Evaluating a National, Renewable Market Transformation Program over a Decade of Massive Change

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ABSTRACT

This paper discusses the approach of and findings from impact and process evaluations of the U.S. Department of Energy's (DOE's) Wind Powering America (WPA) initiative, a wind power market transformation program combining national- and state-based activities. While the initiative's capacity-related goals were exceeded in most states targeted for participation over the ten-year evaluation period, challenges arose in attempting to attribute market development and capacity additions directly to WPA activities. In addition to inconsistent program tracking data and the long evaluation period, the coincident timing and interrelatedness of various market factors that contributed to wind power additions (e.g., federal tax incentives and state renewable portfolio standards) made statistical approaches to attribution untenable. The evaluation team instead implemented a combined historical tracing and expert judging approach, including a modified Delphi process, to estimate WPA's overall share of influence on wind capacity additions in states that the program targeted. The approach enabled the evaluation team to find that the initiative had significant impact on wind capacity additions and to recommend process-related improvements for future WPA or similar program endeavors.

Overview of the Wind Powering America Initiative

The Wind Powering America (WPA) initiative had ambitious goals to dramatically increase the use of wind energy in the U.S. in the first decade of the 21st century. Launched by DOE in 1999, the initiative was designed to help move the market forward in states that were 'stuck' from a wind power development perspective (i.e., states that had a good wind resource, but where sociocultural or policy barriers to wind power existed). Through a combination of national- and state-specific activities, WPA sought to educate, engage, and enable critical stakeholders to make informed decisions about how wind energy contributes to the U.S. electricity supply. The initiative originally focused on utility-scale capacity additions, but several states' interest in small-scale wind led DOE to expand WPA to encompass small and community wind-focused efforts as well. The overall goal of increasing wind energy deployment in the U.S included three measureable objectives:

1. Five gigawatts (GW) of installed wind capacity by 2005 and 10 GW by 2010.
2. Twelve states with 20 megawatts (MW) of installed capacity by 2005 and 24 states by 2010. WPA later revised this state-level goal to target 30 states achieving greater than 100 MW installed capacity by 2010, with intermediate state targets each year.
3. Five percent of the federal government's electricity supplied by wind energy by 2010.

WPA has worked in several focus areas to accomplish its goal, including state-based activities, rural economic development activities, public utility partnerships, and a federal wind power (a.k.a., "Greening Federal Loads") effort. The last three of these initiatives were implemented at the national level. The evaluation team's efforts focused primarily on the state-based activities and their influence on wind power capacity additions in the context of the first two capacity-related objectives. These state-based activities focused on enhancing target state stakeholders' understanding of the barriers and benefits of wind, most

often through state-specific wind working groups (WWGs) that were initially funded by WPA. These WWGs focused on engaging and educating the various stakeholders in a state's wind market (e.g., policy makers, government agencies, landowners, developers and utilities) about the benefits of wind power. They were usually coordinated by a university, state energy office, or a non-governmental organization. In addition to the WWGs, other state-based activities included, but were not limited to, the following key elements:

- Anemometer loan programs;
- State wind resource maps;
- Wind for Schools programs;
- Annual workshops and conferences; and
- State-specific material development (e.g., small-wind development guides).

During the initiative's initial 11 years (through the end of 2010), wind capacity in the U.S. grew to 40 GW. Only 27 states had achieved the revised 100-MW target for installed wind capacity (three states were below WPA's revised goal of 100 MW); however, 14 had exceeded 1,000-MW (DesAutels et al. 2010). At the federal level, DOE spent $38 million (adjusted to 2010$) during these years to support WPA activities. The third objective for federal wind energy usage was supported by national-level activities, and was therefore excluded from the evaluation scope.

Evaluation Objectives

The evaluation of the WPA initiative combined impact and process evaluations (see Stern et al. 2013). The impact evaluation's primary objectives were to assess the following three key outcomes achieved through WPA's state-based activities:

- How many MW of the wind capacity added from 1999 to 2011 were influenced by those efforts.[1]
- The degree to which WWGs were able to leverage other organizations' funds to support their DOE-provided budgets.
- The degree to which partner and third-party organizations have replicated WPA activities.

The process evaluation sought to provide greater understanding of the particular processes that proved most effective in achieving those outcomes. These findings were analyzed in the context of overall progress toward the DOE's three measurable wind deployment objectives listed above in the Introduction section. The process-related research objectives focused on the following researchable questions:

- What elements of WPA's state-based activities have been most successful and why?
- Which WWGs have been most successful and why? What are the characteristics of the successful working groups that fostered their effectiveness?
- What, if any, common conditions were present for states where the WWGs were less effective? What could be done to minimize these conditions in the future?
- What are the lessons learned and best practices from the evaluation for use by DOE in light of its future plans for expansion of wind development across the U.S.?

In addition to the focus on state-based activities, the evaluation provided for limited inquiry into the initiative's secondary influence on states not directly targeted by WPA (e.g., if those states' landowners

[1] While the evaluation covered WPA initiative years 1999-2010, interview respondents acknowledged that the indirect nature of many WPA activities' influence requires several months or years before capacity is installed that was subject to that influence. In addition, initiative outputs and outcomes may continue to impact capacity installed after WPA funding or organized activities have ceased in a particular state. As such, the evaluation used the capacity installed in each state through the end of 2011 (the latest date for which data was available) as the baseline end date for capacity exposed to WPA activities.

traveled to WPA conferences in neighboring states) as well as perceived impacts from the three WPA activities that were implemented at the national level (e.g., rural economic development efforts).

