Framework Conditions of the Energy Transition: Description

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At first glance it may seem that with the three targets for the *Energiewende*—including their quantitative dimensions—and the underlying four basic political motives, the energy policy is largely fixed and that Germany's energy landscape in the next decades is quite clearly defined.

Looking closer, however, one observation in particular points to the fact that this is not the case. After long years of political infighting, since 2011 there has been broad agreement among the major political parties in Germany and a broad and stable consensus throughout society regarding the targets and motives of the *Energiewende*. Yet there are still intense, and not infrequently bitter, political and social discussions and controversies about the proper implementation of the *Energiewende*. How can this be?

Regardless, and from a purely objective point of view, within the constraints imposed by the three targets and four motives and on the basis of currently available technologies, there are in fact numerous potential ways of implementing the *Energiewende*. In other words it is possible to imagine quite different "*Energiewende* landscapes" for Germany.

Let us briefly outline two of these for clarification.

A Consistently *Central Energiewende*

In this variant of the *Energiewende*, from the very beginning (but at least from 2011 on), the state—i.e. specifically an authority equipped with appropriate powers—would have centrally planned the locations for the RE plants to be built, bundled multiple plants in locations selected for their optimal natural conditions, tendered the plants' construction and operation and thus created a system of large-scale renewable energy power plants. Simultaneously, and with the help of a national state-owned transmission system operator, the state would have built an advanced transport grid to distribute the renewable electricity thus generated to the consumption centres. In addition, in the next decades, this authority would also have built the necessary storage facilities. Furthermore, it would have aligned the structure of the fossil power plant fleet so that some of the current challenges on the financial side

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and as regards CO_2 emissions (which are discussed in more detail in the second part of the book) would have been avoided from the outset, for example, by gradually replacing hard coal-fired power plants with gas-fired power plants.

A Consistently *Decentralized Energiewende*
In this variant of the *Energiewende*, a dream would come true that is still being dreamt in many towns and cities in Germany: the dream of energy self-sufficiency or at least—in line with the focus of this book—electricity self-sufficiency.

In fact, even with the technologies available today, it would be possible to make most of the smaller towns and cities (largely) self-sufficient in terms of electricity. All it would take is a suitable combination of local, small-scale wind farms, local biomass plants, PV systems, local cogeneration plants and local storage facilities. As for the major cities, this is more challenging but essentially just as feasible. Major cities would still need to be surrounded by large conventional power stations for a significant period of time, to be gradually supplemented and then replaced by countless photovoltaic, wind and biomass plants including storage at the periphery.

In the electricity system created by this variant of the *Energiewende*, the need for the transmission grid would gradually disappear, and there would be no need to construct new large power lines.

It Is Quite Clear Both these scenarios, i.e. both "energy landscapes", can satisfy the targets and motives of the *Energiewende*. Yet they are fundamentally different, and the "real" *Energiewende*—meaning the path which is actually pursued politically at this time, the actual energy landscape in Germany in 2016—again looks quite different. More accurately, it comprises some elements from scenario 1 and some from scenario 2.

Why is Germany not taking the first or the second path, even though both have significant respective advantages and would prevent quite a number of the current problems and debates?

The reason is, in a nutshell, scenario 1 ultimately means a planned economy and is therefore not compatible with the principle that in Germany the energy sector, and particularly electricity generation, is and should be governed by market economy rules; scenario 2 is extremely expensive and thus incompatible with the principle that energy should be affordable.

These principles, which basically guide the German government's energy policy (in addition to historical incidents and tactical considerations, which always play a significant role in how basic policies are specifically implemented), lead to Germany's choice of its path out of the numerous possible routes of an *Energiewende*.

Conclusion
The implementation of the *Energiewende* by the German government in its present form can be understood only by taking into account that there are other important, fundamental political principles relating to German energy policy that have so far not been addressed here. In this book, we refer to them as the *framework conditions of the Energiewende*.

The three essential framework conditions are:

- Security of supply
- Affordability/cost efficiency
- Market economy in the energy sector

Let us describe them consecutively.

6.1 Security of Supply

Security of supply in the electricity sector is defined as the continuous availability of electricity at all times. It is usually measured as the duration of average power outages per year, i.e. the statistical average time for which each electricity consumer is without electricity. In Germany, for many years this time has been about 15–20 min per year—a top value in Europe and worldwide. When it comes to the *Energiewende*, the framework condition "security of supply" means that the transformation of the energy landscape, and of electricity generation in particular, should proceed in such a way that the above value does not deteriorate—or at least not significantly.

There are other, secondary aspects of security of supply, especially so-called micro-blackouts (voltage fluctuations in the millisecond range), that we will not address in this book.

6.2 Affordability/Cost-Efficiency

The framework condition of "affordability" states that German energy policy has to be such that electricity remains "affordable" for private households as well as for companies. Of course, it is not really clear what "affordable" means in concrete terms. This framework condition therefore translates best into actual politics as the principle of *cost-efficiency*: of several possible future paths for the *Energiewende*, the path—or more cautiously one of the paths—should be selected that results in the lowest macroeconomic cost and therefore imposes the least financial burden on the national economy, that is to say on private households and companies.

It is probably obvious that realizing this principle in practice can be both challenging and controversial. The complexity of macroeconomic relationships and aspects often makes it difficult to calculate the cost of certain paths or specific measures in advance and in detail.

This framework condition, i.e. the question of affordability and cost efficiency within the *Energiewende*, plays an essential role in this book.

6.3 Market Economy in the Energy Sector

For the purposes of this book, the term "market economy" denotes the framework condition to German energy policy that it must comply with the basic framework for the energy economy that was established in and has been valid since 1998. This framework—mostly defined by the German Energy Economy Act (*Energiewirtschaftsgesetz*, EnWG) and a whole host of ordinances—states that the energy sector is subject to free competition. As a matter of principle, any stakeholder can build a power plant and offer the electricity to other stakeholders in the market. Any stakeholder can buy electricity in this market and offer it to (end) customers, such as industrial firms or private households. And every customer is free to choose from whom to buy electricity to meet their needs.

The only exception consists in the power grids, which form a natural monopoly and are therefore subject to state control in terms of operation and pricing.

In electricity generation, trading and sales (as well as other energy-related services such as energy consulting, contracting, etc.), a market economy has been in play only since 1998. For the 80–90 years prior, Germany's electricity economy was a monopoly economy in which all prices—and thus the construction of power plants in particular—were subject to state control.

The main impulse for the change to today's system came from Europe in the 1990s, i.e. from the EU. Cross-border competition within the EU was to be established, and so liberalization of the electricity markets in the member states became a mandatory prerequisite. Already this embedding of the German energy economy legislation into the European body of law, but also the importance of market economy as a fundamental pillar of the political and social order in Germany, results in the framework condition for the fundamental transformation induced by the *Energiewende* in the energy economy that it must leave the above principles (largely) intact.

Since the *Energiewende* is above all a *change in the electricity generation landscape* in Germany, in more specific terms the path for the *Energiewende* should be set out, as far as possible, such that every stakeholder is still permitted to build (or shut down) power plants, that the price of electricity from power plants is still set in the market and that the market, rather than a public authority, decides on the success, mode of operation and utilization of power plants.