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Managing carbon regulatory risk in utility resource planning: Current practices in the Western United States

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ABSTRACT

Concerns about global climate change have substantially increased the likelihood that future policy will seek to minimize carbon dioxide emissions. As such, even today, electric utilities are making resource planning and investment decisions that consider the possible implications of these *future* carbon regulations. In this article, we examine the manner in which utilities assess the financial risks associated with future carbon regulations within their long-term resource plans. We base our analysis on a review of the most recent resource plans filed by 15 electric utilities in the Western United States. Virtually all of these utilities made some effort to quantitatively evaluate the potential cost of future carbon regulations when analyzing alternate supply- and demand-side resource options for meeting customer load. Even without federal climate regulation in the US, the *prospect* of that regulation is already having an impact on utility decision-making and resource choices. That said, the methods and assumptions used by utilities to analyze carbon regulatory risk, and the impact of that analysis on their choice of a particular resource strategy, vary considerably, revealing a number of opportunities for analytic improvement. Though our review focuses on a subset of US electric utilities, this work holds implications for all electric utilities and energy policymakers who are seeking to minimize the compliance costs associated with future carbon regulations.

1. Introduction

Regulated electric utilities in many US jurisdictions are required to prepare long-term resource plans to evaluate demand- and supply-side resource options for meeting customer load requirements over periods typically spanning 10–20 years.[1] Typically, this is done through an evaluation of various "candidate portfolios," each consisting of a different mix of supply- and demand-side resources; based on that analysis, a "preferred portfolio" of generation and efficiency investments is proposed.

Given the long development lead-time and economic lifetime of most electric infrastructure investments, utilities must evaluate the potential costs and risks of candidate portfolios over a lengthy time horizon. One long-term and potentially far-reaching financial risk currently facing the electricity industry is the uncertain cost of future carbon dioxide (CO_2) regulations.[2] Notwithstanding the fact that federal climate regulation does not yet exist in the US, many utilities are beginning to actively assess the *potential* cost of *future* carbon regulations within their resource plans, and are starting to evaluate options for limiting their exposure to these highly uncertain costs. Issues of environmental regulatory risk are, in fact, not new to utility planning, and a variety of authors have discussed the need for utilities to consider such risks.[3] However, the risks posed by the possibility of future greenhouse gas regulations are of unprecedented scale and scope. How utilities evaluate and manage these risks may have substantial implications for generation and demand-side resource choices. Yet, with few exceptions, little effort has been made to assess how utilities (and their regulators) might best analyze and manage these risks through existing resource planning and investment processes.

As a step in this direction, we examine the treatment of carbon regulatory risk in the most recent resource plans filed by 15

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[1] We use the term *resource plan* to include what are variously referred to as *integrated resource plans*, *least-cost plans*, *long-term procurement plans*, *default electric supply plans*, and the like.

[2] Though we only address financial risks related to future climate change regulations, utilities also face risks associated with the physical impacts of climate change, itself (e.g., the potential effects on electricity consumption, hydro-electric generation, and cooling water availability, among others).

[3] Other work that has explored the implications of environmental regulatory risk for utility policy, planning, and investment decisions includes Andrews and Govil (2007), Bokenkamp et al. (2005), Cavanagh et al. (1993), Clemmer and Freese (2006), Gardiner and Associates (2006), Johnston et al. (2006), Repetto and Henderson (2003), and Wiser et al. (2004).

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electric utilities in the Western United States (see Table 1).[4] Together, these utilities account for approximately 60% of retail electricity sales in the West, and cover nine of 11 Western states. Our comparative analysis has two related elements.

First, we compare and assess utilities' approaches to addressing key analytical issues that arise when considering the risk of future carbon regulations, including

- assumptions about the future design of carbon regulations and the cost of carbon emissions;
- the degree to which low-carbon resources and candidate portfolios are evaluated;
- the effects of carbon regulations on other aspects of the utility planning environment (e.g., effects on load growth, natural gas prices, and fossil plant retirements); and
- the manner in which uncertainty in portfolio costs associated with future carbon regulations is considered in the process of selecting a preferred resource portfolio.[5]

Second, we summarize the composition and carbon intensity of the preferred resource portfolios selected by the 15 utilities in their resource plans. This component of our analysis highlights general trends and differences in the strategic direction of Western utilities, and the implications of these decisions for their exposure to carbon regulatory risk.

Though our review focuses on a subset of US electric utilities, this work holds implications for all electric utilities and energy policymakers that are seeking to minimize the compliance costs associated with future carbon regulations. Even in areas where carbon regulations already exist, the possibility of strengthened future policies must be considered in planning decisions. As such, a major component of our effort is to develop a series of recommendations for how energy planners might better address and manage the risk of future carbon regulations.

