



WHITE PAPER

# Are you ready for your next wind deal?

*By Himali Parmar, Adil Sener, Shanthy Muthiah, and Matt Robison*



## Sharables

1. The action in wind should remain heavy. Despite a number of challenges facing wind projects, a combination of policy and technology related factors likely will encourage further new development. Forthcoming contract and hedge expirations for existing facilities will drive increasing merger and acquisition (M&A) activity.
2. Wind could have a substantial new opportunity under the recently finalized Clean Power Plan (CPP) emission rate implementation option whereby renewable energy need not be delivered locally to be credited as reduction in a state's average CO<sub>2</sub> emission rate.
3. Among the rush of projects timed to take advantage of the recent federal production tax credit (PTC) extensions,<sup>1</sup> those that can access premium pricing areas (via smart transmission due diligence) are clearly more likely to succeed than others.

## Executive Summary

As wind development matures and assumes a significant generation role in several markets, ICF International sees both opportunities and challenges ahead, plus growing M&A activity as power purchase agreements (PPAs) expire and more projects have merchant exposure. Potential national carbon regulations and an increasing appetite for renewable generation in state renewable programs (e.g., the recently enacted California 50 percent renewables portfolio standard [RPS]) are likely to drive both additional wind buildout and greater interest in deals for existing wind capacity. On the other hand, several well-known short-to medium-term challenges exist, including 1) expiration of the PTC, 2) oversubscription of wind projects beyond transmission systems' capability in some premium resource areas, and 3) increasing competition from solar generation. In addition to these transitional challenges, the potential low natural gas price outlook in the longer term is not supportive of merchant generator economics in many markets across the United States.

Despite these obstacles, ICF believes that wind generation will continue to grow its market share in the next decade due to regulatory dynamics incenting renewables and technological improvements. One potentially important factor may prove to be the mechanism under the recently finalized CPP wherein renewable energy may not have to be delivered locally to be credited as a reduction in a state's average CO<sub>2</sub> emission rate. But not all wind investments will pan out: For one thing, those located at strategic points across the grid that can access premium pricing areas are clearly more likely to succeed than others. Put another way, transmission strategy is expected to become an even more dominant factor in driving success for wind resources going forward. An additional discriminating factor in determining winning investments is likely to be whether project owners have a sophisticated understanding of the interplay of transmission congestion, carbon policy-driven demand and price impacts, and financial tools for hedging wind contracts for their particular target sites and markets. Therefore, due diligence should

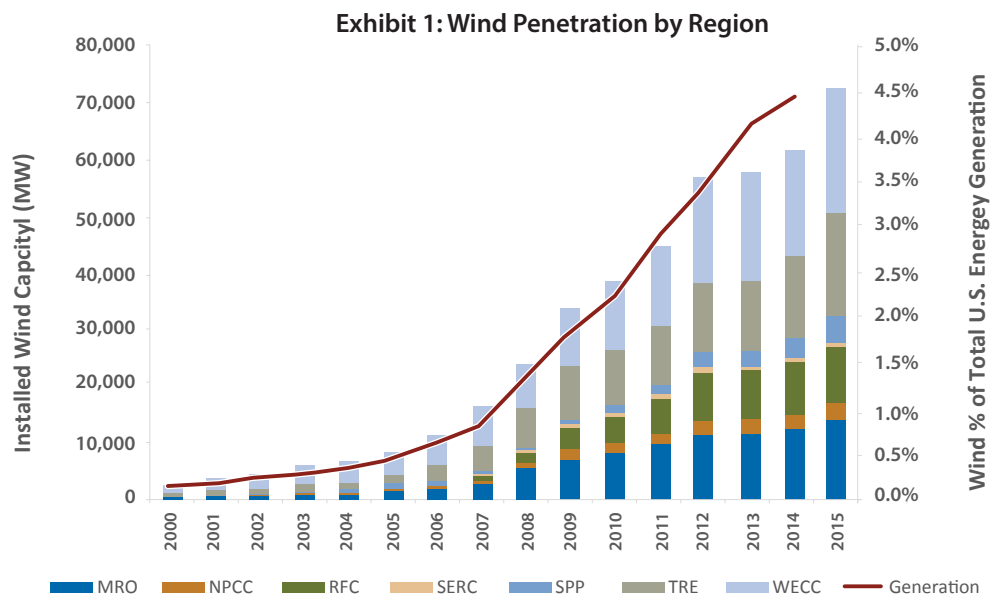
<sup>1</sup> Unlike previous extensions of the PTC, projects that reached certain construction or progress thresholds were declared eligible for the PTC under the last two extensions. These extensions are described in greater detail below.



