Energy Policy 38 (2010) 3431–3442

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Germany's dash for coal: Exploring drivers and factors

Michael Pahle *

Potsdam Institute for Climate Impact Research, PO Box 601203, 14412 Potsdam, Germany

ARTICLE INFO

Article history:
Received 19 November 2009
Accepted 5 February 2010
Available online 6 March 2010

Keywords:
Germany
Dash for coal
Investments in electricity markets

ABSTRACT

The German electricity sector has recently seen extensive planning and construction of new coal-fired power plants. Within a period of only a few years, new investments amounting to around 15% of the total sector capacity were brought on the way, and plans for a multitude of additional projects are pending. This 'dash for coal' in Germany has raised considerable public concern, especially as it risks to undermine recent political attempts to combat global warming. Yet, the question of why the dash for coal has emerged has not yet been addressed in a thorough analysis. This article attempts to close this research gap, while at the same time contributing as a case study to the general understanding of investment patterns in liberalized electricity markets. It finds that the main reasons for the dash have been (1) replacement requirements due to the nuclear phase out, (2) the onset of a new investment cycle in the power market, (3) favorable economic and technological prospects for coal compared with natural gas in the long run, (4) a status-quo bias of investors in regard to future renewable deployment, (5) explicit political support for coal, and (6) the ineffectiveness of public protest in hampering new projects.

1. Introduction

In recent years the European electricity sectors have experienced an increasing influence of the political and societal developments evolving around climate change. New instruments and regulations were introduced to initiate a transition to a less carbon intensive energy system, very often backed up by a broad public debate that demanded early action. Germany, with its strong tradition in environmental protection, can certainly be named as one of the EU member states at the forefront of this process.

Against this background the current extensive investments in new coal power plants in the country may surprise at first glance. As of 2009 ten plants with a total capacity of 11.3 GW are under construction (BUND, 2009), and if planned projects are included this number extends to around 30 GW and more, which equals approximately 40% of the peak electricity demand in 2007 (see BnetzA, 2008). Even for sector experts this turnaround in technology choice[1] has been largely unexpected, as it seemed completely out of time only several years ago (Brunekreeft and Bauknecht, 2006). Accordingly this trend, which in part is also a global one, has created some confusion both about its causes and persistence under the above described developments. Is there indeed a new 'dash' for coal that will shape the energy systems for the next decades, or is this just a minor boom that will soon fade away in a new era of green energy supply? The controversy of this issue is also acknowledged by the research community, as several titles demonstrate, e.g. 'The Rush to Coal: Is the Analysis Complete?' (Hamm and Borison, 2008), 'Future of Coal: Rhetoric vs. Reality' (Sioshansi 2009), and 'Coal: Hype or Reality?' (Capgemini, 2008). However, analyses so far have been rather superficial and especially short in explanations and exploration of potential causes.

Motivated by this shortcoming the central intention of this article is to identify and explore the drivers and factors that may have given rise to the revival of coal in Germany. Being a case study the underlying method can be classified as a qualitative analysis which tries to establish 'causes-of-effects' (see Mahoney and Goertz, 2006), with the effect under scrutiny being the observed trend for coal. It follows from the methodological restrictions that insights are limited to exploration of potential causes and hypothesis building, but do not allow a decision on necessary or sufficient conditions or generalization. Nevertheless, this article presents a broad overview which reveals previously unaccounted interdependences and perspectives.

A central difficulty faced thereby is the lack of a proper integrated theory of technology choice in liberalized electricity markets. On one side, the main drivers of investment in restructured markets are still unknown (Murphy and Smeers, 2005). On the other side decision factors, i.e. the determinants of technology choice once a new investment has been decided on, are only well defined within economic theory. But this approach is

* Tel.: +49 331 2882687.
E-mail address: michael.pahle@pik-potsdam.de

[1] In this context 'technology' and 'fuel' are used synonymously in the sense that one technology generates electricity with only one type of fuel.

0301-4215/$ - see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.enpol.2010.02.017

only partial and neglects relevant influences, as will be argued in this article. Therefore the identification of drivers and factors within this analysis can be seen as a scientific contribution by itself.

The article is structured as follows: Section 2 reviews investments in generation capacity in Germany over the last decades. It describes the development of the technology mix, including a preliminary identification of patterns that guide technology choice. Moreover, data of new plants currently under construction or planned are presented and discussed in order to make the trend for coal evident and put it on a solid factual basis. Section 3 compiles drivers and decision factors from the literature and the previous findings, and explores how they pertain to the situation. Section 4 shows under which constellations and relative importance of drivers and factors the current situation is a plausible outcome, and what this implies for the future.

