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JUN 07 2010
PUBLIC SERVICE
COMMISSION

**Via Overnight Mail**

June 7, 2010

Mr. Jeff Derouen, Executive Director
Kentucky Public Service Commission
211 Sower Boulevard
Frankfort, Kentucky 40602

**Re: Case No. 2009-00545**

Dear Mr. Derouen:

Please find enclosed the original and twelve (12) copies of the REDACTED JOINT BRIEF OF THE ATTORNEY GENERAL OF COMMONWEALTH OF KENTUCKY AND KENTUCKY INDUSTRIAL UTILITY CUSTOMERS, INC. filed in the above-referenced matter. I also enclose under seal (1) original of the CONFIDENTIAL version. Please place this document of file.

By copy of this letter, all parties listed on the Certificate of Service have been served.

Very Truly Yours,

David F. Boehm, Esq.
Michael L. Kurtz, Esq.
**BOEHM, KURTZ & LOWRY**

MLKkew
Attachment
cc: Certificate of Service

G:\WORK\KIUC\KP Cases\2009-00545 (Renewable Energy)\KPSC Ltr..doc

## CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing was served by mailing a true and correct copy via electronic mail (when available) and by first-class postage prepaid mail, to all parties on the 7th day of June, 2010.

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RECEIVED
JUN 07 2010
PUBLIC SERVICE COMMISSION

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

IN THE MATTER OF: :
THE APPLICATION FOR APPROVAL OF :
RENEWABLE ENERGY PURCHASE : Case No. 2009-00545
AGREEMENT FOR WIND ENERGY RESOURCES :
BETWEEN KENTUCKY POWER COMPANY AND :
FPL ILLINOIS WIND, LLC

**REDACTED**

# JOINT BRIEF OF THE ATTORNEY GENERAL OF COMMONWEALTH OF KENTUCKY AND KENTUCKY INDUSTRIAL UTILITY CUSTOMERS, INC.

## INTRODUCTION

On December 29, 2009 the Kentucky Power Company ("Kentucky Power") applied to this Commission for approval of a renewable energy purchase agreement (REPA) between itself and FPL Illinois Wind, LLC. The agreement calls for Kentucky Power to purchase 100 mw of energy, capacity and renewable energy certificates (RECs) for a 20 year term from FPL's wind project located in Lee and Dekalb counties in Illinois. Pricing under the REPA is time differentiated, with the highest price during super peak periods, next highest pricing during peak periods, and lowest pricing during off-peak periods. The wind farm consists of 145 GE 1.5 mw XLE wind turbines on 80-meter tubular towers (Exhibit B to the REPA).

Kentucky Power asserts that the wind project will operate at a 39.3% annual capacity factor. (KIUC Cross Exam Ex 1 at p. 2). At a 39.3% capacity factor, the annual cost of the 100 mw contract is $20,000,000. (KIUC Cross Exam Ex. 1 at p. 7). Because of the intermittent nature of wind power (compared to conventional fossil fuel generation), the AEP Pool gives the 100 mw project a capacity value of only 36.5 mw. (KIUC Cross Exam Ex. 1 at p. 6). The addition of the wind project would make

Kentucky Power less deficit in the AEP Pool and would therefore result capacity equalization payment savings of between $5.3 million and $5.7 million. (KIUC Cross Exam Ex. 1 at p. 7-8). After the appropriate jurisdictional allocation, the net base rate increase to Kentucky retail ratepayers from the wind contract would be between $14.3 million-$14.5 million. (KIUC Cross Exam. Ex. 1 at p. 7). The wind contract would also result in fuel adjustment clause savings that are dependent on a number of factors, including the wind facility's actual capacity factor and Kentucky Power's avoided fuel costs.

Kentucky Power's obligations under the REPA are contingent upon it receiving final and non-appealable orders from this Commission authorizing Kentucky Power to: 1) enter into the REPA; and 2) recover all jurisdictional costs associated with the REPA through its base rates. (REPA Section 6.1). If both of these conditions are not meet by September 15, 2010, then Kentucky Power may terminate the contract. (REPA Section 6.1).

Kentucky Power asserts that acquiring renewable energy under the REPA is reasonable because of the probability that some form of renewable portfolio standard (RPS) will be enacted by either the federal or state governments in the near future. (Application at p. 11). It further asserts that this REPA is likely to be lower cost than future wind power contracts because of the December 31, 2012 scheduled expiration of the federal production tax credit (PTC) currently provided to wind power developers. (Application at p. 12). Kentucky Power therefore believes that it is in the best interests of its ratepayers for the Commission to approve the 20 year contract and the corresponding base rate recovery.

