Impact of Policy Uncertainty on Renewable Energy Investment: Wind Power and PTC

Merrill Jones Barradale[1]

PhD Candidate
Energy and Resources Group
University of California at Berkeley

310 Barrows Hall
Berkeley, CA 94720-3050
Tel: (510) 393-4530
Email: mej@berkeley.edu

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 U.S. 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 widely assumed that the severe downturn in investment during "off" years is evidence that wind power is unviable without the PTC. However, as this paper demonstrates, the volatility of investment associated with the PTC is unrelated to the underlying economics of wind; instead it is due to the dynamic of power purchase agreement (PPA) negotiations in the face of uncertainty.

The PTC is not the only means, existing or potential, for encouraging wind power investment. Various alternative policy incentives are considered and compared in terms of their perceived reliability for supporting long-term investment.

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Introduction

The idea that public policy uncertainty has a negative impact on private-sector investment is not new. Within the renewable energy industry, for example, Meyer and Koefoed (2003) look at 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 a well-established wind industry to stall.

The present paper contributes to the literature by demonstrating that contract negotiation dynamics can amplify the effect of public policy uncertainty on corporate investment decisions. This paper uses a strategic negotiations model to show why uncertainty over the renewal of federal tax incentives discourages wind plant investment in the U.S. The model incorporates the concept of bargaining power, willingness to wait vs. willingness to negotiate, the number of players on the buy and sell sides of power purchase agreements (PPA), and supply and demand for wind power.

The federal production tax credit (PTC) provides an income tax credit for electricity generated during the first 10 years of operation of a wind plant. Each time the PTC expires, there is uncertainty as to whether or not it will be renewed, and this uncertainty drives the wind industry investment cycle.

In addition to the uncertainties associated with the pre-implementation period (not knowing if, when, or what type of policy will be implemented), some uncertainty may remain even after government passes legislation creating policy incentives, that is, investors may not "trust" all types of policy equally. For example, even though the deadline for wind plant installation in order to qualify for the PTC is variable, once operating, qualifying plants are considered by investors to be certain recipients of PTC financing over the next 10 years (subject to their own tax credit appetite). By contrast, the renewable energy production incentive (REPI), a cash-equivalent subsidy for non-tax-paying municipal utilities, is considered unreliable due to the annual appropriations process, and financiers rarely include it in their calculations (Wiser and Pickle 1997).

In considering alternatives to a PTC, this paper presents data comparing investor attitudes on the stability of various types of policy incentives.

The primary source of data for this paper comes from an online survey conducted in May 2006. An email invitation was sent to approximately four thousand[2] 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,[3] and 272 reached the end of the survey. All questions were voluntary, with most questions getting about 300 responses, representing an overall response rate of 8-9%. Most questions were close-ended (multiple choice).

The rest of this paper is organized as follows. The first section, "PTC Volatility," describes the federal production tax credit, its history, and its connection to investment in the wind industry. The second section provides background on PPAs in the electric power sector in general and in wind power in particular. The third section, "PPA Negotiations," lays out the central argument linking negotiation dynamics with policy uncertainty and investment volatility. The fourth section, "Beyond the PTC," considers alternative policy incentives to the production tax credit for supporting renewable energy development. The final section summarizes the conclusions of this paper in light of recent developments in the energy sector and how these might impact the role of PTC uncertainty in the wind industry going forward.

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[2] 4274 emails were sent, of which 475 were undeliverable, resulting in 3799 emails which "arrived" (at least were not returned).

[3] The first page of the survey, which caused the 20% drop from 420 to 338, was a "Consent to Participate in Research" (required by university regulations) describing the survey as confidential and voluntary.