go beyond typical gross margin analysis, particularly for hedged assets that may incur additional costs in case of transmission curtailment and congestion. The end result of all of these combined effects is not always obvious. More sophisticated analysis and modeling are required to determine which projects have accretive value.

### An Industry in Transition: Near-Term Strength...

In 2015, installed wind capacity in the United States is expected to reach 72 GW, a roughly 10 GW increase from the previous year, which would make 2015 the second best year behind 2012 (13.5 GW). Thanks to the PTC extension, 2016 may even surpass 2012 and become the best year for wind development, with approximately 17 GW of development projects commencing operation. Although the PTC and RPS are the obvious drivers of the wind buildout, friendly transmission policies implemented by the Federal Government, states, and regional transmission organizations (RTOs) have played a key role in enabling such a magnitude of wind penetration into the U.S. power grid (see Exhibit 1).



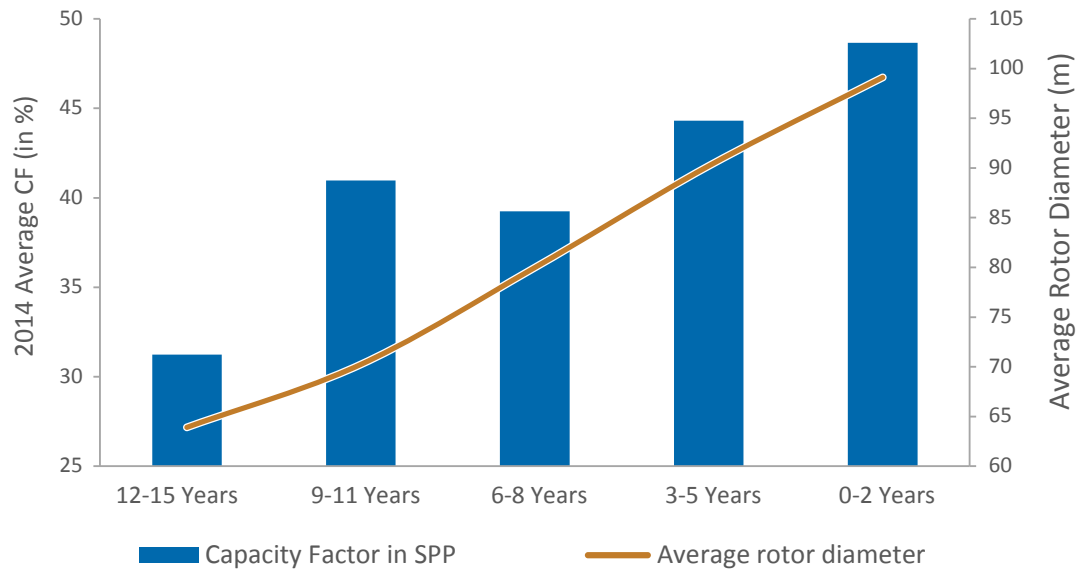
Source: SNL and EIA

Furthermore, the increasing performance of new generation wind plants has significantly reduced the levelized cost of wind, making sub \$30/MWh contracts feasible in the current environment and opening up potential sites in areas like the Southeast United States previously viewed as uneconomic. These performance gains have been driven by several factors. Developers are building higher hubs and bigger rotors, generating more power. From 1999 to 2014, hub height for newly installed wind turbines increased 48 percent to 82.7 meters (m); average rotor diameter grew 108 percent to 99.4 m.<sup>2</sup> The effect of the larger rotor diameters has been especially significant, leading to a decrease in “specific power.” Lower specific power increases capacity factors, because the higher rotor area produces more energy per watt of rated capacity. The end result is wind turbines that more closely match their rated capacity.<sup>3</sup> New turbines in the Southwest Power Pool (SPP) region now have roughly 1.5 times higher capacity factors compared with early 2000s vintages (see Exhibit 2).