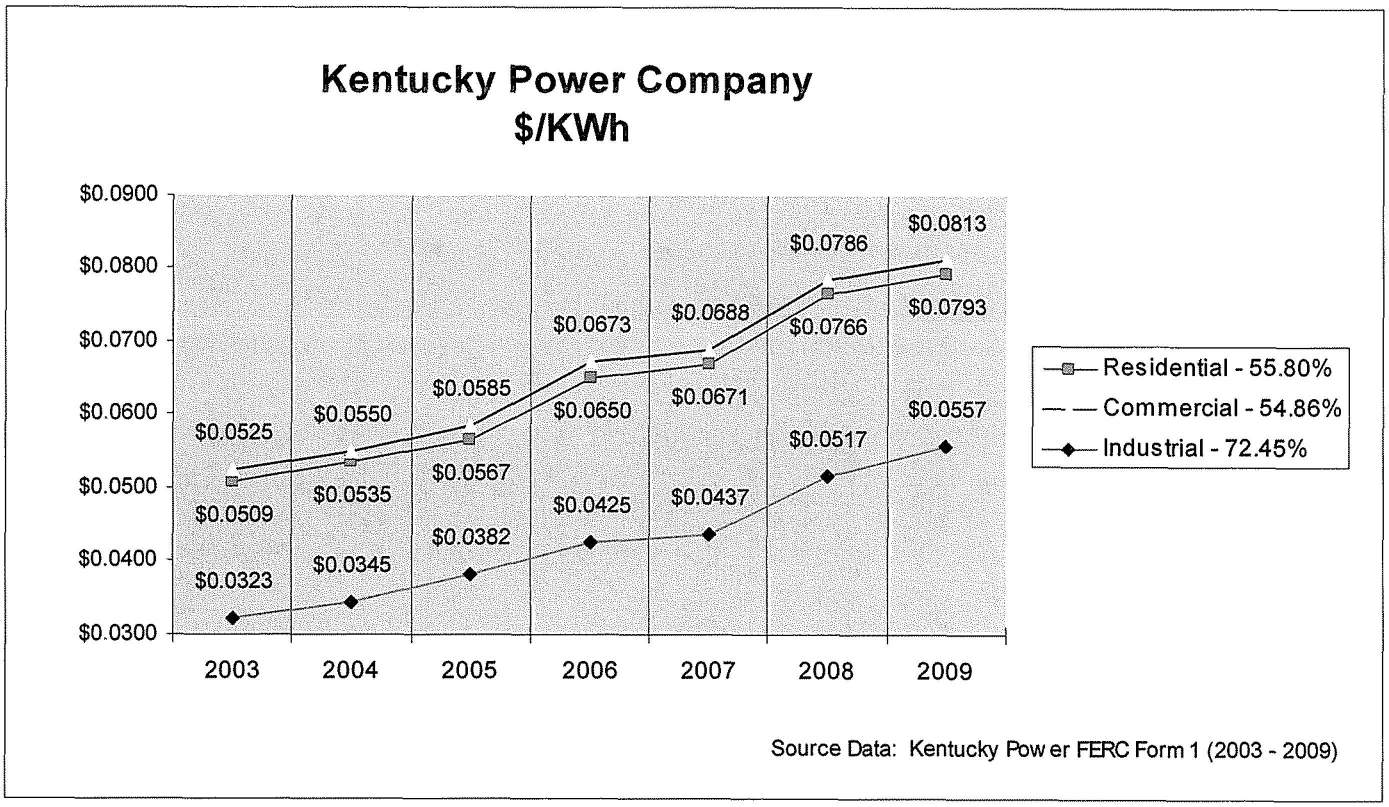
## ARGUMENT

### 1. Consumers In Eastern Kentucky Cannot Afford The Unnecessary, Costly Renewable Power At This Time

As the Commission is well aware, there currently is no federal or state requirement that electric utilities in this Commonwealth provide part of their generation from renewable resources. At this point in time we would only be guessing whether there will ever be such a mandate, and if there is: 1) when it will take effect, 2) how the mandate will be phased in and what percentage of renewable power will ultimately be required, 3) whether energy efficiency will count toward the mandate, 4) whether the renewable resource will have to be located in Kentucky, 5) whether the existing PTC will be extended beyond 2012, 6) whether additional federal or state tax incentives will be provided to utilities or renewable power developers, 7) whether utilities located in regions of the country where wind or solar resources are not viable will be allocated free RECs (similar to how coal dependent utilities were allocated free SO2 emission allowances under the acid rain provisions of the Clean Air Act), and a myriad of other unknowns.

Given all of this uncertainty, the Attorney General and KIUC do not believe that consumers in Eastern Kentucky can afford to gamble that the REPA proposed by Kentucky Power will ultimately be required, and if its is, that it will be a good deal for consumers. Kentucky Power's service territory is dominated by poverty stricken communities. The industries served by Kentucky Power are energy intensive and compete nationally and internationally. None of the company's consumers can afford the costs of renewable power at this time.

As shown on the chart below, from 2003-2009 Kentucky Power's residential rates have increased by 55.8%. Over the same period Kentucky Power's industrial rates have increased by a whopping 72.45%.




The chart above does not include the rate increases stipulated to in Kentucky Power's rate case. If the Unanimous Settlement Agreement in Case No. 2009-00459 is approved, then from January 1, 2003-July 1, 2010 Kentucky Power's residential rates will have increased by 72.64% and its industrial rates will have increased by 76.07%.

Renewable energy unquestionably provides positive environmental attributes. Perhaps the legislative policy makers at the federal or state level will ultimately determine that those environmental attributes are worth the added cost. But right now renewable power is a discretionary expense that residential consumers and industrial manufacturers simply cannot afford.

## 2. <u>Kentucky Power Currently Has Excess Energy And The Wind Contract Is Not Needed.</u>

Kentucky Power currently has no need for the energy expected to be provided by the wind contract. As discussed by KIUC witness Mr. Kollen, Kentucky Power is energy surplus (long) and the wind purchase will only exacerbate that situation. (Kollen Direct Testimony at p. 5). During the twelve months ending September 30, 2009, Kentucky Power sold a total of 10,675,575 mWh, of which 3,621,548 was wholesale (sales for resale) and 7,148,877 was retail. (Id.). In other words, only 2/3 of the energy generated by Kentucky Power was needed for retail ratepayers.

The fact that Kentucky Power is energy long is not a recent development. As shown on KIUC Cross Exam Ex 3, for every year since 2003 at least 1/3 of the energy generated by Kentucky Power was sold off-system. Over the eight year period 2003-2009, on average 37.4% of the energy generated by Kentucky Power was sold off-system. If the wind project operates at its promised 39.3% capacity factor, then this energy surplus would be increased by 344,900 mWh annually.

Because Kentucky Power is a deficit member of the AEP Pool this means it has less capacity than its Member Load Ratio share would dictate. Consequently, Kentucky Power makes capacity equalization payments to the surplus members of the AEP Pool. However, this 100 mw wind contract will only make a small dent in Kentucky Power's capacity deficiency. Given the intermittent nature of wind power, it is only credited for 36.5 mw of Pool capacity. This is not the resource that best fits Kentucky Power's needs, and the utility has provided no study to the contrary.

### 3. Kentucky Power's Own Evidence Shows That The Wind Contract Is Not Economic On A Present Value Basis.

Kentucky Power Exhibit SCW-3 (KIUC Cross Exam Ex. 1 at p. 1) shows the cost of the wind contract (Column D) less capacity equalization Pool savings (Column F) and avoided energy costs (Column E). This Exhibit assumes that the wind project will operate at its promised capacity factor of 39.3%. This Exhibit then compares the net cost to ratepayers of the wind project on a per mWh basis to AEP's forecasted per mWh cost of achieving compliance through the purchase of RECs. This document also assumes that there will be a federal RPS beginning January 1, 2012.

The Exhibit shows that the projected net cost to consumers for July 1, 2010-December 31, 2010 will be [redacted] million (Column G). For 2011, the projected net cost to consumers is shown as [redacted] million.