Key Evaluation Challenges

The evaluation team considered a variety of statistical approaches to characterize and quantify WPA impacts on wind generation capacity. However, identifying these effects using statistical analysis faced two main obstacles:

1. **Non-Random Participation.** WPA's implementation of state-based activities was non-experimental—there was not a random assignment of the initiative across states—and so isolating the effect of WPA state-based activity impacts from other effects that occur contemporaneously, and which might be correlated with metrics of WPA activity, is a nontrivial statistical matter (Winship and Morgan 1999). The main issue in this regard is endogeneity bias; some of the unobserved factors influencing wind generation capacity also affect the measure of WPA activity. For example, the passage of a favorable state-level policy (e.g., a renewable portfolio standard) in a state with underdeveloped wind resources may have simultaneously influenced WPA's funding of that state's WWG (the independent variable) and some developers' decisions to complete wind power projects (the dependent variable).
2. **Direct Versus Indirect Impact.** The effect of WPA on wind generation capacity is likely both direct and indirect, with indirect effects arising because the initiative influences factors that themselves directly impact wind generation capacity. For example, respondents in each state indicated that WPA and the WWGs influenced any one of numerous state- or local-level policies (e.g., renewable portfolio standards or local siting ordinances) that in turn directly affected wind power installations. Consequently, in a statistical analysis accounting for both WPA and these other factors, the inclusion of these other factors as explanatory variables can mask the full effect of the WPA initiative.

Of the statistical approaches considered, fixed-effects regression analysis (wherein the dependent variable is wind-generating capacity in a state-year and the set of explanatory variables includes measures of WPA activity) was thought to be the most promising because of its potential to address endogeneity bias. Nonetheless, after carefully reviewing available data and developing a better understanding of the factors affecting changes in wind-generating capacity across WPA states, the evaluation team concluded that it was not feasible to use regression analysis to identify the impacts of WPA for the following reasons:

- **Insufficient sample size.** First, the panel data on which the analysis would have been based comprised about 400 observations (40 states, 10 years of observation for each state). After accounting for state and annual fixed effects, and allowing for 1- or 2-year lags, the degrees of freedom available for isolating the effect of WPA was about 250-300 observations.
- **Difficulty of identifying the proper metric of WPA activity.** An obvious choice would be the WPA dollars allocated each state-year, because this would convert a variety of WPA activities into a single index, and could be justified as implicitly assuming that states make the best use of the financial resources allocated via WPA. Unfortunately, it became apparent that this variable would not be available for all states and all years, and an alternative single metric or set of inclusive metrics would not be easy to construct.
- **Endogeneity bias likely to remain a serious issue.** Evaluators went to considerable lengths to construct a model that avoided the endogeneity bias discussed above. As the approach developed, however, it became clear that endogeneity bias would remain a serious issue in a regression analysis. The wide variety of other wind-related activities at the state and regional

level are likely correlated with WPA activity and sufficient data that could help isolate those activities' impact are unlikely to be developed.

Methodology

To overcome these challenges and achieve its evaluation objectives, the evaluation team employed an investigative approach that combined historical tracing and expert judging methods. The analysis primarily relied upon a set of in-depth interviews with a sample of key market actors in target states (i.e., those with WWGs) and non-target states (those without a WWG). A single set of interviews addressed both impact and process-related questions, with additional follow-on questioning conducted (via a modified Delphi process approach) for key impact questions. For process-related issues, responses from each state were reviewed in the context of the initiative's perceived share of influence to identify commonalities among more (or less) successful state WWGs.

Sampling Approach

The team's sampling plan sought to maximize the portion of the wind capacity market that could be reasonably evaluated within the project scope and timeframe. The team divided the 36 states that were targeted by WPA into three roughly equal tiers based on their cumulative wind power capacity.[2] The sampling approach included every state in the top two of three tiers of capacity additions for either utility-scale or small-scale wind in order to directly estimate WPA's influence in those states with the most significant capacity additions. The sampling approach resulted in several states being included as interview targets in both the utility-scale and small-wind samples. The team also sampled three of the seven states with significant wind capacity additions that were not targeted by WPA to assess the degree to which the initiative may have influenced capacity additions in those states.

For each sampled state, evaluators sought to conduct four to six interviews (68-102 total) and include at least one respondent in each of three categories of market actors that participated in or were familiar with WWG activities – private sector (i.e., wind developers); government agencies (e.g., state energy offices); and non-government organizations (e.g., nonprofits). To support the development of a robust sample frame, interview candidates were identified in each category and state who were likely to possess a high level of experience with WPA and overall familiarity with wind development in the state. The evaluation team attempted to identify respondents that had been involved in promoting the wind market or developing wind capacity in the state for at least one-third of the years that the state had a WWG or for three years of the 1999-2010 evaluation period (whichever was less).

An initial sample frame was drawn from WPA and WWG records and other historical documents that showed individuals' affiliation or involvement in a working group, attendance at state-level industry-related events, or association with wind projects developed in the state. Priority was placed on participants at high levels in their organizations (e.g., director, vice president, etc.), and all interviewees were screened for familiarity with or participation in WWG activities during the evaluation time period.

[2] WPA's state-based activities in some states focused on promoting utility-scale wind development while others focused on small-wind additions. This evaluation defines "utility-scale" as installed projects greater than 1 MW and "small-wind" as projects of 1 MW or less. Interviews included questions on the various market factors (including WPA state-based activities) that influenced both utility-scale and small-wind capacity; however, to prioritize evaluation resources, the approach focused primarily on utility-scale wind in states that added significant capacity in that category.