PTC Volatility

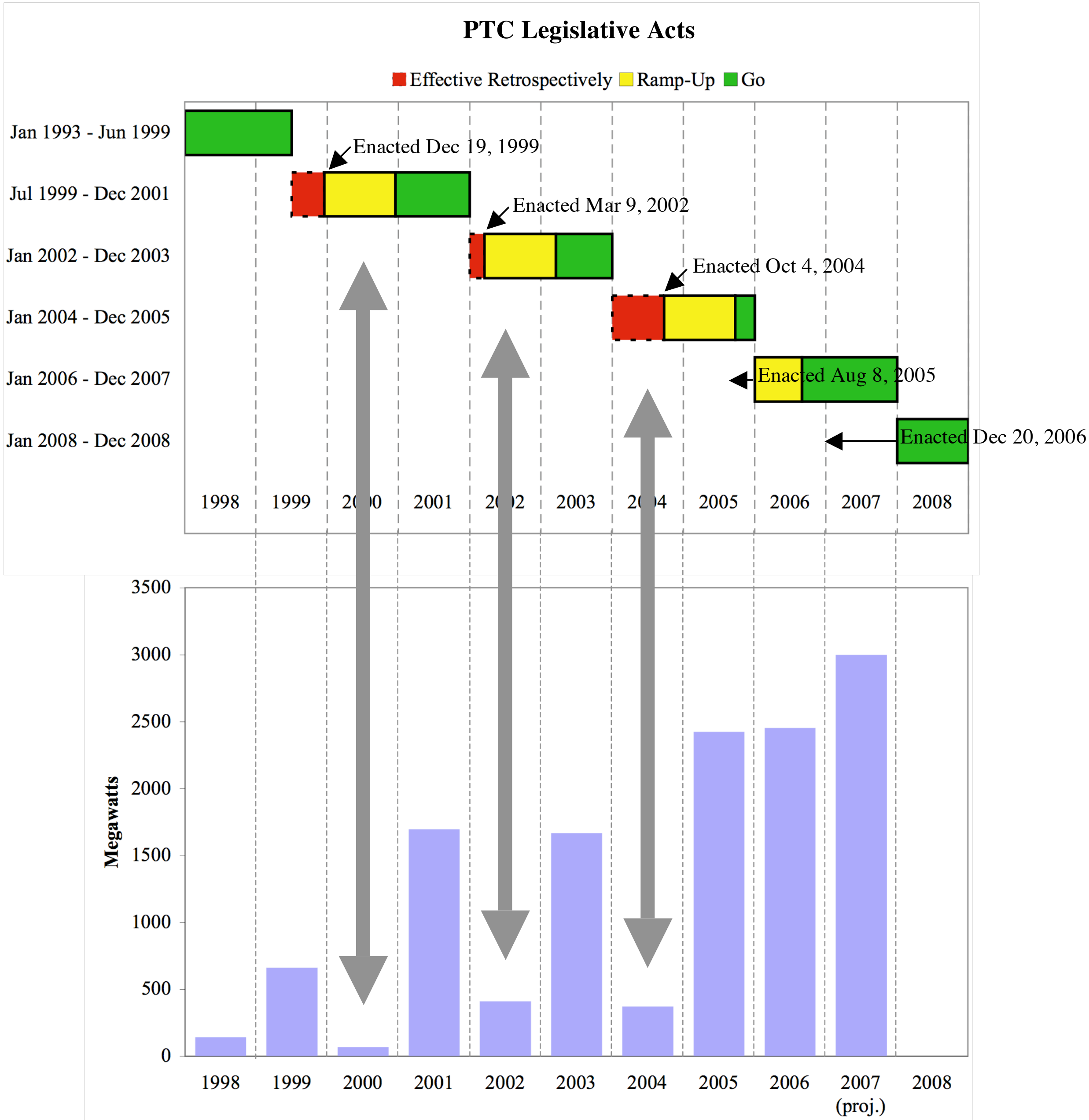
The main form of policy support for the U.S. wind industry is the federal production tax credit (PTC), an income tax credit of 1.5 cents/kWh (1992$, adjusted annually for inflation) for the production of electricity from qualified wind plants and other renewable energy facilities. Plants receive the tax credit for the first 10 years of operation, provided they come online by the PTC expiration date. The current value of the PTC is 1.9 cents/kWh. The credit was created under the Energy Policy Act of 1992 and originally expired June 30, 1999. Since then, it has been renewed five times for 1-2 years at a time, currently expiring at the end of 2008 (AWEA 2007).

Typically, renewal is enacted after the previous act has expired and is made effective retrospectively. Hence there has been no gap in PTC coverage, even though there have been periods when renewal is uncertain. After this uncertainty is resolved, ramp-up time is required before new capacity can be brought online, causing further investment delays. Periods of expiration and ramp-up ("off" years) result in drastic reduction in wind plant investment (see Figure 1).

The fact that this pattern of repeated expiration and short-term renewal of the PTC causes a boom-bust cycle in wind plant investment is broadly understood within the industry. It has several detrimental effects that are frequently highlighted by industry participants:

- Ramp-up and ramp-down costs are high
- Inconsistent policy discourages long-term investment, especially in turbine manufacturing capacity
- Potential new entrants are deterred because they see wind as a "fad" industry, leading to overly pessimistic views of wind's long-term potential

However, the precise source of this volatility is generally misunderstood, since industry participants assume the low investment during "off" years represents the underlying economic viability of wind energy.



U.S. Annual Net Wind Capacity Additions

Source for PTC enactment dates: Wiser (2007)
Source for wind capacity additions: AWEA (2007)

Figure 1: Even though PTC renewal has always been effective retrospectively (red), by the time it is renewed, ramp-up time (yellow) is required before new capacity can be brought online (green). Ramp-up period is assumed to be 12 months following renewal date; in reality ramp-up periods may be getting shorter as industry gains experience; this could explain significant capacity additions in 2005 despite renewal date as late as October 2004.