Finally, the Exhibit shows that beginning in 2012 (the assumed start date for a federal RPS) the net cost of the wind contract on a per mWh basis (Column L) is less than AEP's forecast of the cost of RECs (Column M). For example, in 2012 the net cost of the contract is projected to be [redacted]mWh less expensive than the forecasted cost of RECs, thus saving consumers [redacted] [redacted]mWh times wind generation of [redacted]).

Even if we accept as true AEP's assumptions that the wind project will operate at a 39.3% capacity factor, that a federal RPS will be in place on January 1, 2012, and that the cost of future RECs can be determined today: Is the wind project economic? No, not on a present value basis.

As shown on KIUC Cross Exam Ex. 6, on a net present value basis the contract causes economic harm to consumers. Depending on the discount rate chosen, the harm ranges from $1.86 million to $4.66 million. Bottom line: unnecessarily paying millions of dollars up front in 2010-2011 outweighs the small projected savings in 2012-2020.

The utility's primary argument for incurring the renewable energy expense before being required to do so by law is its contention that a state or federal RPS will ultimately be enacted and that wind power costs will increase if we wait. Recent events undermine that contention. As shown on KIUC Cross Exam Ex. 8, AEP's 2009 RFP bids for renewable power were substantially below its 2008 bids. This demonstrates that being an "*early mover*" in 2008 was not a good idea. What will the RFP bids be in the future? No one knows; they could be higher or lower. Certainly technology improvements in wind generation would tend to lower costs. But whatever the future holds, it would be imprudent to enter into this contract now in an effort to comply with an unwritten federal or state mandate.

## 4. <u>The Wind Project Is Unlikely To Achieve A 39.3% Annual Capacity Factor And The Base Rate Revenue Requirement Is Therefore Overstated.</u>

The $20 million annual base rate revenue requirement (less capacity equalization savings) is premised on the assumption that the wind project will achieve an annual average capacity factor of

39.3%. (KIUC Cross Exam Ex. 1 at p. 2, 7) If the project achieves a capacity factor less than 39.3%, then the amount embedded into base rate rates will be greater than the amount Kentucky Power will pay to the developer. Consequentially, Kentucky Power will make a profit on the contract and ratepayers will be charged for renewable energy they did not receive. If the capacity factor exceeds 39.3%, then the opposite will occur. Which is more likely? The evidence overwhelmingly demonstrates that the 39.3% capacity factor assumption is extremely optimistic.

Kentucky Power did not do an independent analysis of the expected capacity factor. Instead, it relied on information provided by the developer. Obviously, the developer has an incentive to over estimate the capacity factor since that makes its RFP bid look less expensive as more of the energy is projected to be delivered in the least expensive off-peak periods. Kentucky Power has an incentive to over estimate the capacity factor for ratemaking purposes since that increases its revenue requirement.

Kentucky Power would have this Commission believe that there is an equal probability that the actual capacity factor will be above or below 39.3% (a "*bell curve*"). The facts do not bear that out.

KIUC Cross Exam Ex. 2 shows the actual capacity factors by month for all of the six wind projects currently under contract by AEP affiliates in Illinois and Indiana. None of them comes close to a 39.3% capacity factor. Those capacity factors are: Camp Grove [redacted] (27 months data), Fowler I [redacted] (16 months data), Fowler II [redacted] (6 months data), Fowler III [redacted](14 months data), Grand Ridge II [redacted] (6 months data), and Grand Ridge III [redacted] (5 months data).

AEP has provided four months of actual capacity factor data for the Lee-Dekalb project proposed for Kentucky Power. Over the first four months of 2010 its capacity factor has averaged only [redacted] and this was during the windy winter months. (KIUC Cross Exam Ex. 2). During its first four months, the Lee-Dekalb capacity factor was lower than the capacity factor of all of the other six projects during each month. In other words, the Lee-Dekalb project was the worst performing project all four months. But this Commission is being asked to establish base rates under the dubious assumption that the Lee-

Dekalb project will be by far the best performing project. The Commission should not approve a $20 million increase on the backs of the company's financially distressed ratepayers based on questionable evidence.

Data made available by the U.S. Department of Energy National Renewable Energy Laboratory (NREL) supports the Attorney General and KIUC. Attached at Exhibit A are NREL reports which show by state the windy land area with a gross capacity factor of 30% and greater (without losses) for wind turbines on 80 meter towers (the same height as the Lee-Dekalb project). Illinois is a very windy state and 34.25% of the available land in the state is suitable for achieving a 30% or greater capacity factor. As the capacity factor is increased to 35%, then only 16.53% of Illinois is suitable. But when the capacity factor is increased to 40%, only 0.62 percent of Illinois is suitable. In other words, according to NREL only a tiny percent of the land in Illinois can achieve a 40% capacity factor. The NREL data stops at a 40% capacity factor, presumably because that is near the absolute maximum. For the Lee-Dekalb developer to reach its promised 39.3% capacity factor it would have to be in the very best location in Illinois. Based upon its actual performance to date, that does not appear to be the case. In any event, Kentucky Power's assertion that there is an equal probability that the capacity factor will be above or below 39.3% is wishful thinking, at best.

If the Lee-Dekalb project achieves a 30% capacity factor (not 39.3%), then Kentucky Power will charge consumers $20 million for the wind power but it will only pay the developer $15.2 million. Kentucky Power would then make a profit of $4.8 million and consumers would pay $4.8 million for renewable power they did not get. At the public meetings in the Kentucky Power general rate case the Commission was told repeatedly by consumers that they cannot afford the costs of wind power. Imagine their outrage if they learn that their rates have been raised to pay for wind power they never received. Phantom wind power would result in real consumer anger, if not potential harm with ratepayers cutting back on their prescriptions and food.

5. **<u>This Commonwealth Has Utilized Least Cost Resource Planning For At Least 27 Years</u>.**

Vice Chairman Gardner specifically requested that in addition to briefing the general issues in the instant matter, the parties address the specific issue of whether Kentucky is a "*least cost*" state. The Attorney General and KIUC respectfully submit that the issue was previously addressed in KIUC's responses to PSC 1-3 (attached at Exhibit B); for that reason, they incorporate that response by reference as if set forth fully herein. Additionally, the Attorney General and KIUC provide the following information in this regard which conclusively establishes that Kentucky is in fact a "*least-cost*" state.