<sup>2</sup>U.S. Department of Energy, 2014 Wind Technologies Market Report, accessed October 15, 2015, from <http://energy.gov/sites/prod/files/2015/08/f25/2014-Wind-Technologies-Market-Report-8.7.pdf>



**Exhibit 2: Variation in Capacity Factor with Age and Rotor Diameter**



Source: SSP

### ...but Challenges Ahead

Still, wind faces potentially significant challenges, the biggest of which by far is the continued uncertainty surrounding the PTC. The PTC for wind developments last expired January 1, 2015. However, the PTC may still be received by projects that had completed development milestones, subject to certain threshold tests. In particular, developers either had to begin “physical work of a significant nature,” known as the Physical Work Test, or demonstrate that a project had incurred at least 5 percent of total project costs by January 1, 2015, known as the Safe Harbor Test.<sup>4</sup> On average, the PTC provides roughly \$23/MWh after-tax cash flow for wind generation during a 10-year period. On levelized terms, this credit translates to roughly \$15/MWh after-tax cash flow in a 20-year period—a significant boost for developers. The PTC together with high-capacity factors have been key in driving wind buildout, especially in areas where state renewable targets are saturated such as Texas.

Furthermore, existing merchant wind projects, like most of the merchant generation fleet, also must operate in the context of the low natural gas price outlook, which makes them less competitive. In addition, existing projects must compete with new wind projects for transmission. Although some portion of these merchant projects have ongoing hedge agreements that secure some cash flow stability, hedge contracts do not typically cover locational congestion risk and provide fixed payments for only some portion of the generation (e.g., P95 confidence level profiles). In addition, in the years ahead, an increasing amount of hedge contracts will expire, increasing the merchant exposure for these assets (see Exhibit 3).

Currently contracted wind generation capacity is mostly isolated from market fluctuations and the PTC expiration. One exception is contracts that expose the owner to curtailments and dispatch down

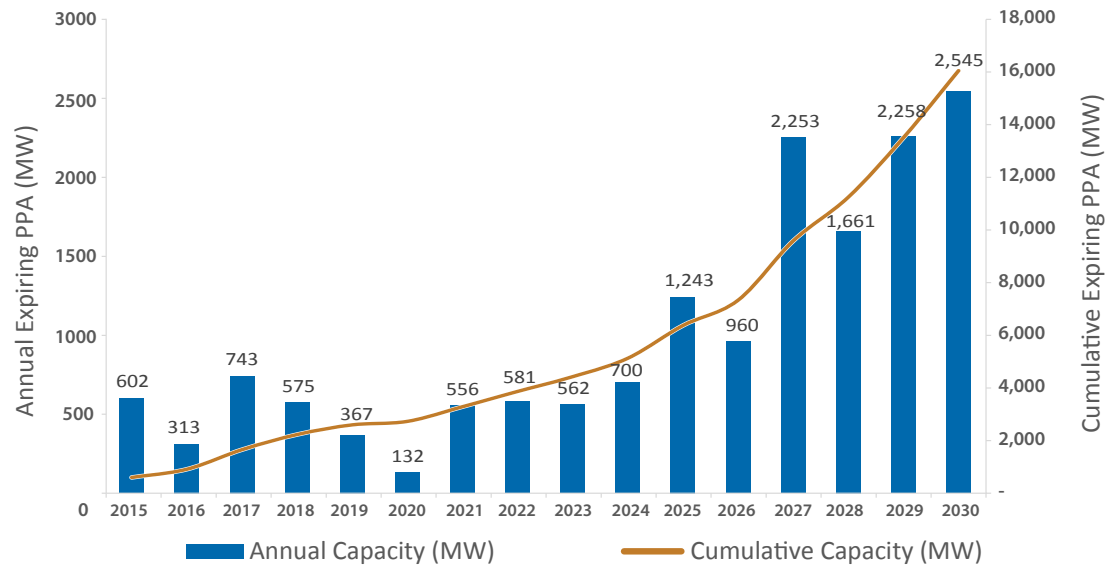
<sup>3</sup>U.S. Department of Energy, 2014 Wind Technologies Market Report, accessed October 15, 2015, from <http://energy.gov/sites/prod/files/2015/08/f25/2014-Wind-Technologies-Market-Report-8.7.pdf>