Historical Tracing Approach

The first step in the investigation for each sampled state included researching the historical activities of WPA and other potential market influences to create a Market Influence Diagram (MID) and a state-specific timeline. The MID appears below as Figure 1.

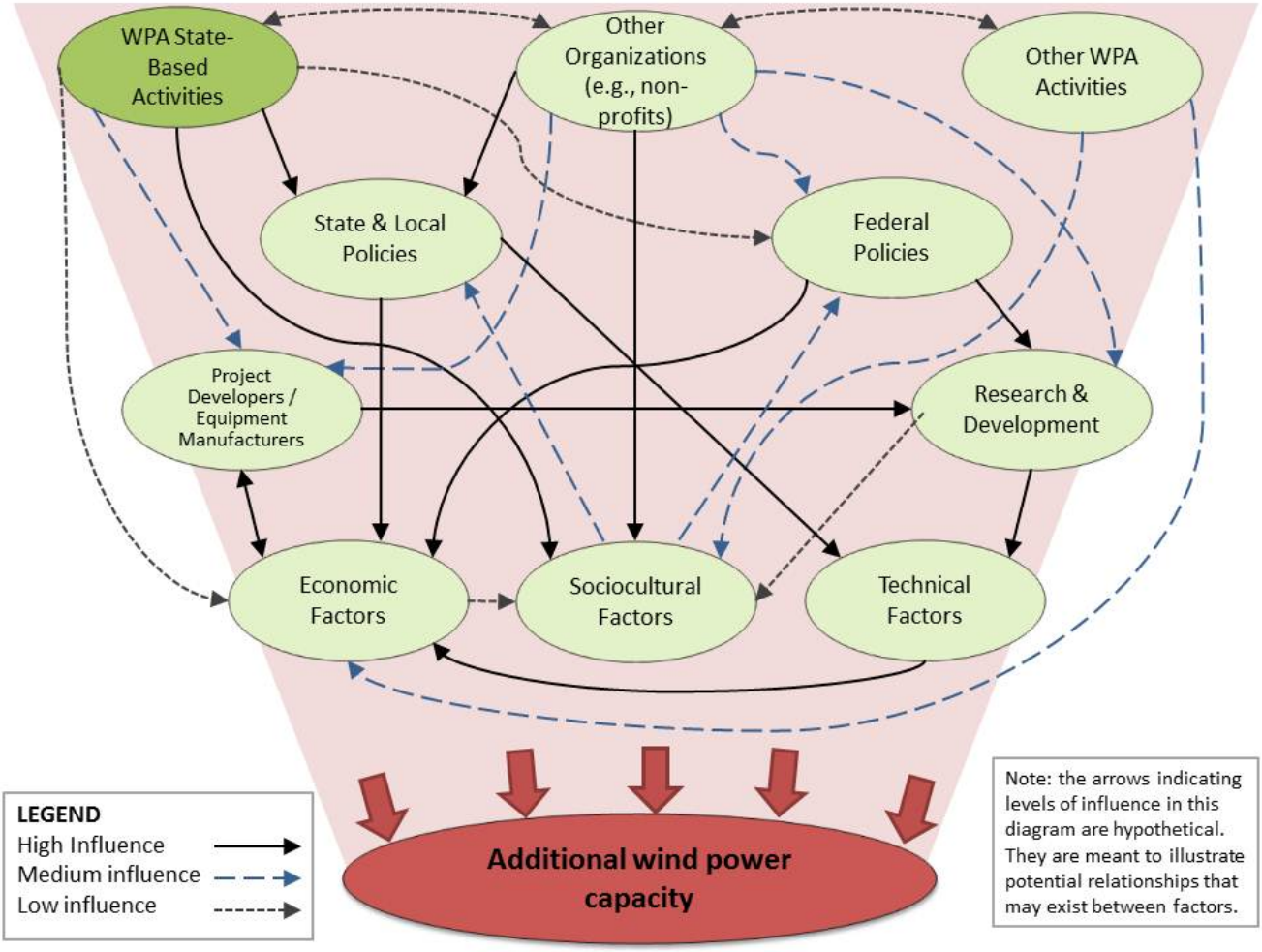

Figure 1. Market Influence Diagram Used in In-Depth Interviews

The MID served two primary purposes. First, it helped illustrate the issue of cross-influence of market factors to interviewees and improved the likelihood that all respondents were treating the issue consistently. Interviewees were instructed that the arrows between the ovals in the MID represented relative degrees of cross-influence between those market factors. Second, the MID listed examples of specific market factors and activities (e.g., wholesale power prices, utilities' willingness to sign power purchase agreements [PPAs], and environmental awareness) that fall within each of the ten market factor categories. Some of these factors could be put into any one of several categories; therefore, the MID sought to provide clarity and consistency for all interview respondents about what belonged in each category. The goal in including non-WPA factors in the exercise (rather than just asking for estimates of the initiative's influence) was to force respondents to consider all of those market factors when providing their estimate of WPA's share of influence on capacity additions, and to do so in relative terms.