First, the Commission's regulation governing the IRP process requires that utilities submit IRPs is manifestly based on the least possible cost standard:

*"807 KAR 5:058 § 8*

*Resource Assessment and Acquisition Plan.*

*(1) The plan shall include the utility's resource assessment and acquisition plan for providing an adequate and reliable supply of electricity to meet forecasted electricity requirements* ***at the lowest possible cost****. The plan shall consider the potential impacts of selected, key uncertainties and shall include assessment of potentially* ***cost-effective*** *resource options available to the utility. . . . . (4) The utility shall describe and discuss its resource assessment and acquisition plan which shall consist of resource options which produce adequate and reliable means to meet annual and seasonal peak demands and total energy requirements identified in the base load forecast* ***at the lowest possible cost****.*

*NECESSITY, FUNCTION, AND CONFORMITY: KRS 278.040(3) provides that the commission may adopt reasonable administrative regulations to implement the provisions of KRS Chapter 278. This administrative regulation prescribes rules for regular reporting and commission review of load forecasts and resource plans of the state's electric utilities to meet future demand with an adequate and reliable supply of electricity* ***at the lowest possible cost for all customers within their service areas****, and satisfy all related state and federal laws and regulations."* (Emphasis added).

In determining which model to adopt for universal service costs, the PSC in Administrative Case No. 360 (Order dated May 22, 1998) stated that the least cost was the first criterion: "*The technology assumed in the cost study or model must be the least-cost, most-efficient, and reasonable technology for providing the supported services that is currently being deployed.*" Id. at 4.

The Commission *In Re Energy Policy Act of 1992*, Administrative Case No. 350, Order dated Oct. 25, 1993, p. 3, stated:

*"The Commission finds that the market will operate to assign prices based on overall risk, not simply the risk associated with a highly leveraged capital structure. A utility can purchase power if that is the* ***least cost*** *option. On the other hand, a utility can build for its own use if that is the* ***least cost*** *option. Moreover, a utility holding company is not restricted from building an EWG for nonaffiliated sales incorporating the maximum degree of leverage the market will bear."* (Emphasis added).

In Case No. 2002-00029, *Petition of LG&E Co. and Ky. Util. Co. for a Certificate of Public Convenience and Necessity and a Certificate of Environmental Compatibility for the Acquisition of Two 152 Megawatt ('MW') Combustion Turbines*, the Commission stated:

*"LG&E's and KU's analysis supports the construction of the two CTs as the* ***least cost*** *option for meeting loads in 2002 and 2003 compared to relying on purchase power peaking alternatives . . . Based on the evidence of record, the Commission finds that the*

*acquisition of the two CTs is the **least cost** option to reliably serve LG&E's and KU's customer loads, is reasonable, and should be approved."*[1] (Emphasis added).

In Case No. 8624, *Application of Kentucky Utilities for an Adjustment of Rates*, the Commission discussed the fact that KU was bringing new generation on line when it was not needed. The Commission noted:

> *"The commission is concerned about KU's load forecasting, and about such related issues as the benefits to be realized by cost-effective conservation programming, pursuing the development of small power production and cogeneration, and the extent to which it would be economically beneficial for KU to purchase power from and/or sell power to neighboring utilities. **These concerns are the heart of the commission's belief that it has an obligation to pursue, for Kentuckians, an energy strategy that represents least cost consistent with appropriate reliability**, and the further belief that the **least cost** system does not exist."*[2] [Emphasis added]

In Administrative Case No. 297, *An Investigation Of The Impact Of Federal Policy On Natural Gas To Kentucky Consumers And Suppliers*, Order dated May 29, 1987 the Commission in multiple locations identified its concern that Kentucky ratepayers pay the lowest costs possible. [3]

In Case No. 8566, *In Re: Small Power Producers and Cogenerators*, Order dated June 28, 1984, the Commission stated:

> *"The commission in recent orders has provided notice to the regulated utilities in Kentucky of its intentions to proceed with a least cost strategy for meeting future load growth . . . . the commission is convinced that this respite in demand growth gives all parties (commission, utilities, and QFs) a rare opportunity to prepare in a timely and efficient manner to meet capacity needs for the future in the least cost manner."*[4]

In Case No. 2005-00053, *In Re: Application of East Ky. Power Coop. Inc. for a Certificate of Public Convenience And Necessity, and a Site Compatibility Certificate*, the Commission went into exhaustive analysis to show that EKPC's self-construct bids were in fact the least-cost options.[5]

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[1] 2002 WL 31458833 (Ky. PSC.), Order dated June 11, 2002, p. 3.

[2] 52 P.U.R. $4^{th}$ 408, Order dated March 18, 1983, p. 21.

[3] *See, e.g.*, p. 7, "least cost purchasing;" p. 8, "The Commission finds that its policies should be formulated to . . . assure that LDCs pursue all avenues to acquire the lowest cost . . . gas for their customers;" p. 26 " . . . all of the Class A LDCs stressed that . . . LDCs have an obligation to pursue least-cost gas for their customers."

[4] 60 P.U.R. 4th 574, p. 4.

[5] 2006 WL 2595353, Order dated Aug. 29, 2006, pp. 2, 4.

In Administrative Case No. 387, In Re: Kentucky Generation Capacity and Transmission System, the Commission noted, "*Since CG&E's generation is being deregulated and will be sold at market-based prices, ULH&P will soon need to address the issue of meeting its post-2006 power requirements in the most reasonable,* ***least costly*** *manner.*" (Emphasis added). [6]

In Case No. 2006-00072, *In Re: Application of Union Light, Heat & power Co. for an Adjustment of Rates*, Duke Energy Kentucky shall file, subject to Commission approval, a least cost back-up supply plan with the Commission when such plan is completed but in no event later than its March 2007 FAC filing.[7]

Accordingly, as evidenced by almost countless, prior Commission decisions, Kentucky uses a "*least-cost*" standard when reviewing the merits of any utility request for approval of any new electric power source to serve its ratepayers – consumers who are captive and must ultimately bear the costs.

[6] Order dated December 20, 2001, p. 17 (2001 WL 1858467).
[7] Order dated Dec. 21, 2006, 2006 WL 3899994 p. 5.

**WHEREFORE**, for the reasons stated above, the Attorney General and KIUC respectfully request that this Application be denied.