In fact, the volatility of investment associated with the PTC is unrelated to the underlying economics of wind; instead it is due to the dynamic of power purchase agreement (PPA) negotiations in the face of uncertainty. These negotiation dynamics, when coupled with PTC uncertainty, will lead to a volatile investment pattern *no matter how strong other motivations for investing in wind may be*. These motivations can include state and local policy incentives for wind investment, demand for wind power from green consumer programs, and particularly profitable project development opportunities. Since most wind is financed through PPAs (see Table 1), the dynamic of contract negotiations impacts the entire industry.

Table 1: Wind Capacity by Power Off-Take Arrangement (MW, per End 2006)

Off-Taker	PPA	Non-PPA	Total
Investor-Owned Utility (IOU)	5,567	1,191	6,758 (58%)
Publicly Owned Utility (POU)	1,349	308	1,657 (14%)
Power Marketer[4]	1,839	0	1,839 (16%)
Merchant/Quasi-Merchant[5]	0	1,297	1,297 (11%)
On-Site[6]	0	24	24 (0.2%)
Total	**8,755** (76%)	**2,820** (24%)	**11,574**

Source: Wiser and Bolinger (2007)

Background on PPAs

Historically in the U.S., power plants were built, owned, and operated by utilities to serve their own load. The federal Public Utilities Regulatory Act (PURPA) of 1978 created a new class of non-utility generators that produced electricity from renewable resources. Utilities were required to purchase electricity from qualifying facilities under long-term contract at prices set by

[4] Power marketers are defined as corporate intermediaries that purchase power under contract and then re-sell that power to others.
[5] Merchant power is sold on the spot market rather than under long-term contract. Even in these cases, hedging transactions are commonly used to mitigate price risk.
[6] Power used on-site by the plant owners (generally commercial entities) to offset their other electricity load.

the state. The earliest grid-connected wind plants in the U.S. were built in the early 1980s under PURPA (Hyman, Hyman and Hyman 2000).

Electricity deregulation in the 1990s created greater opportunity for independent power producers (IPPs) to get involved in the generation business—not just from renewables, but from all fuel sources. IPPs vary in size from single-plant generators to large electric companies operating power plants across the U.S. and include deregulated affiliates of regulated utilities. IPPs do not own transmission and distribution lines, nor do they serve customers directly.

IPPs sell the power from their plants either under long-term contract with a utility, known as a power purchase agreement (PPA), or on a short-term basis by bidding into spot markets operated by regional power pools. Power plants not under long-term contract are called merchant plants.

Until recently, utilities have generally not wanted to build and own wind plants, preferring to purchase wind power under contract—partly for financing reasons (Wiser 1997) and partly because they didn't have as much experience with wind as some of the IPPs. As a result, most wind plants are developed and owned by IPPs. Individual plants are usually financed with a combination of debt (perhaps 70%) and equity (perhaps 30%) in a so-called "project finance" structure.

Wind plants are typically under PPA for two reasons. First, wind is a non-dispatchable resource (cannot be turned on and off at will) and therefore cannot be bid into spot markets as easily as natural gas—the most common merchant plants—can. Second, in the early 2000s, at the time when wind power was beginning to expand, high natural gas prices were causing financial collapse for many merchant gas plants, and lenders refused to finance new merchant plants of any kind. For both these reasons, lenders have not been willing to finance wind plants without a signed PPA guaranteeing a revenue stream (though some equity investors have been willing to take on merchant risk).

PPAs simplify the financial side of wind's intermittency and non-predictability[7] by setting a fixed price per kilowatthour, regardless of time of day or year generated. PPAs normally cover all power generated by the wind plant, but occasionally include maximum or minimum delivery limits. Some PPAs are flat-rate over the contract term, and others have escalating rates, usually at approximately the expected rate of inflation. PPA terms are typically 20 years, with some earlier contracts up to 25-30 years and some more recent contracts as short as 10-15 years.

Most wind PPAs are for the purchase of electricity along with the associated renewable energy attributes, with the power purchaser acquiring the renewable energy certificate (REC). In a few cases, wind PPAs are for electricity only, leaving the owner of the wind plant free to sell RECs separately. RECs can be sold to utilities who are under state renewables obligations (compliance markets) or to meet customer demand for green power (voluntary markets) (Wiser and Bolinger 2007).