The detailed timeline for each sampled state plotted key activities from each market factor category (both WPA and non-WPA-related) and charted the state's annual wind capacity additions. These timelines included key market activities (e.g., timing of state and federal policies) and wind capacity additions for

several years prior to when WPA activities began in order to provide a sense for what was occurring in each state without the initiative's influence. This initial effort served the following three primary functions:

- It painted a detailed, state-specific picture of the context in which WPA state-based activities and outputs occurred over the evaluation period.
- It provided key background for the in-depth interviews and aided respondents' ability to recall the timing of and potential relationships between various market activities (some of which are distant in time).
- It enabled an iterative, expert judging process. Each respondent's insights were incorporated into the sampled state's timeline to inform a second round of interviews that built consensus around WPA's influence in that state.

Participating interviewees received the MIDs and timelines via e-mail a few days ahead of their scheduled interview, so that they had time to review them and consider if anything was missing or inaccurate. Over the course of the expert judging process, the timelines were revised to reflect additional input received through the stakeholder interviews.

Expert Judging Approach

The central component of the evaluation involved a detailed expert judging process that drew on the insights and first-hand experiences of stakeholders that participated in each state's wind market. Iterative expert judging processes such as the Delphi process help ensure that evaluation participants consider several, potentially competing, points of view when assessing WPA's influence on market activities. The facilitated sharing of participants' responses and justifications combined with the confidentiality of the process helps foster consensus among respondents while mitigating some of the effects of personal and recall bias.

The expert judging process was structured around a set of stakeholder interviews that provided primary data for both the impact and process evaluations. Interviews in each sampled state were targeted to include at least one respondent in each of three categories of market actors that participated in or were familiar with WWG activities: private sector (i.e., wind developers); government agencies (e.g., state energy offices); and non-government organizations (e.g., non-profits). To help counter respondent bias (i.e., from those with a perceived stake in the past success of a WWG), each state's interviews included at least one market actor not directly involved in managing that state's WWG. Following review of the initial responses for each state, evaluators prepared a summary of the impact-related responses and comments from that state's respondents to help guide an iterative, Delphi-based approach to narrowing the estimated range of WPA's share of influence on wind capacity additions in the state.

After confirming that interviewees had reviewed the MID and timeline of key activities in the subject state, each interviewee was asked to address several key impact-related questions. In particular, respondents were asked: 1) what percent of the total share of influence (i.e., out of 100%) should be allocated to WPA state-based and WWG activities in terms of the overall amount of wind capacity added from 1999 through 2010, and 2) what percent of the total share of influence should be allocated to other market factors. Respondents were provided with a Market Influence Worksheet that they could use to keep track of the share of market influence that they allocated to each market factor category (including WPA state-based activities). The total for all shares had to total 100%, thereby requiring the respondents to acknowledge the relative importance of each factor in their estimates of WPA's influence.

The interview also included several process-related questions to help identify the state-specific conditions that may have fostered more effective WWGs and activities (or the conditions that prevented a greater degree of influence). Secondary impact questions asked respondents to estimate the existence and relative importance of third-party funding and resources for the working groups' efforts and the degree to which other organizations may have replicated WPA state-based activities.

Modified Delphi Process (Seeking Consensus and Bounding Uncertainty)

Literature from the energy program evaluation industry includes several examples of using the Delphi approach to conduct impact and attribution analyses (TecMarket Works Team 2006, Vine 2012, New York State Department of Public Service and the Evaluation Advisory Group 2012, Siebold et al. 2001). In most cases, these approaches ask respondents to estimate a range within which the sought value is likely to fall. The evaluator then seeks to determine where in that self-reported range the respondent believes the true value most likely falls (e.g., by dividing the range into quartiles or asking for a point estimate). This iterative process may include sharing other respondents' estimates (or an average) with the individual. Due to the nature of this evaluation, however, this study employed a modified Delphi process wherein uncertainty ranges were developed after each respondent had settled on a point estimate of the WPA initiative's share of market influence. The reason for this variation stems both from the number of factors influencing wind power capacity additions in each state and the differences in individual respondents' knowledge or ability to recall WPA-related events over the 11-year period.

To account for these two issues, the evaluators' used the first round of Delphi feedback to enable each respondent to learn from their peers' collective knowledge, familiarity, and recall of WPA and other market factors in each state. Following initial analysis of responses for each state, the evaluators compiled the responses related to the estimated share of each primary market factor's influence (including the WPA's state-based activities) on the state's capacity additions and the initiative's relative share of influence on each of those other primary market factors. This summary table included contextual comments that respondents provided to support their assessments. All responses and the identities of the respondents remained confidential to prevent any potential contaminating effects. Evaluators then distributed each state's market influence assessment summary documents to the original respondents via e-mail with clear instructions on the Delphi panel process. Each respondent was asked to 1) respond to the ratings and supporting comments of the other reviewers and 2) revisit his or her original allocations of each factor's share of market influence in light of disparate ratings or comments.

The research approach anticipated that respondents would exhibit significant variation in their view of the initiative's influence in a particular state. The opportunity to adjust their allocations in consideration of their peers' ratings and comments aimed to address differences in knowledge of WPA and WWGs' activities (i.e., recall bias) as well as potential respondent bias (e.g., those directly involved in promoting WWG activities may have rated those activities as more influential than other respondents). Fifteen percent of respondents adjusted their initial percentage allocations of factors' market influence, and an even greater share commented on their colleagues' responses, during this initial round of feedback and revision. Based on these revisions and other respondents' apparent comfort with their initial estimates, it appeared that additional attempts at consensus-building would provide diminishing returns. Instead, the third round of input used the modified Delphi process to quantify the level of uncertainty surrounding each individual's estimate of the share of market influence allocated to WPA state-based activities and the other WPA national-level initiatives. Each respondent was asked to approximate a 90% confidence interval surrounding their revised point estimate of WPA's percentage share of influence on capacity additions. This uncertainty estimate (a range of percentages) provided a simple, albeit self-reported, approach to accounting for measurement error within each sampled state (see Electric Power Research Institute 2010 and Schare and Ellefsen 2007).