The remainder of this article is organized as follows. We begin in Section 2 by characterizing the significance of carbon regulatory risk for electric resource economics. In the following four sections, we compare utilities' treatment of the four analytical issues itemized above, namely their base-case and alternate assumptions about future carbon regulations and emission prices (Section 3); the extent to which they evaluated low-carbon candidate portfolios and the underlying type and quantity of low-carbon resources included in those portfolios (Section 4); the potential indirect impacts of carbon regulations that utilities considered in their portfolio analysis (Section 5); and the manner in which information about uncertainty in carbon emission costs informed utilities' selection of specific preferred resource portfolios (Section 6). In Section 7, we describe the composition and carbon intensity of the preferred resource portfolios selected by the 15 utilities. Last, in Section 8, we offer several concluding remarks and recommendations for utilities and energy policymakers that are seeking to minimize the costs associated with future carbon regulations.

[4] This article draws from a lengthier study conducted by Berkeley Lab (Barbose et al., 2008). Our review is limited to the resource plans filed by utilities. This work builds off of previous efforts at Berkeley Lab to evaluate Western utility resource plans, including Bolinger and Wiser (2005), which examines the treatment of renewable energy, and Hopper et al. (2006), which examines the treatment of energy efficiency.

[5] Another important methodological issue, which we do not address, is utilities' assumptions about the cost and performance of different types of resources (low-carbon or otherwise); see Bolinger and Wiser (2005) for a comparison of utilities' cost and performance assumptions for various renewable electricity sources.

2. The importance of carbon regulatory risk for utility resource planning

The emergence of carbon regulatory risk as a fundamental issue for utility resource planning stems, in part, from growing consensus within the industry that carbon regulations are likely to be enacted (or become more stringent) well within the lifetime of new resource investments. In a recent poll of approximately 100 senior electricity industry executives in the US, for example, about half expected federal climate change legislation to be enacted by 2009, and more than 90% expected such legislation to be adopted by 2014 (GF Energy, 2007). These sentiments are, no doubt, fueled by the proactive efforts of other countries to limit carbon emissions, as well as by the array of legislative proposals introduced in the US Congress over the past several years and by the fact that, in the absence of federal legislation, many states have begun taking action on their own to limit greenhouse gas emissions.[6]

In addition to perceptions of increasing likelihood, carbon regulations represent a significant regulatory risk because of the potentially dramatic impact they could have on electric resource costs. To illustrate the potential impact of a carbon tax or cap-and-trade system on the relative cost of different electric resource options, Fig. 1 translates carbon emission prices into incremental operating costs for various resource options. Overlaid on top of these cost curves are projections from the Energy Information Administration (EIA) of the CO_2 emission allowance prices (EIA, 2003, 2007a, b) that could occur under a range of US federal legislative proposals: the McCain–Lieberman Climate Stewardship Act of 2003 (S.139), draft legislation prepared by Senator Bingaman in late 2006, and the McCain–Lieberman Climate Stewardship and Innovation Act of 2007 (S.280).

All three of these proposals would establish economy-wide cap-and-trade systems for US greenhouse gas emissions, but they differ significantly in terms of the size and timing of the emission cuts and other key provisions. EIA's projection of CO_2 emission prices for the 2006 Bingaman proposal corresponds to a levelized emission price of approximately \$6/short ton[7] over the period 2010–2030, adding about \$6/MWh to the operating cost of coal-fired power generation without carbon capture and storage (CCS) and about \$3/MWh to the cost of natural gas-fired combined cycle gas turbine generation (CCGT). At the other end of the spectrum, EIA's projection of emission prices under S.139 corresponds to a levelized price of approximately \$44/short ton, which would add about \$41/MWh to the operating cost of coal-fired generation without CCS, and about \$18/MWh to the cost of a CCGT. Such a price increase could fundamentally alter the relative economics of different electric resource options.

3. Carbon regulations and emission prices modeled in utility resource plans

The starting point in quantitatively evaluating carbon regulatory risk is to develop specific assumptions about the carbon regulations that could plausibly be implemented over the lifetime of the resource investments being considered. Given the high degree of uncertainty in the nature and timing of future carbon regulations, utilities often develop a range of alternate assumptions to evaluate through scenario analyses. In this section, we describe the carbon regulations that utilities in our sample

[6] For recent summaries of existing state and regional carbon policies throughout the US, see Lutsey and Sperling (2008) and Pew Center (2006a, b).

[7] 1 short ton = 0.907 metric tons.