PPA Negotiations

In order to understand how the combination of PPA financing and PTC volatility leads to a boom-bust cycle in investment, consider the following scenarios in which an IPP is negotiating a PPA price with a utility. Assume a 2¢/kWh PTC and a 5¢/kWh cost of producing wind power (these are illustrative numbers only, not meant to represent exact costs).

Case 1: PTC available. The IPP can plan on receiving a 2¢/kWh revenue stream from the PTC, reducing its net cost to 3¢/kWh. The IPP is therefore willing to sign a PPA as low as 3¢/kWh. As long as the value of wind power to the utility is 3¢/kWh or greater, the utility is willing to sign a PPA for 3¢/kWh, knowing that represents the IPP's net cost and therefore the best price the IPP is able to offer. Utility and IPP sign a PPA for 3¢/kWh.

[7] Technical aspects of intermittency must be addressed through an interconnection agreement with the local grid operator and through coordination with relevant system operators and short-term wind forecasts provided to load planners.

Case 2: No PTC. The IPP's net cost is now 5¢/kWh and certain to remain there, assuming there is no PTC and no prospect of its return. The IPP is willing to sign a PPA as low as 5¢/kWh. As long as the value of wind power to the utility is 5¢/kWh or greater, the utility is willing to sign a 5¢ PPA, knowing that represents the IPP's net cost and therefore the best price the IPP is able to offer. Utility and IPP sign a PPA for 5¢/kWh.

Case 3: PTC uncertain. When PTC renewal is uncertain, the IPP cannot sign a PPA for less than 5¢ because lenders, upon whom the IPP is dependent for financing, conservatively assume the PTC will not be renewed. The utility will not sign a PPA for more than 3¢, because the IPP will receive the value if the PTC is subsequently renewed (as a windfall gain!), and the utility will have left substantial value on the table. To prevent the windfall gain from going to the IPP, it is in the interest of the utility to wait until uncertainty is resolved before signing a PPA, leading to a boom-bust cycle in construction.

These scenarios are summarized in Table 2.

Table 2: PPA Agreements Under PTC Certainty and Uncertainty

PTC?	Net cost to IPP	Why?	PPA price	Conditions for agreement
Yes	3¢	2¢ PTC	3¢	As long as value to utility ≥ 3¢
No	5¢	No PTC	5¢	As long as value to utility ≥ 5¢
Maybe	5¢	PTC not bankable	No deal	No matter how valuable wind is to utility

Hence, it is not the lack of PTC that drives such drastic dips in investment during "off" years, but uncertainty over its return. This happens because of the relative bargaining positions of utility and IPP. In a typical situation, a utility will issue a request for proposal (RFP) for wind power, and IPPs will respond by submitting a bid. As a result, there is often one buyer and several sellers in a market, creating a monopsony or near-monopsony situation.

It is not necessary for the utility to have full bargaining power: if even some of the value of the PTC flows through to the utility, that is sufficient for this negotiation dynamic to occur. In other words, if there is *any* difference between the PTC and no-PTC price of the PPA, then it is in the utility's interest to wait.

The only situation in which there would be *no* difference between the two prices is with a flat demand curve (see Figure 2). A flat demand curve represents the following situation:

1. There exist multiple buyers in the market (therefore no strategic behavior on the part of buyers); AND
2. All buyers have (an) alternative source(s) of power available to them at the same backstop price (e.g. coal at 5 cents)

Since this situation is not common for electricity markets, utilities do generally retain some bargaining power.

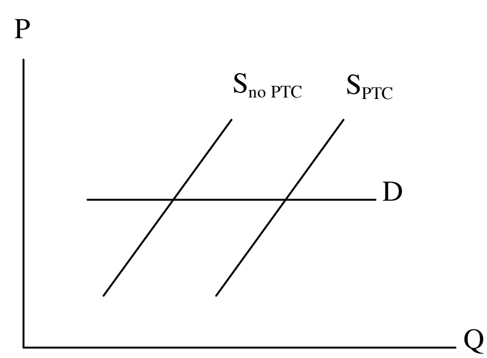


Figure 2: Wind Plant Supply Curves in a PTC- and no-PTC World. A flat demand curve is required for there to be no difference between the PTC- and no-PTC price of wind.

The evidence from actual PPA negotiations confirms that the utilities have the bargaining power and are receiving the benefit of the PTC. In a request for proposal (RFP) for wind power issued in early 2005, at a time when PTC renewal was uncertain, the utility asked for two bids from each bidder, one assuming PTC renewal and the other assuming no renewal. According to a representative of the utility, the bids differed by exactly the value of the PTC.[8] This implies that developers are bidding at marginal cost, and the value of the PTC is passed through to the utility.

More recently, a leading industry player with considerable active involvement in structuring wind-financing contracts stated that "99% of the time, PPAs pass the value of the PTC to the utility" (Feo 2007).