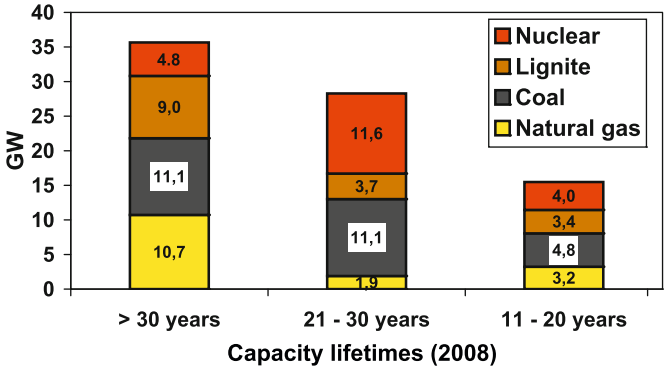

Fig. 1. Age structure of German fossil and nuclear power plants.
Source: Kjärstad and Johnsson (2007).

2. Investments in generation capacity

In this section data of historic and recent investments in generation capacity are presented and discussed. Even though the focus is on current technology choice, the long average lifetimes of power plants together with the industry around it have created lock-ins by which past actions determine present and future ones (Unruh, 2000). As will later be outlined, investments trends both in the 1970–1980s and the decade following liberalization in 1998 have played a considerable role in the recent revival of coal. The latter period will be described in more detail, because liberalization fundamentally changed the rules guiding investments and opened up the market for new players. In the course of events diverse groups of investors emerged, which for a number of reasons had a bias for one technology or the other. So as a relevant dimension regarding technology choice the type of investor will be accounted for.

Furthermore, taking the decision to build new capacity as given, the question arises in this context which technologies would have offered an alternative to coal. Coal power plants in Germany typically supply base (lignite) or intermediate (hard coal) load, and alternative options should possess similar technological and economic characteristics.[2] So only nuclear or natural gas can thus be considered as suited, depending on the envisaged operating scenario. Since the phase out of nuclear power has been decided in 2002, possible choices narrow down to a single alternative: natural gas. Below, this technology will be employed for counterfactual argumentation, i.e. to contrast the dash for coal against a possible 'dash for gas' that never materialized. Other technologies, in particular renewables, are taken account of only as additional boundary conditions for fossil plant operation and profitability. This is mainly justified by their lack of techno-economic characteristics required to make them an appropriate substitute for coal: large-scale centralized deployment, regional availability and non-intermittent generation. Respective arguments are described in more detail throughout Section 3.

2.1. Historic investments

As argued current investment trends in Germany are still influenced by the historical development of the sector, documented for example in Hilmes and Kuhnhenne (2006), Matthes (2000), and Brunekreeft and Bauknecht (2006). Until the 1960s power generation was nearly completely based on the domestic resources hard coal and lignite. In the first years of the 1970s oil and natural gas amended the generation mix, but the oil crises and rising prices switched priorities back to coal. The 1970s saw the last large investment boom in conventional fossil power plants in Germany so far (Lambertz and Krahl, 2007). At the same time, the newly developed nuclear technology emerged and dominated power sector investments until the early 1980s. While the 1986 Tchernobyl incident practically brought an end to nuclear power in Germany, the reunification in 1990 opened up new opportunities, namely the replacement or refurbishment of old lignite plants by Western integrated suppliers, and the entry of the newly founded Eastern municipal utilities into the market. For the bigger part the new utilities relied on natural gas that had become more attractive after the political situation had changed and access to the Russian resources was more readily available. These developments reflect themselves in the age structure of German power plants (Fig. 1).

2.2. Investments in the newly liberalized market (2001–2008)

With the liberalization of the national power sector in 1998 investment trends passed a turning point. Brunekreeft and Twelemann (2004) point out that '[t]he combination of the traditional model of cost-based regulation, incentives to invest in new capital and an obligation to guarantee a reasonable supply security, [had] created severe excess generation capacity in the German ESI [Electricity Supply Industry].' With electricity prices reaching a historic low and even temporarily falling below generation costs in 2000 (Lambertz, 2006), the large integrated suppliers (IS) in particular closed down old and inefficient plants (Brunekreeft and Twelemann, 2004). Even though prices started to rise again from then on, they were sending only tentative signals for new investments. Between 2001 and 2008 only 7.4 GW of new fossil fired capacity were build (Fig. 2). The predominant part of it (5.5 GW) was natural gas combined-cycle gas turbines (CCGT), seen as basically the only option for new plants for several years after liberalization (Brunekreeft and Bauknecht, 2006). Lignite accounted for around 1.6 GW, and hard coal hardly played a role at all.

Regarding the type of investor coal power plants were exclusively build by an IS or joint ventures with IS majority. In fact, the entire lignite capacity addition stems from the retrofit (2002) and an additional generating unit (2008) of a single plant (Nierderaußem /RWE). Natural gas plants, in contrast, were built by all the various players in the German electricity market:

[2] This implies that these factors essentially influence technology choice – for now a working hypothesis which will be dealt with more thoroughly in the next section.