- The national instrument (FIT system) in Germany has an impact on the whole European Union due to changes in the CO₂ prices
- Without the FIT system the extension of renewable electricity generation in Germany is very limited – the ETS targets are fulfilled through a larger reliance on natural gas, a lower electricity consumption and larger purchase of emission allowances
- The expansion of renewable electricity is therefore not the most cost efficient CO₂ abatement strategy for Germany
- **Areas of further research:**
 - modelling of electricity imports
 - Impact of FIT system on division between ETS and Non-ETS targets



Thank you for your attention!

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