<sup>4</sup>Internal Revenue Service, Notice 2014-46, accessed October 15, 2015, at <https://www.irs.gov/pub/irs-drop/n-14-46.pdf>



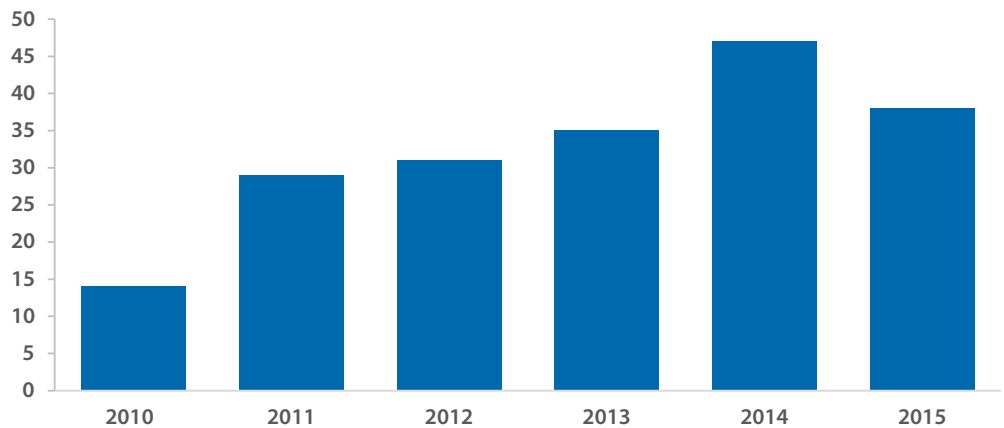
because of transmission constraints. Note: In the next decade, a significant amount of wind PPAs will expire, creating full merchant exposure for these assets. Based on publicly available sources, ICF estimates that wind contracts are likely to expire at a 1 GW/year pace on average. This shift from contracted to merchant exposure is likely to result in a change in ownership of these assets, triggering a wave of M&A activity around merchant wind. In fact, we already observe an increasing amount of wind M&A deals in the past couple of years (see Exhibit 4): in 2014, 45 such deals occurred, up from 14 in 2010.

**Exhibit 3: Wind Capacity with Expiring PPAs**



Source: SNL Financial

**Exhibit 4: Number of M&A Deals in Wind Sector**



Source: SNL



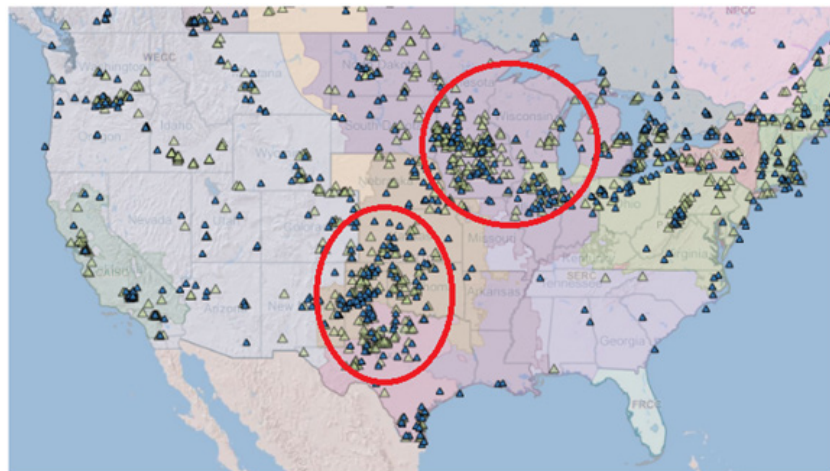
Another issue for wind is that competition from distributed solar is increasing rapidly in some markets. Distributed solar has several inherent advantages, including no transmission loss and congestion issues and rapidly improving relative economics as well as a more complex incentive structure in some cases (e.g., net metering at near-retail rates and solar renewable energy credits) that provides greater insulation from the loss of any single incentive mechanism.<sup>5</sup> The federal investment tax credit (ITC) is certainly extremely significant for solar, but several analysts, including ICF, foresee a measure of resiliency following the drop down of the ITC that is legislatively slated to occur at the end of 2016. For example, in a study completed for ISO-New England, ICF found in one sample state that the ITC in 2015 was fourth among six major revenue drivers on a levelized, long-term basis for distributed solar and would fall in relative importance to sixth by 2019 (after the tax credit decreases to 10 percent or zero in 2017, depending on system ownership).<sup>6</sup> In other words, with a relatively diversified portfolio of revenue sources, economic drivers, and incentives, distributed solar is positioned for long-term growth.