Respondents in the 2006 wind industry survey also said they consider utilities to be the major beneficiary of the PTC. Asked who would end up absorbing the cost difference between a PTC and a non-PTC world (see Table 3), 59% said the utility off-taker and 36% the developer.

Table 3: Respondents' Views of Cost Absorption in a No-PTC World

Question	Answer	% of Respondents[9] (Number)	Mean Share of Cost (Respondents)
Who would absorb cost difference?[10]	Developer/plant owner	13.1% (33)	
	Split between developer and off-taker	49.2% (124)	
What percent split?[11]	*Developer*		*47.0% (87)*
	Off-taker		*53.1% (87)*
	Utility off-taker	32.5% (82)[12]	
	Other[13]	5.2% (13)	
Total	Developer		36.2%
	Off-taker		58.7%
	Other		5.2%

[8] Author interview with utility representative, July 2005

[9] Percentages exclude 19 respondents who answered "No opinion"

[10] Exact question: *For those projects that you believe would go forward even without the PTC, who do you think would generally* ***absorb the cost difference*** *between a PTC and a no-PTC world?*

[11] The 124 respondents who answered "Split between developer and off-taker" to the previous question were asked: *Approximately what percentage split?*

[12] The 82 respondents who answered "Utility off-taker" were asked: *How much of that cost difference do you think would get passed on to the customer?* The mean response was 89.8% (68 responses).

[13] "Other (please specify)" included turbine manufacturers.

In theory, a two-part PPA, in which the PPA price is agreed to be one price with the PTC and a different price without the PTC, would resolve this impasse. However, this does not occur in practice, for two reasons. First, utilities have not institutionally addressed the question of what they would do in a no-PTC world.[14] Second, utilities do not want to signal regulators or Congress what they would do in a no-PTC world.[15]

Beyond the PTC

The need for stable policy with a long-term horizon is broadly recognized as a priority within the wind industry. Not everyone agrees on the best strategy for achieving this goal, however. Some industry participants, including the American Wind Energy Association (AWEA), have been working to encourage Congress to pass a PTC lasting 3-5 years or longer. Despite these ongoing efforts, Congress has repeatedly renewed the incentive by only 1-2 years, perhaps because of the way Congress calculates its budget. However, not all industry participants think the PTC is a necessary, or even a good, way to support the wind industry. One prominent project developer and equity investor goes so far as to refer to the PTC as the "heroin" of the wind industry (Armistead 2006).

It is important to consider alternatives to the PTC, not only because the short-term renewal cycle causes harmful volatility, but also because the PTC program is expected to ultimately end. Indeed, most survey respondents (58%) do not expect the PTC to last beyond 2011 (see Figure 3). Partly this may be due to the increasing cost of the tax credits to the federal government as the wind industry grows. Hence, relying on the PTC as vehicle for getting to the industry's goal of 20% of U.S. electricity generation may not be realistic.

[14] Author interview with utility representative, March 2006
[15] Author interview with industry investor, September 2005

*How long **beyond 2007** do you think the U.S. government will continue **extending the PTC**?*