Respectfully submitted,

**JACK CONWAY**
**ATTORNEY GENERAL**

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**COUNSEL FOR KENTUCKY INDUSTRIAL UTILITY CUSTOMERS, INC.**

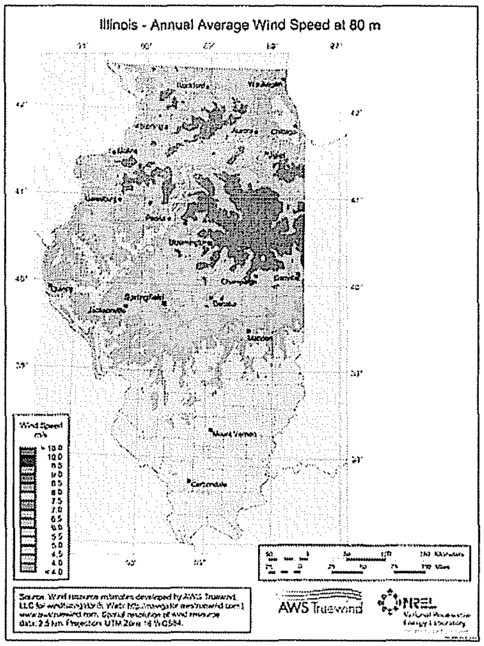
June 7, 2010

# EXHIBIT A

# Illinois Wind Map and Resource Potential

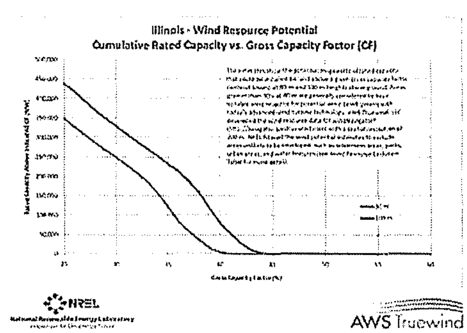
SHARE

The Department of Energy's Wind Program and the National Renewable Energy Laboratory (NREL) published a new wind resource map for the state of Illinois. The new wind resource map shows the predicted mean annual wind speeds at 80-m height. Presented at a spatial resolution of 2.5 km (interpolated to a finer scale for display). Areas with annual average wind speeds around 6.5 m/s and greater at 80-m height are generally considered to have suitable wind resource for wind development.




This Illinois wind map shows the wind resource at 80 meters. You can view a larger version or download a printable map (PDF 778 KB) Download Adobe Reader.

Additionally, a national dataset was produced of estimated gross capacity factor (not adjusted for losses) at a spatial resolution of 200 m and heights of 80 m and 100 m. Using AWS Truewind's gross capacity factor data, NREL estimated the windy land area and wind energy potential in various capacity factor ranges for each state. The table (Excel 108 KB) lists the estimates of windy land area with a gross capacity of 30% and greater at 80-m height and the wind energy potential from development of the "available" windy land area after exclusions.




The chart shows the potential megawatts of rated capacity above a given gross capacity factor (without losses) at 80-m and 100-m heights above ground. You can view a larger version or download a printable map (PDF 104 KB) Download Adobe Reader.

The "Installed Capacity" is the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" is the estimated annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. NREL reduced the wind potential estimates by excluding areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail). Additional wind potential tables (Excel 208 KB) are included for various capacity factor ranges.

The chart to the right shows the wind resource potential above a given gross capacity factor at both 80-m and 100-m heights for Illinois.

These maps and wind potential estimates resulted from a collaborative project between the National Renewable Energy Laboratory and AWS Truewind of Albany, New York. This is the first comprehensive update of the wind energy potential by state since 1993. NREL has worked with AWS Truewind for almost a decade on updating wind resource maps for 36 states and producing validated maps for 50-meter height above ground. U.S. Department of Energy's Wind Powering America project supported the mapping efforts. The Illinois 50-meter wind map is still available.

Note: Wind resource at a micro level can vary significantly; therefore, you should get a professional evaluation of your specific area of interest.

If you have a disability and need assistance reading the wind map, please email the Webmaster.

Printable Version

National Renewable Energy Laboratory
*Innovation for Our Energy Future*

**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 30% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 30% and greater at 80-m height above ground and the wind energy potential from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 30% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|
| State | Total ($km^2$) | Excluded[2] ($km^2$) | Available ($km^2$) | Available % of State | % of Total Windy Land Excluded | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Alabama | 80.4 | 56.7 | 23.6 | 0.02% | 70.6% | 118.2 | 333 |
| Arizona | 4,545.0 | 2,364.1 | 2,180.8 | 0.74% | 52.0% | 10,904.1 | 30,616 |
| Arkansas | 4,663.2 | 2,823.2 | 1,840.1 | 1.34% | 60.5% | 9,200.3 | 26,906 |
| California | 26,901.3 | 20,079.2 | 6,822.0 | 1.67% | 74.6% | 34,110.2 | 105,646 |
| Colorado | 95,830.4 | 18,386.5 | 77,443.9 | 28.73% | 19.2% | 387,219.5 | 1,288,490 |
| Connecticut | 31.4 | 26.1 | 5.3 | 0.04% | 83.1% | 26.5 | 73 |
| Delaware | 36.6 | 34.7 | 1.9 | 0.04% | 94.8% | 9.5 | 26 |
| Florida | 9.6 | 9.5 | 0.1 | 0.00% | 99.2% | 0.4 | 1 |
| Georgia | 281.3 | 255.3 | 26.0 | 0.02% | 90.7% | 130.1 | 380 |
| Idaho | 13,420.4 | 9,805.3 | 3,615.1 | 1.67% | 73.1% | 18,075.6 | 52,118 |
| Illinois | 70,763.6 | 20,787.1 | 49,976.4 | 34.25% | 29.4% | 249,882.1 | 763,529 |
| Indiana | 46,255.2 | 16,609.7 | 29,645.5 | 31.63% | 35.9% | 148,227.5 | 443,912 |
| Iowa | 134,900.1 | 20,757.3 | 114,142.8 | 78.32% | 15.4% | 570,714.2 | 2,026,340 |
| Kansas | 211,861.3 | 21,387.1 | 190,474.2 | 89.38% | 10.1% | 952,370.9 | 3,646,590 |
| Kentucky | 48.7 | 36.6 | 12.1 | 0.01% | 75.1% | 60.6 | 173 |
| Louisiana | 125.5 | 43.6 | 82.0 | 0.07% | 34.7% | 409.8 | 1,100 |
| Maine | 6,026.5 | 3,776.2 | 2,250.2 | 2.69% | 62.7% | 11,251.2 | 33,779 |
| Maryland | 567.7 | 271.1 | 296.6 | 1.18% | 47.8% | 1,482.9 | 4,269 |