These challenges make avoiding transmission problems—which to some extent can be mitigated—even more important for wind moving forward than in the past.

### Why Understanding Transmission Challenges Is Critical

The transmission challenge arises from the accumulation of wind projects in high wind potential areas and the reliance on nonfirm transmission arrangements. Roughly 50 percent of existing generation and 45 percent of planned projects are located in two geographical zones known as the Midwest Wind Belt (see red circled areas in Exhibit 5 below). These zones are clustered into even fewer subzones such as ERCOT-Panhandle, SPP-SPS, and MISO Zone 3. In fact, the wind penetration in some zones exceeds their subzones' peak demand multiple times. For example, ERCOT-West has 4 GW of peak demand and 11 GW of installed capacity. In addition, announced capacity in ERCOT-West is roughly 16 GW. Wind projects in such wind clusters compete for transmission access to premium pricing zones in and around load zones.

**Exhibit 5: Existing and Planned Wind Additions**



Source: SNL

<sup>5</sup> Solar has a federal ITC of 30 percent, and wind has a federal PTC of 23\$/MWh indexed to inflation. Distributed generation additionally can benefit from a widespread discrepancy between marginal costs and tariff rates. Namely, embedded fixed costs of accessing the system usually are not included explicitly in the tariff, causing the variable portion to be well above marginal costs. Note that the ITC for residential solar goes to zero in 2016.

<sup>6</sup> ICF International, Economic Drivers of PV Report for ISO-New England, February 2015, available at [http://www.iso-ne.com/static-assets/documents/2015/02/icf\\_economic\\_drivers\\_of\\_pv\\_report\\_for\\_iso\\_ne\\_2\\_27\\_15.pdf](http://www.iso-ne.com/static-assets/documents/2015/02/icf_economic_drivers_of_pv_report_for_iso_ne_2_27_15.pdf)

