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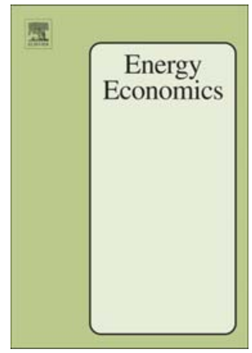

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Adaptation of Thermal Power Plants: the (Ir)relevance of Climate (Change) Information.☆

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Abstract

When does climate change information lead to adaptation? We analyze thermal power plant adaptation by means of investing in water-saving (cooling) technology to prevent a decrease in plant efficiency and load reduction. A comprehensive power plant investment model, forced with downscaled climate and hydrological projections, is then numerically solved to analyze the adaptation decisions of a selection of real power plants. We find that operators that base their decisions on current climatic conditions are likely to make identical choices and perform just as well as operators that are fully 'informed' about climate change. Where electricity supply is mainly generated by thermal power plants, heat waves, droughts and low river flow may impact electricity supply for decades to come.

Keywords: Thermal Power Plants, Climate Change, Adaptation, Real Options
JEL: D8, Q40, Q51, Q53, Q54

1. Introduction

1.1. Problem and question

In the United States more than 85% of all electricity is generated from nuclear and fossil fuels (e.g., coal, natural gas) in thermal power plants (EIA, 2015). At 75%, the European Union exhibits a significant dependence on this type of electricity production too (Eurostat, 2013). Many thermal power plants depend on a river for their cooling water. As such, these plants may experience forced load reductions or shut downs during heat waves or droughts. This is due to sheer lack of water, or due to environmental regulations that limit waste-heat discharges from power plants to prevent excessive river warming. The effects of two European heat waves in 2003 and 2006, during which several power plants in France and Germany were forced to reduce production or even had to shut down temporarily, have been well documented (see Kopytko and Perkins (2011), Rubbelke and Vogele (2011) and Pechan and Eisenack (2014)). Cooling water is indeed "a critical resource in the thermoelectric power industry" (Feeley III et al., 2008).

No matter the extent and speed of mitigation, some degree of climate change over the course of this century seems inevitable (IPCC, 2014). Melting of glaciers will impact river runoff worldwide (IPCC, 2014), shifting rivers to become dominantly precipitation-fed. Secure cooling water supply, the life-line for thermal power plants, may no longer be a given. Indeed, van Vliet et al. (2012b) have shown that increases in river water temperature and decreases in summer river flow in Europe and the United States are to be expected, and subsequently find that in these regions the probability of extreme

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