National Renewable Energy Laboratory

*Innovation for Our Energy Future*

**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 30% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 30% and greater at 80-m height above ground and the wind energy potential from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 30% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|
| State | Total ($km^2$) | Excluded[2] ($km^2$) | Available ($km^2$) | Available % of State | % of Total Windy Land Excluded | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Massachusetts | 1,709.0 | 1,503.4 | 205.6 | 0.99% | 88.0% | 1,028.0 | 3,323 |
| Michigan | 19,761.3 | 7,952.9 | 11,808.5 | 7.85% | 40.2% | 59,042.3 | 169,221 |
| Minnesota | 121,884.7 | 24,030.6 | 97,854.1 | 44.83% | 19.7% | 489,270.6 | 1,679,480 |
| Mississippi | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Missouri | 69,676.8 | 14,805.8 | 54,871.0 | 30.39% | 21.2% | 274,355.1 | 810,619 |
| Montana | 232,768.6 | 43,967.7 | 188,800.9 | 49.60% | 18.9% | 944,004.4 | 3,228,620 |
| Nebraska | 199,627.8 | 16,028.0 | 183,599.7 | 91.64% | 8.0% | 917,998.7 | 3,540,370 |
| Nevada | 5,873.6 | 4,424.2 | 1,449.4 | 0.51% | 75.3% | 7,247.1 | 20,823 |
| New Hampshire | 1,663.8 | 1,236.8 | 427.1 | 1.78% | 74.3% | 2,135.4 | 6,706 |
| New Jersey | 280.8 | 254.5 | 26.4 | 0.14% | 90.6% | 131.8 | 373 |
| New Mexico | 111,445.8 | 13,029.1 | 98,416.7 | 31.25% | 11.7% | 492,083.3 | 1,644,970 |
| New York | 17,705.8 | 12,549.6 | 5,156.3 | 4.10% | 70.9% | 25,781.3 | 74,695 |
| North Carolina | 1,155.6 | 994.1 | 161.5 | 0.13% | 86.0% | 807.7 | 2,395 |
| North Dakota | 182,374.6 | 28,335.4 | 154,039.2 | 84.25% | 15.5% | 770,195.8 | 2,983,750 |
| Ohio | 17,189.9 | 6,205.9 | 10,983.9 | 10.28% | 36.1% | 54,919.7 | 151,881 |
| Oklahoma | 123,243.6 | 19,879.2 | 103,364.4 | 57.10% | 16.1% | 516,822.1 | 1,788,910 |
| Oregon | 17,109.8 | 11,689.7 | 5,420.1 | 2.16% | 68.3% | 27,100.3 | 80,855 |
| Pennsylvania | 2,123.5 | 1,462.1 | 661.4 | 0.56% | 68.9% | 3,307.2 | 9,673 |

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**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 30% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 30% and greater at 80-m height above ground and the wind energy potential from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 30% Gross Capacity Factor at 80m | | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|---|
| State | Total ($km^2$) | Excluded[2] ($km^2$) | Available ($km^2$) | Available % of State | % of Total Windy Land Excluded | | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Rhode Island | 74.0 | 64.7 | 9.3 | 0.35% | 87.4% | | 46.6 | 153 |
| South Carolina | 102.8 | 65.8 | 37.0 | 0.05% | 64.0% | | 185.0 | 504 |
| South Dakota | 193,828.3 | 17,345.8 | 176,482.5 | 88.36% | 8.9% | | 882,412.4 | 3,411,690 |
| Tennessee | 359.9 | 298.1 | 61.9 | 0.06% | 82.8% | | 309.3 | 900 |
| Texas | 435,638.6 | 55,332.7 | 380,305.9 | 55.54% | 12.7% | | 1,901,529.7 | 6,527,850 |
| Utah | 5,273.6 | 2,652.8 | 2,620.7 | 1.19% | 50.3% | | 13,103.7 | 37,104 |
| Vermont | 2,569.6 | 1,979.8 | 589.7 | 2.39% | 77.0% | | 2,948.7 | 9,163 |
| Virginia | 1,567.2 | 1,208.5 | 358.7 | 0.35% | 77.1% | | 1,793.3 | 5,395 |
| Washington | 11,932.6 | 8,236.9 | 3,695.7 | 2.12% | 69.0% | | 18,478.5 | 55,550 |
| West Virginia | 1,495.2 | 1,118.6 | 376.6 | 0.60% | 74.8% | | 1,883.2 | 5,820 |
| Wisconsin | 30,228.8 | 9,477.3 | 20,751.4 | 14.29% | 31.4% | | 103,757.1 | 300,136 |
| Wyoming | 146,166.2 | 35,751.7 | 110,414.5 | 43.58% | 24.5% | | 552,072.6 | 1,944,340 |
| | | | | | | | | |
| US 48 Total | 2,571,180 | 479,391 | 2,091,789 | 26.89% | 18.6% | | 10,458,945 | 36,919,551 |

[1] NREL's wind potential estimates were based on maps produced by AWS Truewind using the MesoMap® system.

[2] Excluded lands include protected lands (national parks, wilderness, etc.), incompatible land use (urban, airports, wetland, and water features), and other considerations. See Table 1 for full listing.