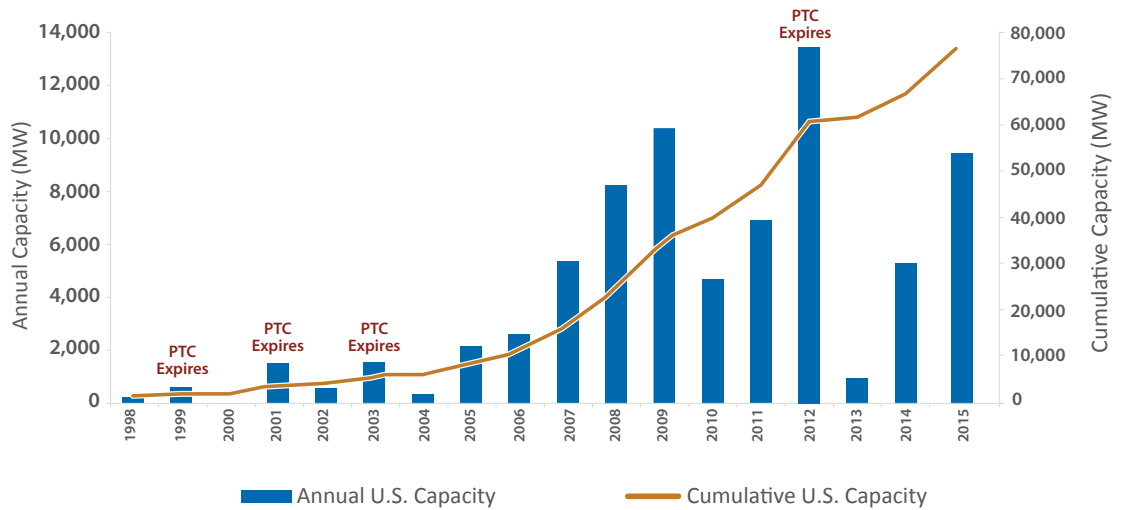


As a consequence of not having firm transmission, a surplus of wind relative to the transmission system can result in depressed locational prices, including negative prices (where one has to pay to deliver as rather than being paid to deliver) and curtailment of output that can decrease the revenues—whether from electrical energy sales, PTC, or RPS—available to offset wind costs.

Several potential answers address this problem. In the current PTC rush, the transmission issue likely will only grow, requiring even more active and knowledgeable management. Therefore, transmission strategy will be critical for wind buyers and sellers. The key elements of this strategy include 1) securing and developing sites with the right balance between resource endowment and transmission access, 2) strategically and opportunistically pursuing firm transmission arrangements in the transmission interconnection queue, and 3) actively participating in the RTO and state stakeholder processes.

Although RTOs proactively work to address transmission challenges and incorporate wind generation into the grid, currently pending interconnection requests in many high potential areas are beyond what RTOs can accommodate in the near term vis-à-vis their transmission expansion plans. This lag between transmission expansion and wind builds is mainly driven by the rush to take advantage of the most recent PTC extensions. Wind installations typically peak prior to expiration of the PTC and plummet by an average of 70 percent immediately afterward.<sup>7</sup> Exhibit 6 below tracks the annual wind capacity additions in United States against the backdrop of PTC expirations.

**Exhibit 6: Progress of Wind Developments and PTC—Annual and Cumulative Growth in U.S. Wind Power Capacity**



Source: SNL Financial

<sup>7</sup>Facilities still can qualify for the PTC subject to the tests described earlier. The effect of wind installations peaking prior to expiration is expected to be observed in 2016, as projects that qualified under the test are completed.



Looking at these regional interconnection queues provides further insights into wind pockets within the broader wind regions. The Texas Panhandle region, for example, has some of the highest quality wind in the country. A total of more than 14 GW of wind is in different stages of development in the combined SPP and ERCOT queues.<sup>8</sup> However, the region has low local demand and limited existing transmission outlet capability. For these reasons, the wind in this region is considered high risk. By contrast, Texas South also has a significant amount of wind in the queue, but this wind is expected to have a lower risk relative to the Panhandle based on higher local demand in the region and a higher degree of transmission connectivity. The table below summarizes this kind of regional high level assessment.

### High-Level Qualitative Assessment for Wind in Texas and Eastern Interconnect

Subregion/State	ISO	Total Wind in Queue (GW)	Approved Interconnection Agreements (GW)	Existing Wind (GW)	Risk
Texas Panhandle	ERCOT	11	2	2	High
Texas South	ERCOT	6	1	2	Low
SPS Texas	SPP	3	1	2	High
Oklahoma	SPP	7	3	4	Medium
Kansas	SPP	5	2	3	High
Iowa	MISO	5	0	4	High
Minnesota	MISO	2	1	3	Medium
Michigan	MISO	2	0	1	Medium
Illinois	MISO	1	0	1	Low
Maine	ISO-NE	3	0	0	High
Upstate New York	NYISO	3	0	2	Medium
<b>Total</b>		<b>48</b>	<b>10</b>	<b>24</b>	

Several other factors such as transmission expansion, cost allocation, and changes in public policy could affect the risk assessment in the longer duration. For example, in Texas, with a favorable transmission cost allocation approach and the transmission-proactive nature of the state regulators, one could expect some lag in transmission buildout but not an indefinite delay. This lag was evident with the competitive renewable energy zone transmission expansion and ongoing considerations for accommodating Panhandle wind. As such, this kind of high-level assessment should not be used to make strategic financial decisions. As discussed in the sections below, site-specific basis and curtailment risks should be assessed by using detailed nodal and transmission analyses.