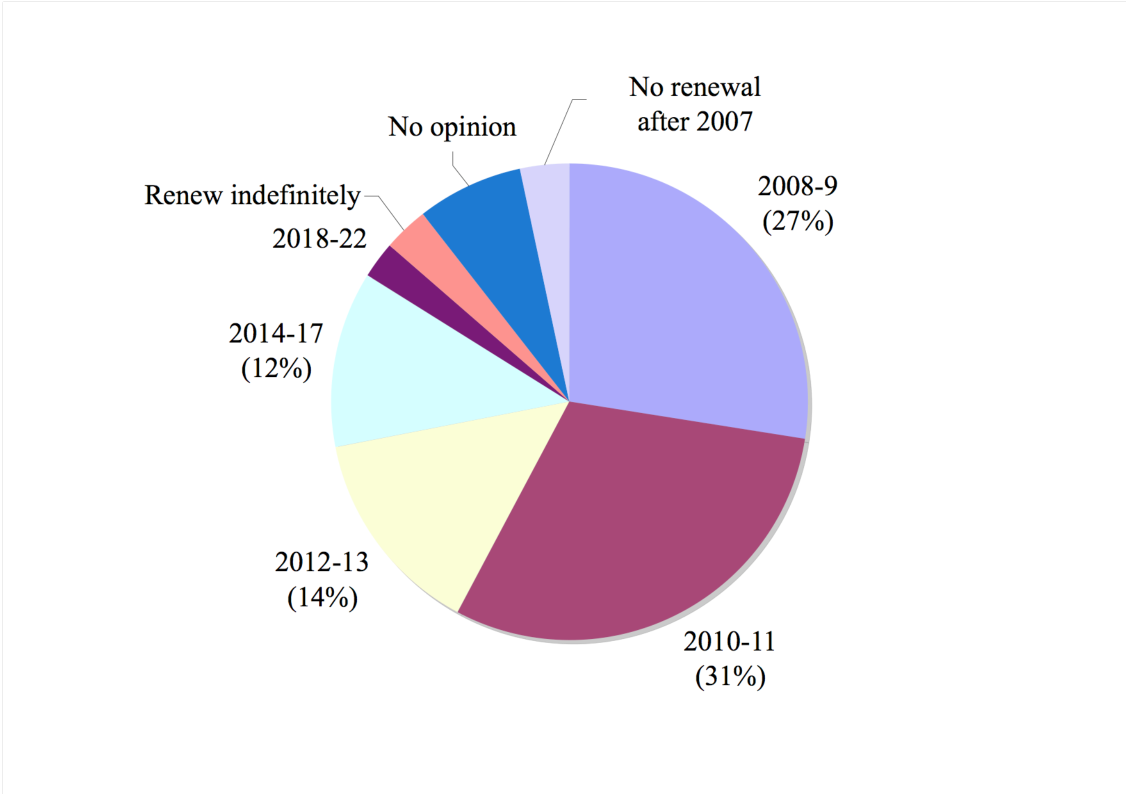


Figure 3: Respondents' Expectations for Final PTC Expiration (292 Respondents)

How critical is the PTC to ongoing wind project development? Survey respondents were asked to imagine a world in which the PTC no longer exists and will never be reinstated. Less than 10% of respondents think this would kill the wind industry entirely; the vast majority express the view that at least some wind projects would still go forward. People estimate that across the U.S., a third (33.3%) as many projects would go through compared to with the PTC in place (see Table 4).

Optimism is even greater among those whose organizations have already been involved in wind projects. Developers estimate that 42% of their own projects—and utility off-takers 48% of theirs—would still be developed without the PTC. The fact that off-takers suggest they would go forward with almost half of their projects even without the PTC is significant, because they drive the requisition process.

The discrepancy between people's estimates for the industry as a whole and for their own projects suggests two inferences: 1) the reality may not be as dire as people believe; and 2) those already involved in the industry may be less deterred by a no-PTC world than prospective new entrants.

Table 4: Respondents' Views of Wind Development in a No-PTC World

Question	Answer	% of Respondents (Number)	Mean Share of Projects (Respondents)
Any new projects?[16]	No, none at all	8.7% (26)	
	Yes, at least some	91.3% (274)	
What percent of projects?[17]	*All projects in U.S.*		*33.3% (226)*
	Respondent's own projects		*37.0% (128)*

Given the short-term nature of the PTC, it is useful to consider other types of policy incentives supporting renewable energy development that may have a longer planning horizon. Some of the alternatives to production tax credits include:

Depreciation rules. Accelerated depreciation for capacity investment can reduce a company's tax expense during early years.

Production subsidies. These can be provided at the national or state and local levels.

Pricing or tariff mechanisms. Guaranteed prices for renewable energy, for example as was the case under PURPA, address the risk that market prices are below cost. Favorable tariff mechanisms have been used to promote wind energy development in Germany and Denmark.

[16] Exact question: *Suppose the federal production tax credit **no longer existed** and you knew it would **never** come back. Do you think **any new wind projects** would be planned and developed in the U.S.?*

[17] The 274 respondents who answered "Yes, at least some" to the previous question were asked: *What percentage of **new** projects (i.e., not already under construction) do you think would go forward even **without** the PTC?*

- *Percent of **all** projects in U.S. (%, capacity basis)*
- *Percent of **your** projects in U.S. (%, capacity basis)*

Renewable portfolio standards (RPS). These require electricity suppliers to meet a certain percentage of their load from renewable energy sources. Suppliers can do this by 1) building plants themselves; 2) contracting with renewable energy plants to serve their load; or 3) purchasing renewable energy certificates (RECs) from producers of renewable energy who are selling the power elsewhere. 22 states in the U.S. have now passed various RPS requirements. A federal-level RPS requirement has been debated but not yet enacted.

Many wind energy analysts have argued that renewable portfolio standards (RPS) policies ought to be more effective than the PTC in stimulating renewables development at a low cost to government. Initial experience with the RPS in Texas suggests that this is true (Langniss and Wiser 2003). Since then, many more states have implemented RPS requirements, some using the successful Texas RPS as a model and others using their own. Some of the latter have so far failed to spur the growth of wind capacity, highlighting the importance of careful design and implementation in achieving policy goals (Wiser, Namovicz, Gielecki and Smith 2007).

