

Massimo Genoese, Frank Sensfuss, Dominik Möst and Otto Rentz
POWER PLANT INVESTMENTS UNDER DIFFERENT EMISSION
ALLOCATION SCHEMES

Massimo Genoese: Institute for Industrial Production, Universität Karlsruhe, Hertzstr. 16, 76187 Karlsruhe, Tel.+49-721-608-417; massimo.genoese@wiwi.uni-karlsruhe.de
 Frank Sensfuss: Fraunhofer-Institute for System- and Innovation Research, Breslauer Straße 48, 76139 Karlsruhe, Tel. +49-721-6809-133, Frank.Sensfuss@isi.fraunhofer.de
 Dominik Möst: Institute for Industrial Production, Universität Karlsruhe
 Otto Rentz: Institute for Industrial Production, Universität Karlsruhe

Overview

The European Union has created an EU-wide greenhouse gas allowance trading scheme based on the Emission Trading directive (ETD, 2003/87/EC) in order to fulfil the obligations of the Kyoto Protocol. It started in January 2005. The member states have to specify national allocation plans in which the allocation rules of both existing and new power plants are defined. These rules have a large impact on investment decisions, as emission certificates based on technology specific benchmarks are allocated free of charge. The total monetary equivalent can be in the same dimensions as the investment itself. In this article, the impact of different allocation schemes on power plant investments is analysed. Thereby data of the German energy system is used.

Methods

The PowerACE simulation platform simulates important players of the electricity sector as computational agents. Among these are agents representing consumers, utilities, renewable agents, grid operators, government agents and market operators. Complex players like utilities are modelled using several computational agents representing different functions within the company like trading, plant dispatch or investment planning. The current version of the PowerACE model incorporates a spot and a forward market for electricity, different markets for balancing power and a market for CO₂-emissions. An overview of the model structure is given in Figure 1.

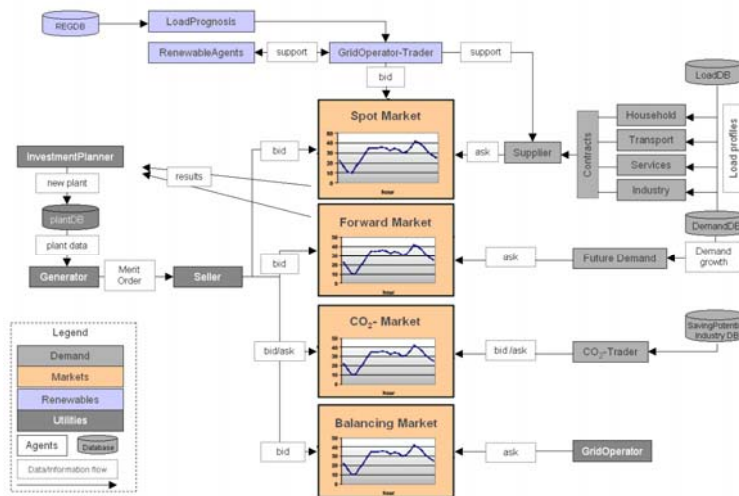


Figure 1: Structure of the simulation platform (own visualisation)

Results

In the base scenario the current allocation scheme is used. Results are shown in Figure 2. On the left side, the power plants that are built under the given circumstances are shown. Coal and lignite fired power plants are preferred. The right side of Figure 2 shows the development of the energy system. Lignite and coal fired capacities replace the nuclear power plants and also part of the gas fired power plants. A moderate price path for CO₂-emission allowances is assumed, starting with 5€/tCO₂ in 2005 reaching 15€/tCO₂ in 2030. The base scenario is also discussed in (Möst et. al., 2006).

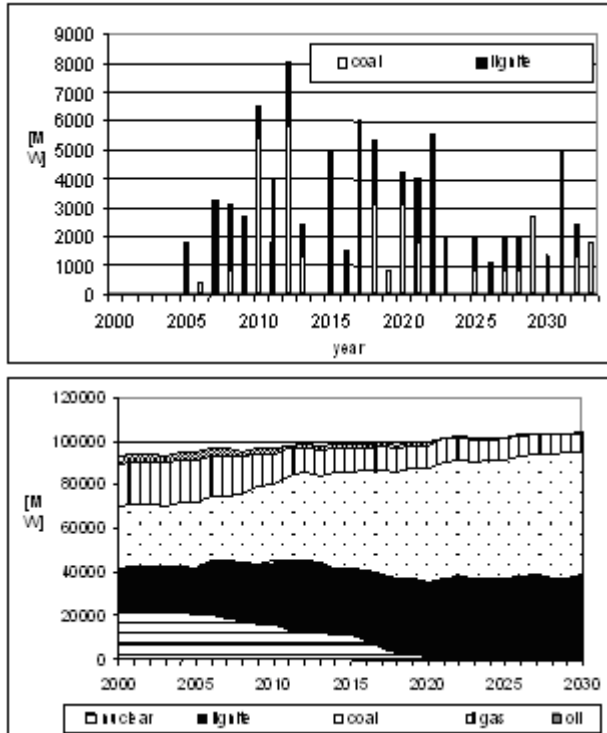


Figure 2: New power plants built (left) and German energy system (right) (own visualisation)

Within a scenario analysis the allocation rules are varied and the influence on investment decisions is analysed. The results will be presented and discussed in the full paper and the presentation. Following variations in the allocation rules for new power plants are considered:

- Fuel independent benchmark for new power plants
- Shorter period of guaranteed full endowment of power plants with emission certificates

Furthermore, different CO₂-emission allowance price paths will be taken into account. Preliminary results show a significant impact on investment decisions and an at least partial switch to gas and steam power plants.

References

- Bundesministerium für Umwelt [BMU], 2006. National Allocation Plan 2008-2012. http://www.bmu.de/files/emissionshandel/downloads/application/pdf/nap_2008_2012.pdf. Downloaded 10.09.2006
- European Parliament and the Council of the European Union (2003), Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowances trading within the Community and amending Council Directive 96/61/EC, Official Journal of the European Union 32-46
- Genoese, M.; Möst, D., Sensfuß, F., Rentz (2006): An Agent-based model to analyse the long-term development of the German electricity system, Proceedings IAEE: Securing Energy in insecure times, Potsdam, Germany
- Genoese, M.; Möst, D.; Sensfuß, F., Rentz (2007): Auswirkungen des CO₂-Emissionshandels auf Strompreise- eine agentenbasierte Analyse für den deutschen Spotmarkt, Proceedings IEWT 2007, Vienna, Austria
- Möst, D.; Genoese, M., Fichtner, W., Sensfuß, F., Rentz, O.(2006): Agentenbasierte Simulation der langfristigen Entwicklung des deutschen Elektrizitäts- und CO₂-Zertifikatemarktes, submitted to „Wirtschaftsinformatik“, Special issue Emission Trading