Essentially, respondents were asked how small and how large WPA's share of influence on capacity additions might have reasonably been. This range estimate was explained to the respondent to not be absolute (i.e., there may be some likelihood that the share of influence may fall below the low estimate and above the high estimate). This allowed the respondent to develop a practical estimate of the range rather than ask for absolute values for WPA's minimum and maximum share of influence, which might be more difficult for a respondent to envision.

Data Analysis and Derivation of Capacity-Equivalent Estimates of WPA's Influence

Data analysis efforts focused primarily on 1) identifying and organizing state-specific information to provide historical tracing evidence of the timing and potential relationships among various market activities, and 2) expert judging estimates of the initiative's share of influence on capacity additions.

The evaluation's primary quantitative goal was to provide a reasonable range for the estimated share of capacity additions that were influenced by WPA state-based activities in each of the utility-scale and small-wind segments. Evaluators used an analytic model built in Analytica® to aggregate respondents' individual estimates of the expected value (including ranges of uncertainty) of WPA's influence on wind capacity additions, first into state-level average estimates and then into sample-wide estimates.[3] This estimate was then extrapolated to the broader population of all WPA-targeted states (i.e., including those that were not sampled) by accounting for sampling error and scaling the estimate to account for capacity added in non-sampled states. The respondent estimates and subsequent outputs were provided for each of four combinations of utility-scale and small-wind and WPA state-based and other national-level activities. A flow chart of this analytic process appears in Figure 2, followed by detailed explanation of each step.

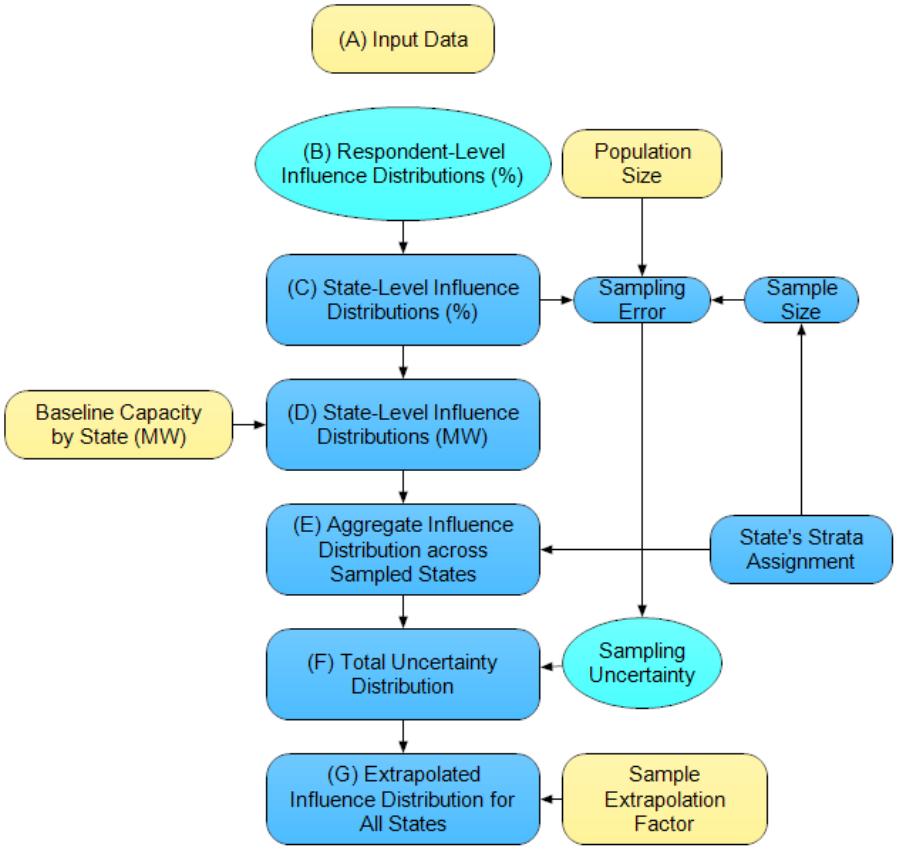

Figure 2. Diagram of Approach to Capacity-Equivalent Influence Estimates (Navigant Analysis)

(A) Input Data included, for each respondent in each state, an estimate of the expected value and lower and upper bounds of the share (%) of a state's capacity additions influenced by each of WPA state-based activities and other WPA activities (e.g., the greening federal loads initiative).

(B) Respondents' uncertainty distributions approximated a 90% confidence interval. These influence range estimates were entered into the model as triangular distributions to create Respondent-Level Influence Distributions for each state-respondent combination.[4]

[3] Analytica® is modeling software that uses a graphic, diagram-based approach to establishing the relationships between various inputs and sets of data. (www.lumina.com)

[4] A triangular distribution is a continuous probability distribution used in statistical analysis and modeling, often in cases

(C) For the calculation of each State-Level Influence Distribution, the model calculated 1,000 potential outputs within each Respondent-Level Distribution, and then averaged those outputs to determine an overall WPA influence distribution for that state. This provided an expected value and uncertainty range for the WPA share of influence on capacity additions in each state.