The finding that RPS programs can provide a stable policy incentive is supported by survey responses. Respondents were asked to compare a variety of types of renewable energy incentives in terms of their perceived stability in providing a long-term planning horizon for investment. Respondents consider renewable portfolio standards to be most likely to stay in effect—above favorable depreciation rules, production tax credits, production subsidies, and favorable pricing mechanisms (see Figure 4). Interestingly, respondents consider state-level RPS programs to be somewhat more stable than a federal-level RPS (were it enacted). Despite this difference, however, there are good reasons for seeking a federal RPS, including lower transaction costs. Indeed, Xcel Energy, a utility operating in several states with an RPS and currently the largest purchaser of wind power in the U.S., supports a national RPS due to the lower transaction costs (Bonavia 2007).

*How likely would you consider the following types of renewable energy incentives, once enacted, **to stay in effect** (i.e., law not likely to be reversed) long enough to influence long-term investment planning?*

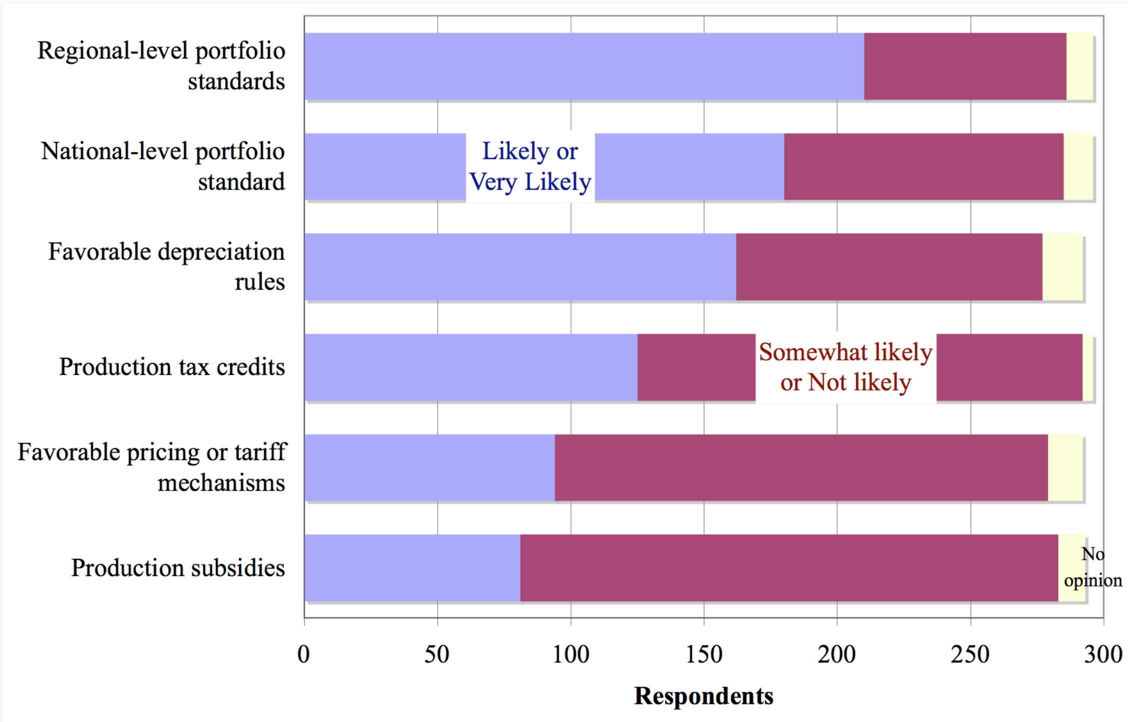


Figure 4: Respondents' Views on Stability of Various Policy Incentives

In addition to the policy incentives discussed above, global warming policy—at the regional, national or international level—could further encourage wind industry growth. Several states have already taken steps to reduce CO2 emissions as the primary contributor to global warming: 1) California passed legislation in August 2006 requiring state-wide CO2 emissions to be reduced to 1990 levels by 2020; 2) eight northeastern states, under the Regional Greenhouse Gas Initiative, have agreed to reduce CO2 emissions from power plants to 2005 levels by 2009 and by an additional 10% by 2019 through a cap-and-trade system. Federal policy is currently being debated, with a cap-and-trade program currently the most likely form of legislation. The main alternative would be a carbon tax. Under a cap-and-trade system, the regulator sets a total limit on CO2 emissions (the "cap") and then divides this into individual permits, which are then allocated or sold to CO2 emitters such as power plants and industrial entities. These permits can be traded. Each emitter must either reduce CO2 emissions or purchase sufficient permits from other players to cover its emissions. As a zero-emissions resource, wind power becomes more valuable under either a cap-and-trade or a carbon-tax system, while conventional fossil fuels, such as coal and gas, become relatively more costly.

