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Impact of public policy uncertainty on renewable energy investment: Wind power and the production tax credit

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ABSTRACT

It is generally understood that the pattern of repeated expiration and short-term renewal of the federal production tax credit (PTC) causes a boom–bust cycle in wind power plant investment in the US. This on–off pattern is detrimental to the wind industry, since ramp-up and ramp-down costs are high, and players are deterred from making long-term investments. It is often assumed that the severe downturn in investment during “off” years implies that wind power is unviable without the PTC. This assumption turns out to be unsubstantiated: this paper demonstrates that it is not the absence of the PTC that causes the investment downturn during “off” years, but rather the uncertainty over its return. Specifically, it is the dynamic of power purchase agreement (PPA) negotiations in the face of PTC renewal uncertainty that drives investment volatility. With contract negotiations prevalent in the renewable energy industry, this finding suggests that reducing uncertainty is a crucial component of effective renewable energy policy. The PTC as currently structured is not the only means, existing or potential, for encouraging wind power investment. Using data from a survey of energy professionals, various policy instruments are compared in terms of their perceived stability for supporting long-term investment.

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1. Introduction

Since public policy uncertainty is a known deterrent in securing private-sector investment, it needs to be better understood. As elsewhere, this negative impact has been observed in the renewable energy industry. For example, Meyer and Koefoed (2003) examine the impact on investors of changing a decades-long, stable wind promotion policy in Denmark – in particular the impact of delayed implementation of the new policy – and find that it caused the wind industry to stall. The German wind power industry began to suffer similar investment downturns when a biennial review process was added to the Renewable Energy Act, causing significant uncertainty and opening the door for frequent changes in the feed-in tariff laws (Agnolucci, 2006). Similarly, the dramatic stop-and-go investment pattern in the US wind energy sector has been attributed to ongoing uncertainty over the renewal of favorable tax incentives (e.g., Wiser et al., 2007a).

Although the problem of uncertainty is widely noted, much less attention has been paid to the precise reasons it is problematic. By examining the issue for the US wind industry, which has been characterized by a boom–bust investment pattern during much of the past decade, this paper serves as a case study

in how public policy uncertainty deters investment. Specifically, it investigates the dynamics of uncertainty over the renewal of the federal production tax credit (PTC) and the reasons this has discouraged wind plant investment.

What *exactly* about the on-again, off-again PTC cycle causes investment volatility? While the industry has been largely focused on the problem of PTC *expiration* and the subsequent *absence* of the PTC, I argue that the bigger problem is *uncertainty* over its *return*.

It is sometimes assumed that the economics of wind (i.e., the notion that wind energy would be unviable without the PTC subsidy) drives the ups and downs in wind investment. Although the presence or absence of tax credits impacts the *total amount* of wind investment over time, the *pattern* of investment (boom–bust volatility) is driven primarily by the dynamic of contract negotiations in the face of uncertainty.

A strategic negotiations model is used to understand the impact of contract negotiations on players' investment decisions. This qualitative model considers the strategic and behavioral incentives of both buyers and sellers in negotiating a power purchase agreement (PPA). The negotiating parties will necessarily operate under different constraints. In times of renewal uncertainty, independent power producers (IPPs), who are dependent on investors, pessimistically assume no PTC renewal, whereas utilities, who are under statutory obligation to secure least-cost power, optimistically assume PTC renewal. This

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asymmetry of assumption causes negotiations under uncertain conditions to stall.

It follows then that reducing policy uncertainty is especially important for industries in which contract negotiation is common. Since many industry observers agree that long-term contracts are both necessary and useful for mitigating market risk and facilitating the financing of wind and other renewable energy plants (e.g., Johnston et al., 2008), effective renewable energy policy must focus on reducing uncertainty. In considering policy options that could provide greater certainty, this paper compares the levels of investor confidence in the stability of various policy instruments.

The source of this data on investor confidence is the 2006 Wind Industry Survey, an online survey conducted in May 2006. An email invitation was sent to approximately four thousand¹ individuals who had attended conferences on wind energy during the past year, including the American Wind Energy Association (AWEA)'s WINDPOWER 2005 conference in Denver. Of the 420 people who clicked on the survey link, 338 continued past the first question, and 272 reached the end of the survey. All questions were voluntary, with most questions soliciting about 300 responses, representing an overall response rate of 8–9%. Most questions were closed-ended (multiple-choice). Table 1 provides a profile of the respondents. Information from this survey is supplemented with interviews with industry representatives.