(D) To provide MW-based estimates of the range of WPA's influence in each state, the percentage-based estimates were multiplied by the baseline amount of capacity that had been added in state from (and including) the year that state's WWG was founded through the end of 2011. This allowed the model to display State-Level Influence Distributions showing the capacity-based expected value (in MW) and range (within a 90% confidence interval) of WPA's estimated influence.

(E) Summing these State-Level Influence Distributions produced an Aggregate Influence Distribution across Sampled States. This distribution estimates WPA's combined influence across all of the states that were sampled. The model also maintained each of three separate distribution estimates that included only the states within each of the three capacity-based strata (high-, middle-, and lower-tier states) used in the sampling approach.

(F) The additional uncertainty arising from sampling error was accounted for separately for each of the three capacity-based strata. A normalized Sampling Uncertainty Distribution for each of the three strata was then multiplied by the Aggregated Influence Distribution across Sampled States to produce a Total Uncertainty Distribution (for each strata). This aggregated distribution combined the estimated influence values and ranges, including sampling error, for each of the three sample strata to generate a Total Uncertainty Distribution for all sampled states.

(G) Finally, the Total Uncertainty Distribution was extrapolated to account for WPA's estimated influence on capacity additions in those states that were not included in the sample. This was done by multiplying a Sample Extrapolation Factor (1 / (percent of capacity added in WPA-target states that was included in the sample) to the Total Uncertainty Distribution for each of the three strata.[5] The resulting distributions were summed to produce an Extrapolated Influence Distribution for All States.

As noted above, the above process was applied to both the utility-scale and small-wind markets for each of the WPA state-based and other WPA activity categories. This same process was also used to calculate a capacity-equivalent estimate of WPA's influence on non-WPA-targeted states. However, for the non-targeted states, the results were not extrapolated beyond the three states sampled (i.e., the process stopped at Step E (Aggregated Influence Distribution) in Figure 2.

Impact Evaluation Findings

This section summarizes the key impact-related findings, including wind industry stakeholders' perceptions of various market factors' influence on wind capacity additions, the capacity-based share of influence from WPA state-based activities and other national initiatives, and the role and importance of leveraged funds and replication of initiative activities and tactics.

Influence of Various Market Factors on Wind Capacity Additions

After an open-ended discussion of the market factors that may have influenced wind capacity additions in a sampled state, WWG members and industry stakeholders were asked whether they perceived WPA and its state-based activities (e.g., the WWG) to have had an influence on either the timing or rate of wind capacity additions in their state. A majority (71%) of respondents affirmed that the program's state-

where sampling data is limited. It is frequently based on a range of possible values (minimum and maximum) within which a "best guess" value is provided (as in the Delphi process).

[5] Since the interviews included a census of the states in the top two capacity tiers for the utility-scale wind market, this step was only required for the low-tier strata. For the small-wind sample, it was conducted for all three tiers.

based activities had at least some influence in their state. Another 20% said the activities had little to no influence, while 9% were unsure.

Respondents were then asked to allocate shares of influence on a state's wind capacity additions among each of the ten market factor categories, so that the total shares allocated across all factors totaled 100%. The goal was to have respondents quantify the share of influence that they would allocate to WPA state-based and other national activities in the context of the other market factors that also influenced capacity additions in each state. Based on these stakeholder assessments of each market factor category's share of influence on wind capacity additions, the following key findings emerged for the sampled target states:

- Federal policies (particularly the production tax credit [PTC]) have had the greatest overall share of influence (26% on average) on utility-scale wind capacity additions in sampled target states.
- State and local policies had the second greatest share of influence (19% on average) on utility-scale capacity additions. This influence primarily arose from states' renewable portfolio standards (RPS); however, state-level tax incentives or specific regulatory decisions by a state's utility commission have also been important. In some sampled target states, the influence of RPS requirements in neighboring states has also played a role (up to a 20% share; 8% on average), particularly for those states that did not have their own RPS at the time.
- In most sampled states, respondents allocated a significant, but lesser, share of utility-scale market influence to economic and technical factors (12% and 11% on average, respectively). Primary economic factors included electric load growth and the cost of competing power sources like natural gas. Technical factors generally included wind resource quality or access to transmission.
- The allocations of market influence were more diverse for small-scale wind than for utility-scale. However, federal policies (particularly the Investment Tax Credit [ITC] cash grant option) and state and local policies (e.g., utility or state rebates and net metering) were again among those factors receiving the greatest shares of perceived influence (17% and 21% on average, respectively).
- WPA state-based activities were perceived to have had a greater share of the influence on small-wind capacity additions than with utility-scale wind, with a capacity-weighted average of 18% of the overall market influence. WPA state-based activities received a 10% or greater average share of the perceived market influence in eleven of the fourteen states sampled.

Estimate of WPA's Influence on Wind Capacity Additions

Respondents' estimates of WPA's share of influence on the market (including the uncertainty of those estimates) were aggregated to determine an overall percentage-based range of the initiative's share of influence on wind capacity additions across the 14 sampled target states. Using the wind power capacity added in each targeted state following the formation of its WWG (through the end of 2011) and extrapolating the range to account for non-sampled target states, the evaluation team calculated an overall capacity-equivalent influence of approximately 2,300 MW for WPA state-based activities in the 36 WPA-targeted states. Other WPA activities (e.g., rural economic development and public utility partnerships) were allocated another 1,050 MW, for a combined total of approximately 3,375 MW, or nearly 15% of capacity additions in those states targeted by the initiative. In terms of WPA's objective that 10 GW be installed in the U.S. by 2010, this expected influence represents nearly 34% of that capacity goal. Table 1 summarizes the calculated capacity-equivalent influence for each wind market and category of WPA activities.