In a separate survey of the general electric power sector,[18] respondents indicated that they do expect to eventually see carbon legislation in the U.S., and that this legislation could begin to have economic impacts on the power sector within the next 5-10 years (see Table 5).

Table 5: Respondents' Expectations for Carbon Policy

Question	Answer	% of Respondents[19]	(Number of Respondents)
Carbon policy?[20]	No	10.7%	(46)
	Yes	89.3%	(408)
When affect economics of generation?[21]	*Next 5 years*	*39.2%*	*(157)*
	Next 6-10 years	*44.4%*	*(178)*
	Next 11-20 years	*14.5%*	*(58)*
	More than 20 years	*1.5%*	*(6)*
	Never	*0.5%*	*(2)*

[18] This online survey was sent to ca. 5000 energy professionals in the electric power sector (members of various industry trade organizations and attendees of industry conferences) between June-September 2006. The results are based on 509 respondents, with ca. 400-500 responding to most questions, representing an overall response rate of about 10%.

[19] Percentages exclude 14 respondents who answered "No opinion" on first question and 7 respondents who expressed no opinion on second question

[20] Exact question: *Do you think that the U.S. will at some point enact a* ***carbon policy*** *to address the perceived/predicted threat of global warming?*

[21] The 408 respondents who answered "Yes" to the previous question were asked: *When do you think the* ***effects*** *of this U.S. carbon policy will be significant enough to affect the* ***economics of electricity generation****?*

Conclusions

Over the past decade, the wind industry has followed a volatile boom-bust cycle of investment closely linked to the short-term renewal and expiration cycle of the federal production tax credit, the primary source of current policy support for wind power generation. As demonstrated in this paper, this boom-bust cycle is caused by the negotiation dynamics of power purchase agreements in the face of PTC renewal uncertainty. These negotiation dynamics serve to exacerbate downturns in investment during periods of policy uncertainty, irrespective of any other factors motivating investment in wind projects.

Going forward, there are four reasons to believe that PTC uncertainty will have a reduced impact on new wind development. First, the possibility of alternative policy support in the form of a federal RPS is receiving greater attention in Congress. Second, the view that some form of climate change policy is needed in the U.S., for example a cap-and-trade program for carbon emissions in the electric power industry, is gaining ground among politicians in Washington, D.C. Both of these policies would give wind energy a boost relative to conventional alternatives, reducing industry focus on the PTC as the only policy supporting wind development.

Third, IPPs are becoming less dependent on PPAs for financing. Recently, there have been more projects developed without a PPA, as market rules enabling intermittent renewables (wind and solar) to participate in spot markets are followed in more states. Additionally, lenders' distaste for merchant risk is fading, and, as they gain experience with wind power and become comfortable with turbine technology and plant performance, they are becoming more open to the idea of merchant wind power. Indeed, 2006 saw more merchant wind development than all previous years combined (794 MW of the total 1297 MW), although PPA financing remains the norm. This has resulted in utilities no longer being the sole beneficiaries of the PTC. As developers become less dependent on PPA financing, they are able to make more money from wind projects (Armistead 2006).

Fourth, utilities are demonstrating greater interest in owning wind plants, rather than just purchasing wind through PPAs. In 2006, for the first time, investor-owned utilities (IOUs) added more wind capacity through ownership than they did through PPAs, doubling their total wind capacity ownership. Reflecting this shift, Xcel Energy is seeking an additional 6,000 MW of wind capacity over the next years in order to meet its various state RPS obligations and would like to see "a balance of owned and purchased" wind capacity. Whereas to date, most of their wind has been purchased through PPAs, going forward they would like to participate in the wind industry as an equity investor, because their "capital return requirements are very appropriate" for wind (Bonavia 2007).

The result of these last two developments—reduced dependence on PPA financing for IPPs and decreased interest in acquiring wind through PPAs for utilities—is fewer wind PPAs. Indeed, only 42% of the wind capacity added in 2006 was under PPA, with 24% under direct IOU ownership and 32% merchant wind.

Turbine manufacturers, who have until now refrained from setting up turbine manufacturing capacity in the U.S. due to the short-term nature of the industry, appear to believe that the risk of extreme industry volatility at the hands of PTC uncertainty has declined. Turbine manufacturers Clipper Wind and Gamesa have recently set up manufacturing facilities in the U.S.

Even if it plays a lesser role in the future, PTC uncertainty provides an interesting case study in how industry structure, and in particular the dynamic of contract negotiations, can amplify the impact of public policy uncertainty on corporate investment.

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