I focus on the years 1999–2007. Year 2007 is something of a compromise as a choice of when to end the time period. The most dramatic boom–bust investment pattern was 1999–2005, but it continued thereafter to a lesser extent (AWEA, 2010a). The industry has been growing and maturing, and certain aspects of this development began around 2005. These factors have somewhat mitigated the effect of PTC uncertainty whose impact on the industry was particularly pronounced during the first half of the decade. But it is since 2007 that even broader changes outside the industry have changed the whole picture for the wind industry: the overall political climate, economic conditions, and the specific policies relevant to the wind industry.

By examining the period 1999–2007 we can draw some important lessons about the effect of policy uncertainty on investment. These lessons continue to be relevant even if some of the specific circumstances that led to the phenomena examined in this paper have changed. This is a case study on the impact of public policy uncertainty for investment in an emerging industry. In particular it examines the role of industry structure – in this case an industry structured around contract negotiations – in contributing to this impact.

The rest of this paper is organized as follows: Section 2 describes the federal production tax credit, its history, and its connection to investment in the wind industry. Section 3 describes the history of wind energy development, the prevalence of PPAs, and the particular financing structures used in the wind industry. Section 4 lays out the paper's central argument that negotiation dynamics provide the link between policy uncertainty and investment volatility. Section 5 considers a variety of policy instruments for supporting renewable energy development. Section 6 discusses recent developments in the energy sector and how these might impact the role of PTC uncertainty in the wind industry going forward. Section 7 summarizes the conclusions of this paper and discusses their implications for the wind industry, for renewable energy policy, and for the literature on investment decision-making under uncertainty.

Table 1
Profile of 2006 Wind Industry Survey respondents.

Question	Responses (% of respondents ^a)	Responded to question
Experience in electric power ^b	13.5 years	262
Experience in wind energy ^c	6.6 years	262
Work focuses on US ^d (exclusively or substantially)	245 (94%)	262
Work associated “very much” with... ^e		261
Private sector	192 (74%)	
Public sector	61 (23%)	
Non-profit sector	20 (8%)	
Experience by fuel source ^f (number responding “extensive”)		333
Coal	47 (14%)	
Natural gas	71 (21%)	
Petroleum	38 (11%)	
Nuclear	21 (6%)	
Hydro	33 (10%)	
Wind	217 (65%)	
Solar	30 (9%)	
Geothermal	13 (4%)	
Biomass	30 (9%)	
Other	1 (0%)	
Professional positions held over course of career ^g		249
Developer	120 (48%)	
Finance/investment	106 (43%)	
Utility/load-serving entity	47 (19%)	
Equipment/plant services	123 (49%)	
Consulting	116 (47%)	
Government agency	27 (11%)	
Research/media/advocacy	59 (24%)	
Other	15 (6%)	

^a Percentages do not add to 100% because respondents are allowed to mark more than one answer. Percentages are of total respondents for that question.

^b Exact question: *How many years of work experience do you have involving the electric power sector?*

^c Exact question: *How many years have you been involved in wind energy?*

^d Exact question: *On which regions of the world has your work with the electric power sector focused?*

^e Exact question: *To what extent is your experience with the electric power sector associated with the....*

^f Exact question: *How much professional experience do you have with the following fuel sources?*

^g Exact question: *Over the course of your professional experience involving the electric power sector, what “hats” have you worn?*

2. The PTC and investment volatility

The main form of financial support² for the US wind industry is the federal production tax credit (PTC), an income tax credit of 1.5 ¢/kWh (1992\$, adjusted annually for inflation, or 2.1 ¢/kWh in 2010) for the production of electricity from qualified wind plants and other renewable energy facilities. Plants receive the tax credit for the first 10 years of operation, provided they come online by the PTC expiration date. The credit was created under the Energy Policy Act of 1992 and originally expired June 30, 1999. Since then, it has been renewed seven times, usually for only one or two years at a time. In February 2009, as part of the American Recovery and Reinvestment Act (ARRA), the PTC was extended by three years through the end of 2012.

Typically, the PTC has either been allowed to expire or come within just a few months of expiring before getting renewed.

² An additional source of support at the federal level is provided through the tax code. The Modified Accelerated Cost Recovery System (MACRS) allows investments in wind plant equipment to be depreciated at an accelerated rate over five years. MACRS has no expiration date. In addition, there are various forms of support for wind and other renewables at state and local levels.

¹ In total 4274 emails were sent, of which 475 were undeliverable, resulting in 3799 emails which “arrived” (at least were not returned).

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