Table 1. Capacity-Based Estimates of WPA's Share of Market Influence: Extrapolated to All WPA-Targeted States (Navigant Analysis)

Market / Activity Category	WPA-Influenced Capacity Range (MW)		
	Lower Bound	Expected Value	Upper Bound
Utility-Scale Market	***2,966***	***3,350***	***3,752***
State-Based Activities	2,074	2,306	2,546
Other WPA Activities	891	1,044	1,206
Small-Wind Market	***22.8***	***24.6***	***26.5***
State-Based Activities	17.0	18.1	19.4
Other WPA Activities	5.8	6.5	7.1
Total: All Markets and WPA Activities	**2,988**	**3,375**	**3,779**

Among the sampled WPA target states, approximately 70% of respondents also indicated that the capacity installed in a particular state by the end of 2010 would have been lower without WPA's intervention, while 69% felt that capacity additions would have been delayed in the initiative's absence. In the context of the objective that 30 states achieve 20 MW of installed capacity by 2010, WPA's influence on increasing the amount and timing of capacity installed in the states it targeted can be considered a success.

For states that were not directly targeted by WPA (i.e., those that did not have a WWG), the interviews provided some evidence of market effects and influence from the initiative's national and state-based activities in adjacent states. Combining both state-based and other WPA activities, the initiative's perceived influence on wind capacity additions would equate to approximately 1,100 MW of capacity additions in the three non-targeted states sampled (Iowa, New York and Texas). This represents approximately 7.7% of the capacity added in those three non-targeted states since the founding of WWGs in neighboring states.

Extent and Importance of Leveraged Funds[6]

According to respondents in sampled states, federal funds served as important seed money for the WWGs, but were often insufficient on their own for running a productive group or organization. In most cases, interviewees familiar with WWG administration perceived third-party funding as critical to a WWG's ability to succeed in their efforts. Such outside funding (and in-kind contributions) for WPA state-based activities has come from a wide range of sources, including state energy offices, other federal and state agencies, universities, private foundations, and corporate sponsorships or donations. As participation in the WWG was voluntary, much of the time spent by attendees and committee members was on their own behalf or that of their employers and was itself a form of in-kind support.

The majority (67%) of those familiar with the WWG's administration in sampled states considered these third-party funds to have been "very important" in terms of affecting the WWG's ability to influence wind capacity additions. However, the estimated share of WWG funds represented by outside resources varied from 20% to 95% of the total budgets in sampled target states (based on interviewee approximations). In some cases, third-party funding sources were cited as representing an increasingly greater share of the WWG's budget over time as the group attracted more participants and sources of support.

Based on the interview responses, WWGs coordinated by universities and non-governmental organizations (NGOs) in sampled target states were more likely to cite higher levels of third-party funding than those based within a state agency. Notably, both types of organizations (universities and NGOs) tend to

[6] This evaluation defined leveraged funds using an established DOE methodology (see Wolf 2008). In summary, for an organization's resources or funds to be considered leveraged by the WPA initiative, those funds must have been 1) provided by another party for a primary or related activity in WPA's logic model, 2) secured concurrent with or following a WWG's receipt of federal funding, and 3) been of a character and amount sufficient to impact the associated activities' effectiveness.

require some level of fundraising from external sources (e.g., grants, corporate partnerships, donations), and their staff may be more accustomed to seeking out such funding.

Extent and Importance of Replication of WPA Activities

The evaluation also sought to characterize the extent of secondary impacts that may have arisen from other organizations' replication of WPA state-based activities. The objective of this inquiry was not to quantify the MW-impact of any replication, but to identify which, if any, of WPA's activities or tactics were perceived as effective enough to be implemented by other organizations. Most interview respondents were unable to provide evidence of or extensive details about such replication; however, several of these stakeholders did offer the following examples:

- In four states, respondents discussed how knowledge and best practices (and the WWG approach) was shared across state lines, with members and coordinators of one WWG helping to inform the establishment and practices of those in other states.
- In two states, individuals involved in WWGs reported that they had applied the WWG approach to other markets, issues or technologies (e.g., solar, biomass, or other renewables); however, in the few cases where such replication was discussed, resulting efforts appear to have been short-lived or had limited impact.
- In at least six states, respondents listed numerous organizations that have contributed to carrying forward the efforts and activities of states' WWGs after their federal funding ended. For example, members of the various organizations that had participated in WWGs carried forward the knowledge, momentum, and relationships formed through the WWG to continue influencing the market.
- Examples of replication can also be found in states not targeted by WPA (e.g., Texas sponsored its own Wind for Schools project), though the impact of those activities has been limited.

While such anecdotal evidence of replication exists, the most oft-cited forms related to the positive network effects that stem from WPA's approach to its state-based activities. Specifically, WPA's influence appears to grow as the network of individuals and organizations connected to the initiative expands.

Process Evaluation Findings

This section summarizes the key process-related findings, including identification of the initiative's key pathways to influencing wind capacity additions, stakeholder perceptions of which state-based activities have been most influential, common characteristics of successful state WWGs, and characteristics of those states where working groups have had less success.