[3] Assumes 5 $MW/km^2$ of installed nameplate capacity

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**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 35% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 35% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 35% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|
| State | Total ($km^2$) | Excluded[2] ($km^2$) | Available ($km^2$) | Available % of State | % of Total Windy Land Excluded | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Alabama | 15.9 | 13.3 | 2.6 | 0.00% | 83.4% | 13.2 | 42 |
| Arizona | 611.7 | 417.3 | 194.4 | 0.07% | 68.2% | 972.1 | 3,100 |
| Arkansas | 1,130.0 | 687.5 | 442.5 | 0.32% | 60.8% | 2,212.5 | 7,215 |
| California | 11,456.4 | 8,650.1 | 2,806.3 | 0.69% | 75.5% | 14,031.7 | 49,073 |
| Colorado | 64,296.7 | 10,914.6 | 53,382.1 | 19.80% | 17.0% | 266,910.6 | 945,484 |
| Connecticut | 1.3 | 1.1 | 0.2 | 0.00% | 84.8% | 1.0 | 3 |
| Delaware | 1.2 | 1.2 | 0.0 | 0.00% | 100.0% | 0.0 | 0 |
| Florida | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Georgia | 99.2 | 93.0 | 6.1 | 0.00% | 93.8% | 30.6 | 101 |
| Idaho | 4,652.2 | 4,006.9 | 645.3 | 0.30% | 86.1% | 3,226.3 | 10,938 |
| Illinois | 30,709.2 | 6,585.0 | 24,124.1 | 16.53% | 21.4% | 120,620.7 | 391,737 |
| Indiana | 12,238.0 | 2,436.9 | 9,801.1 | 10.46% | 19.9% | 49,005.4 | 160,827 |
| Iowa | 111,938.1 | 15,455.1 | 96,483.0 | 66.20% | 13.8% | 482,414.9 | 1,772,460 |
| Kansas | 200,304.4 | 17,463.9 | 182,840.5 | 85.80% | 8.7% | 914,202.3 | 3,535,480 |
| Kentucky | 6.9 | 5.4 | 1.5 | 0.00% | 78.0% | 7.6 | 24 |
| Louisiana | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Maine | 2,134.3 | 1,444.3 | 690.0 | 0.82% | 67.7% | 3,450.0 | 11,961 |
| Maryland | 103.8 | 66.1 | 37.7 | 0.15% | 63.7% | 188.6 | 607 |

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**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 35% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 35% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 35% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|
| State | Total (km²) | Excluded[2] (km²) | Available (km²) | Available % of State | % of Total Windy Land Excluded | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Massachusetts | 722.5 | 615.3 | 107.2 | 0.52% | 85.2% | 536.0 | 1,945 |
| Michigan | 4,182.6 | 1,850.3 | 2,332.3 | 1.55% | 44.2% | 11,661.6 | 37,619 |
| Minnesota | 92,937.6 | 15,156.2 | 77,781.4 | 35.64% | 16.3% | 388,907.2 | 1,392,590 |
| Mississippi | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Missouri | 19,137.3 | 3,353.8 | 15,783.4 | 8.74% | 17.5% | 78,917.2 | 256,650 |
| Montana | 174,285.7 | 30,585.0 | 143,700.6 | 37.75% | 17.5% | 718,503.2 | 2,581,510 |
| Nebraska | 191,998.9 | 14,259.8 | 177,739.1 | 88.72% | 7.4% | 888,695.6 | 3,455,480 |
| Nevada | 1,436.2 | 1,178.1 | 258.1 | 0.09% | 82.0% | 1,290.4 | 4,263 |
| New Hampshire | 837.3 | 644.8 | 192.5 | 0.80% | 77.0% | 962.3 | 3,405 |
| New Jersey | 55.6 | 52.6 | 3.0 | 0.02% | 94.6% | 15.0 | 47 |
| New Mexico | 71,483.6 | 6,483.3 | 65,000.3 | 20.64% | 9.1% | 325,001.5 | 1,170,490 |
| New York | 3,972.1 | 3,011.1 | 961.1 | 0.76% | 75.8% | 4,805.3 | 15,826 |
| North Carolina | 401.2 | 361.9 | 39.3 | 0.03% | 90.2% | 196.3 | 695 |
| North Dakota | 179,145.7 | 27,138.8 | 152,006.9 | 83.13% | 15.1% | 760,034.4 | 2,954,260 |
| Ohio | 969.2 | 736.6 | 232.6 | 0.22% | 76.0% | 1,163.0 | 3,662 |
| Oklahoma | 91,844.2 | 11,709.4 | 80,134.9 | 44.26% | 12.7% | 400,674.3 | 1,457,740 |
| Oregon | 7,098.1 | 5,479.2 | 1,618.9 | 0.64% | 77.2% | 8,094.3 | 27,517 |
| Pennsylvania | 526.6 | 364.4 | 162.2 | 0.14% | 69.2% | 810.9 | 2,685 |

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**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 35% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 35% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 35% Gross Capacity Factor at 80m | | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|---|
| State | Total ($km^2$) | Excluded[2] ($km^2$) | Available ($km^2$) | Available % of State | % of Total Windy Land Excluded | | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Rhode Island | 26.1 | 20.6 | 5.5 | 0.21% | 78.8% | | 27.6 | 99 |
| South Carolina | 9.4 | 8.8 | 0.6 | 0.00% | 93.2% | | 3.2 | 11 |
| South Dakota | 184,910.2 | 14,435.9 | 170,474.4 | 85.35% | 7.8% | | 852,371.8 | 3,325,230 |
| Tennessee | 114.0 | 101.1 | 12.9 | 0.01% | 88.7% | | 64.5 | 220 |
| Texas | 302,837.0 | 30,799.9 | 272,037.1 | 39.73% | 10.2% | | 1,360,185.5 | 4,989,570 |
| Utah | 861.6 | 558.1 | 303.4 | 0.14% | 64.8% | | 1,517.1 | 4,939 |
| Vermont | 1,042.2 | 803.2 | 239.0 | 0.97% | 77.1% | | 1,195.2 | 4,243 |
| Virginia | 647.4 | 524.5 | 122.9 | 0.12% | 81.0% | | 614.5 | 2,070 |
| Washington | 5,952.6 | 4,693.0 | 1,259.6 | 0.72% | 78.8% | | 6,298.1 | 21,289 |
| West Virginia | 693.4 | 529.4 | 164.0 | 0.26% | 76.3% | | 820.2 | 2,822 |
| Wisconsin | 6,239.9 | 2,091.8 | 4,148.1 | 2.86% | 33.5% | | 20,740.5 | 66,171 |
| Wyoming | 113,309.6 | 26,892.9 | 86,416.6 | 34.11% | 23.7% | | 432,083.1 | 1,601,240 |
| | | | | | | | | |
| US 48 Total | 1,897,377 | 272,682 | 1,624,695 | 20.88% | 14.4% | | 8,123,477 | 30,273,339 |

[1] NREL's wind potential estimates were based on maps produced by AWS Truewind using their MesoMap® system.

[2] Excluded lands include protected lands (national parks, wilderness, etc.), incompatible land use (urban, airports, wetland, and water features), and other considerations. See Table 1 for full listing.