<sup>8</sup>This region is split between ERCOT and SPP.



## Emphasis on Basis Risk in Wind Hedge Contracts Signals Increasing Significance of Transmission

Another key element of merchant wind project economics is a hedge agreement whose success has become increasingly transmission driven. Merchant wind developers typically engage in hedge contracts to mitigate cash flow uncertainty due to resource uncertainty and market price uncertainty. In many cases, a hedge contract is a requirement for financing.

Typical wind hedge contracts are complex and are structured around a number of parameters, including fixed price, fixed notional volume, node and zone, and tracking account limits. A simplified structure for a wind hedge is presented in [Exhibit 7](#).

### Exhibit 7: Basic Wind Hedge Principle

#### Settlement = Hedge Volume X (Fixed Price) – Tracking Account Adjustment



Basis risk is driven by the difference between the nodal price and the corresponding (settlement) hub price. Basis difference occurs because of congestion on the transmission grid and transmission losses.<sup>9</sup> Hedge providers usually do not undertake the risk of congestion between the plant node and trading hub and hedge structures typically do not cover basis risk. In fact, hedges may create additional financial exposure for the wind projects that have substantial nodal discount potential. Among investors, interest is growing in understanding the magnitude of exposure created by basis risk under a hedge structure.

Because the hedge obligation (contract volume times floating price) is settled at the trading hub, any negative differential between the project node and pricing hub must be covered by the wind project's merchant revenues. Put another way, basis risk is the risk of pricing at a project node lower than the settlement hub. Persistently high basis differentials or negative pricing could potentially result in additional costs for hedged projects, because these contracts typically create delivery obligations at liquid trading hubs.

## Transmission Due Diligence for Wind Is Key to Success

Understanding of transmission dynamics is a key driver of success for wind investments. For this reason, due diligence for wind projects requires efforts beyond typical gross margin analysis, especially for hedged assets that may incur additional costs in case of transmission curtailment and congestion. ICF believes that many wind projects today require both voluntary and involuntary curtailment analysis as a standard part of due diligence.

### Assessing Voluntary Curtailment

Voluntary curtailment refers to actions of the power off-taker that might curtail wind or other renewable generation in lieu of turning down a coal or nuclear facility. The reasons are usually for economic, i.e., power prices are negative, indicating that one must pay to produce electricity.

<sup>9</sup>In all ISO markets with marginal loss pricing mechanism except ERCOT.





Assessment of voluntary curtailment at the plant node requires deployment of nodal security-constrained economic dispatch and security-constrained unit commitment models. These models help to determine if operation of the proposed wind projects and other resources in the market, coupled with transmission constraints, will result in severely depressed locational marginal prices. Severe transmission congestion and mismatches between supply and demand typically result in low energy prices. Therefore, extremely low or even negative prices indicate a high likelihood of voluntary wind curtailment.<sup>10</sup>

### ***Assessing Involuntary Curtailment***

Involuntary curtailment refers to curtailment of wind or other renewable generation to preserve system reliability and to relieve transmission equipment overloads in the system. Assessment of involuntary curtailment requires deploying an AC transmission model (e.g., GE's PSLF model). Such a model is helpful to understand the capability of the grid to absorb full power out of the wind assets under steady state and contingency conditions. A snapshot assessment, it can be performed only for certain specific system conditions such as peak summer and off-peak summer. This form of curtailment is more prevalent in off-peak conditions when the megawatts available to the grid could exceed system demand.

By reflecting the likelihood and prevalence of involuntary curtailment, developers can estimate revenues for a given project more accurately, examine scenarios involving weather and deployment of other resources, and generally assign value to a given resource site vis-à-vis the availability of firm (or uncongested) transmission. This approach helps to inform an overall wind investment or development strategy and determine the relative value of competing investments with greater precision.

