

Challenges of the Energiewende from a Policy Analysis Perspective: Understanding the goals and improving the policy instruments of Germany's energy transition

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Summary

Germany is currently restructuring its energy system, an endeavor its chancellor, Angela Merkel, called the *project of the century*. This *Energiewende* has moved into rough waters in recent years. The relatively high and rapidly growing shares of fluctuating renewable energy sources (mainly wind and photovoltaic) have led to numerous technical and socio-economic challenges. The unclear and sometimes contradictory policy goals of the Energiewende as well as suboptimally designed policy instruments in key areas of the Energiewende are the two major areas of concerns of this dissertation.

The aim of this dissertation is to contribute to the solution of selected challenges of the Energiewende in the context of goals and policy instruments.

In this regard, the following four research questions are addressed:

1. What are the goals of the Energiewende and how do they interact with the design of policy instruments?
2. What are the impacts of the German nuclear phase-out on the electricity market and the security of supply?
3. How do different designs of support mechanisms for renewable energy affect the riskdistribution between society, investors in renewable energy and investors in conventional power plants?
4. What is the impact of ex-post transaction costs on the cost-effectiveness of selected climate policy instruments?

The main results and the subsequent policy conclusions of this thesis can be summarized as follows:

The research on the *goals of the Energiewende* was based on a survey among elite policy actors, which showed that climate protection is the most important goal of the Energiewende. However, climate protection is neither the only goal, nor an indispensable one. Additional goals such as the nuclear phase-out, import independence from fossil fuels and job creation also play an important role. A large majority agrees that the Energiewende would make sense even if climate change did not exist.

The following policy conclusions can be derived: first, there should be a clear, transparent and public debate on the goals of the Energiewende, i.e. a debate on what the Energiewende is actually bound to achieve. Second, economic policy analysis of the Energiewende should acknowledge the multiplicity of political goals and take them into account in their models.

Regarding *the phase-out of the German nuclear power plants* it is found that the precise date for the complete shut-down of Germany's nuclear power plants has a relatively small effect on the wholesale electricity price and security of supply.

The following policy conclusion can be derived: the German nuclear phase-out will neither have a substantial effect on the wholesale electricity prices, nor on the security of supply.

Regarding the *design of RES-support schemes* it is found that the distribution of long-term electricity price risk between society and investors strongly depends on various set ups. A design that exposes RES-investors to higher risks may result in more efficient investments. However, more risks for RES-investors means that small actors (e.g. cooperatives) have less opportunities to invest in the Energiewende, because they are less capable to hedge long-term price risks efficiently.

The following policy conclusion can be derived: the question whether investors in RES, investors in conventional power plants or society should carry the long term electricity price risk is a political (i.e. distributional) issue, which crucially depends on political goals such as actor diversity.

On the question of *transaction costs of climate policy instruments*: the ex-post transaction costs are relatively low for instruments such as emissions trading systems and affect the costeffectiveness only slightly.

The following policy conclusion can be derived: Given the minor role of ex post transaction costs, they can be neglected as a source of significant distortions. However, this statement only refers to regions with strong institutions (such as the EU or the US). The focus in policy instrument design should be on properties that fundamentally influence cost effectiveness as well as equity and political economy considerations.