Pathways for WPA's Influence on Wind Capacity Additions

Interview respondents were asked to estimate the share of influence that WPA and their state's WWG had on each of the other primary market factors that directly impacted capacity additions in their state. Respondent perceptions revealed that WPA influenced wind capacity additions through multiple indirect pathways. Specifically, the initiative's effects on sociocultural factors, other groups' activities, and state and local policies each contributed to a positive collective influence on the market.

Most Influential State-Based Activities

Two activities, described below, stand out as having played the greatest role in the success of WPA's state-based activities in sampled WPA-target states:

- Both utility-scale and small-wind interview respondents considered activities aimed at either increasing public support or building networks to facilitate information sharing among

stakeholders as the most important.

- WPA's role as a repository and provider of technical information was seen as another key driver for successful state-based activities. At least one respondent in each state indicated that these public resources, particularly reports and webinars associated with national labs or universities, were viewed as a credible, non-biased source of information.

Characteristics of Successful State Wind Working Groups

In general, the success of state WWGs has been influenced by each one's ability to establish itself as a credible contributor in helping to address the important issues and barriers to wind power development in a particular state. Findings suggest that successful groups tended to establish a niche role in the wind advocacy space wherein the WWG could engage a diverse set of stakeholders (who might not otherwise converge) and provide a forum for constructive dialogue. Specific examples of WWG attributes considered to be effective by interview respondents include the following:

- Market actors indicated information sharing and the ability to bring together a diverse set of stakeholders as a key characteristic contributing to the effectiveness of the WWG. Policymakers, landowners, wind developers, utility companies, and other stakeholders could each contribute a unique perspective on the industry, and the neutral forum created by successful WWGs was a good place to do so.
- The capacity of a WWG to fill a niche as the driver of network building and information sharing in a particular state's wind market depended to some degree on minimizing duplication of efforts or even competition with other wind or renewable energy-oriented groups.
- Interview respondents from at least six states made a point of identifying by name a small number of individuals in those states whose dedication to promoting and pushing forward the market for wind development were a vital part of the WWG's success. Some considered these individuals to be champions for the wind industry because of their ability to expand the sphere of influence and make connections among key stakeholders.
- Another factor mentioned by respondents as contributing to the effectiveness of some WWGs was their ability to partner with entities like universities that helped foster the group's credibility and objectivity. Respondents in other states noted that WWGs that formed partnerships with (or were coordinated by) the state's energy office benefitted from the government-based support structure and offered better opportunities to interact with policymakers.

Characteristics of Challenging States

Each respondent was asked if any characteristics of the state's WWG, or of the state itself, contributed to the WPA state-based activities having had any less of an influence on wind capacity additions. Recurring themes that were cited by respondents in the six states where WPA was perceived to have had a less-than-average share of influence include the following:

- WWGs were perceived as less effective in states where the market for wind power had already established some momentum before the groups were fully active. This trend was sometimes tied to the presence of other pro-wind groups in the area.
- In four of the sampled target states, interview respondents indicated that their WWG could have been more effective if they had done a better job engaging and forming positive relationships with utility companies. In some instances, respondents indicated that the WWGs formed "adversarial" relationships with utilities that were seen as "anti-wind" instead of confronting the issue in a positive way.
- In at least five of the sampled states, respondents indicated that limited funding prevented WWGs from being more effective. While some made reference to federal funding levels,

respondents in two states indicated that an inability to secure additional or matching funds from state agencies inhibited WWG effectiveness.
- There was an apparent connection between the perceived objectivity and stability of WWG leadership and the perceived effectiveness of some groups.
- Despite their best efforts, some WWGs felt that they faced insurmountable political opposition either at the state or federal level.

Recommendations

The evaluation team's recommendations based on the key findings and in the context of strategic decisions facing WPA and the DOE included the following:

- Leverage WPA's reputation as a provider of objective and credible technical information to address current and emerging barriers to the continued large-scale deployment of wind capacity in states where the market is already developed.
- Continue to utilize the initiative's ability to influence the market through stakeholder engagement and expand partnerships with universities and organizations perceived to contribute to WPA's objectivity and credibility.
- Use the Program Theory and Logic Model approach to define objectives and progress indicators that better align with WPA's role as a market transformation initiative.
- More frequently evaluate the initiative's impact and progress against goals and objectives and require better tracking and reporting of associated metrics.

Conclusions

While the initiative's capacity-related goals were exceeded in most states targeted for participation over the ten-year evaluation period, challenges arose in attempting to attribute market development and capacity additions directly to WPA activities. The coincident timing and interrelatedness of various market factors that contributed to wind power additions (e.g., federal tax incentives and state renewable portfolio standards) made statistical approaches to attribution untenable. The evaluation team instead implemented a combined historical tracing and expert judging approach, including a modified Delphi process, to estimate WPA's overall share of influence on wind capacity additions in states that the program targeted. The approach enabled the evaluation team to find that the initiative had significant impact on wind capacity additions and to recommend process-related improvements for future WPA or similar program endeavors.

Elements of the state- and region-specific approach DOE used in implementing the WPA initiative can be seen in other market transformation and technology development programs managed by various organizations. Issues such as non-random assignment of program participation, inter-related or cross-influential market factors, and a lack of reliable counterfactual cases can pose barriers to statistical analysis of program impacts. Similarly, tying program success to broad goals (i.e., gross capacity installations) without identifying (and measuring) indicators of short- and intermediate-term progress makes attribution of program-specific impacts even more difficult. This is particularly the case when evaluation periods span several years or program administration and recordkeeping are decentralized. Despite these common issues, alternative evaluation approaches—including historical tracing and expert judging—can provide useful and defensible insights into such programs.

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