### **CPP Is Potentially a Game Changer**

Despite the challenges and complexities, enough robust opportunities exist for wind to project additional wind penetration in the near- to midterm. A major new driver could be the CPP. Under the recently finalized CPP, and specifically the emission rate implementation option, renewable energy may not have to be delivered locally to be credited as a reduction in a state's target CO<sub>2</sub> emission rate standard. Although the incentive may not be as potent as the PTC in all states, it is still potentially a significant driver of wind demand in the medium term.<sup>11</sup> Thus, premium sites with high average wind speeds, often in distant states with attractive wind resources, become more attractive due to the CPP, all else equal. However, the projects counting on their output having reasonable revenues from electrical energy sales and other revenue streams will continue to run risks from congestion.

We expect states to take advantage of high potential wind resource areas in designing their programs. CPP provides many different avenues for wind investment. For example, trading of emission reduction credits generated by renewable sources across state lines is an option that could boost wind investments. Under this option, out-of-state credits could potentially be used for compliance with a state standard. In addition, the Clean Energy Incentive Program that targets early (2020–2021) investments offers credits for renewable development projects satisfying certain conditions. Combined with friendly transmission policies and natural gas price recovery, wind buildout could even exceed the past decade's 6 GW/year average pace with the boost it will get from CPP, and more than double currently installed capacity through 2030.

<sup>10</sup> Wind output is economical up to negative of the PTC. As with many wind plants, especially the ones with volume obligations, wind could continue to dispatch in spite of negative prices.

<sup>11</sup> Consider a wind plant with revenues of \$70/MWh and costs of \$15/MWh. Pre-tax profits are \$55/MWh. Taxes at a 40 percent tax rate equal \$22/MWh. The PTC eliminates taxes, and hence profits are \$55/MWh. Revenues would have to increase by \$37/MWh to offset the loss of the PTC. This is the solution to the formula  $(1 - \text{tax rate}) \times (70 + x - 15)$ . If a region's CO<sub>2</sub> emission rate is 0.7 tons/MWh, the CO<sub>2</sub> price would have to be \$52/ton to raise prices enough to fully offset the loss of the PTC.



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### About the Authors



**Himali Parmar** joined ICF International in 2002. Ms. Parmar performs analysis in the areas of generation, transmission, and ancillary services valuation. Her expertise spans production cost modeling as well as forecasting transmission congestion and losses and their effect on locational power prices and plant dispatch in the U.S. power markets. Ms. Parmar has managed numerous wind asset valuations with specific focus on effects of transmission congestion on nodal pricing and associated basis risk. Her expertise also includes involuntary curtailment assessment by using detailed load flow models. Ms. Parmar is very proficient in load flow simulation tools such as Power World and GE's PSLF model.

**Dr. Adil Sener** joined ICF in 2006. His transactional experience includes acquisition support for potential bidders, largely private equity and independent power producers (IPPs), and sellers of generation assets and portfolios. He provides energy markets advisory services in bankruptcy and restructuring processes, financing and development due diligence support for various IPPs and utilities, litigation and regulatory support to utilities, and advisory support to power companies in contracting and asset optimization for new or existing power plants.

**Matt Robison** is an Expert Consultant with ICF's Energy Advisory and Solutions team. He has written and developed numerous papers, expert testimonies, and analyses for utility clients on market design, the impact of regulatory programs and incentives, and asset valuation. His particular focus is distributed energy resources grid integration issues and "utility of the future" models, Clean Power Plan implementation, and New England regional issues, including gas-electric integration.



**Shanthi Muthiah**, who joined ICF in 1995, has power industry experience spanning regional markets in North America, Europe, Australia, Asia, Latin America, and the Caribbean. Her transactional experience includes acquisition support for potential bidders, largely private equity and IPPs, and sellers of generation assets and portfolios; energy markets advisor in bankruptcy and restructuring processes; financing and development of due diligence support for various IPPs and utilities; litigation and regulatory support to utilities; and advisor to power companies in contracting and asset optimization for new or existing power plants.

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For questions, please contact:

Himali Parmar | [himali.parmar@icfi.com](mailto:himali.parmar@icfi.com) | +1.703.934.3497  
Shanthi Muthiah | [shanthi.muthiah@icfi.com](mailto:shanthi.muthiah@icfi.com) | +1.703.934.3881

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