[3] Assumes 5 $MW/km^2$ of installed nameplate capacity

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**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 40% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 40% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 40% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|
| State | Total (km²) | Excluded[2] (km²) | Available (km²) | Available % of State | % of Total Windy Land Excluded | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Alabama | 3.2 | 3.2 | 0.0 | 0.00% | 100.0% | 0.0 | 0 |
| Arizona | 47.9 | 40.4 | 7.4 | 0.00% | 84.5% | 37.2 | 135 |
| Arkansas | 194.6 | 145.7 | 48.9 | 0.04% | 74.9% | 244.4 | 901 |
| California | 4,035.0 | 2,986.3 | 1,048.7 | 0.26% | 74.0% | 5,243.5 | 20,543 |
| Colorado | 33,040.8 | 6,225.2 | 26,815.6 | 9.95% | 18.8% | 134,078.1 | 507,885 |
| Connecticut | 0.0 | 0.0 | 0.0 | 0.00% | 0.0% | 0.2 | 1 |
| Delaware | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Florida | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Georgia | 27.2 | 26.0 | 1.2 | 0.00% | 95.6% | 6.0 | 22 |
| Idaho | 2,121.0 | 1,948.8 | 172.2 | 0.08% | 91.9% | 861.0 | 3,294 |
| Illinois | 1,001.5 | 101.2 | 900.2 | 0.62% | 10.1% | 4,501.2 | 15,942 |
| Indiana | 1,396.6 | 210.4 | 1,186.3 | 1.27% | 15.1% | 5,931.4 | 21,387 |
| Iowa | 72,119.2 | 8,400.1 | 63,719.0 | 43.72% | 11.6% | 318,595.1 | 1,232,860 |
| Kansas | 163,169.6 | 11,104.9 | 152,064.8 | 71.36% | 6.8% | 760,323.9 | 3,024,280 |
| Kentucky | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Louisiana | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Maine | 856.8 | 633.3 | 223.4 | 0.27% | 73.9% | 1,117.2 | 4,411 |
| Maryland | 6.0 | 3.6 | 2.4 | 0.01% | 60.0% | 12.0 | 43 |

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**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 40% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 40% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 40% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|
| State | Total ($km^2$) | Excluded[2] ($km^2$) | Available ($km^2$) | Available % of State | % of Total Windy Land Excluded | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Massachusetts | 267.1 | 203.0 | 64.1 | 0.31% | 76.0% | 320.7 | 1,237 |
| Michigan | 432.2 | 353.4 | 78.8 | 0.05% | 81.8% | 394.0 | 1,420 |
| Minnesota | 41,476.1 | 6,439.9 | 35,036.2 | 16.05% | 15.5% | 175,181.0 | 681,616 |
| Mississippi | 0.0 | 0.0 | 0.0 | 0.00% | N/A | 0.0 | 0 |
| Missouri | 1,507.3 | 144.1 | 1,363.2 | 0.76% | 9.6% | 6,815.9 | 24,672 |
| Montana | 98,308.5 | 18,737.2 | 79,571.4 | 20.91% | 19.1% | 397,856.8 | 1,529,560 |
| Nebraska | 165,445.2 | 10,012.2 | 155,433.0 | 77.58% | 6.1% | 777,165.0 | 3,084,090 |
| Nevada | 267.1 | 223.2 | 43.9 | 0.02% | 83.6% | 219.6 | 810 |
| New Hampshire | 421.6 | 340.6 | 81.0 | 0.34% | 80.8% | 404.8 | 1,593 |
| New Jersey | 0.4 | 0.4 | 0.0 | 0.00% | 100.0% | 0.0 | 0 |
| New Mexico | 39,573.8 | 2,424.7 | 37,149.1 | 11.80% | 6.1% | 185,745.3 | 712,877 |
| New York | 934.8 | 801.3 | 133.4 | 0.11% | 85.7% | 667.1 | 2,560 |
| North Carolina | 149.4 | 132.2 | 17.2 | 0.01% | 88.5% | 86.0 | 337 |
| North Dakota | 160,496.5 | 21,932.3 | 138,564.2 | 75.78% | 13.7% | 692,821.1 | 2,728,620 |
| Ohio | 45.1 | 44.9 | 0.2 | 0.00% | 99.6% | 0.8 | 3 |
| Oklahoma | 55,593.0 | 6,038.4 | 49,554.6 | 27.37% | 10.9% | 247,773.2 | 952,678 |
| Oregon | 2,969.1 | 2,527.8 | 441.3 | 0.18% | 85.1% | 2,206.6 | 8,439 |
| Pennsylvania | 85.0 | 55.3 | 29.6 | 0.03% | 65.1% | 148.2 | 546 |

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**Estimates of Windy[1] Land Area and Wind Energy Potential by State for Areas >= 40% Capacity Factor at 80m**

*February 4, 2010*

AWS Truewind

These estimates show, for each of the 48 contiguous states and the entire United States, the windy land area with a gross capacity factor (without losses) of 40% and greater at 80-m height above ground and the wind energy potential that could be possible from development of the "available" windy land area after exclusions. The "Installed Capacity" shows the potential megawatts (MW) of rated capacity that could be installed on the available windy land area, and the "Annual Generation" shows annual wind energy generation in gigawatt-hours (GWh) that could be produced from the installed capacity. AWS Truewind, LLC developed the wind resource data for windNavigator® (http://navigator.awstruewind.com) with a spatial resolution of 200 m. NREL produced the estimates of windy land area and windy energy potential, including filtering the estimates to exclude areas unlikely to be developed such as wilderness areas, parks, urban areas, and water features (see Wind Resource Exclusion Table for more detail).

| | Windy Land Area >= 40% Gross Capacity Factor at 80m | | | | | Wind Energy Potential | |
|---|---|---|---|---|---|---|---|
| State | Total ($km^2$) | Excluded[2] ($km^2$) | Available ($km^2$) | Available % of State | % of Total Windy Land Excluded | Installed Capacity[3] (MW) | Annual Generation (GWh) |
| Rhode Island | 18.7 | 15.8 | 2.8 | 0.11% | 84.8% | 14.2 | 55 |
| South Carolina | 0.3 | 0.1 | 0.2 | 0.00% | 42.9% | 0.8 | 3 |
| South Dakota | 163,280.6 | 10,004.1 | 153,276.5 | 76.74% | 6.1% | 766,382.5 | 3,039,460 |
| Tennessee | 33.6 | 30.2 | 3.4 | 0.00% | 90.0% | 16.8 | 66 |
| Texas | 180,822.4 | 15,425.8 | 165,396.6 | 24.15% | 8.5% | 826,982.8 | 3,240,930 |
| Utah | 120.7 | 93.0 | 27.8 | 0.01% | 77.0% | 138.8 | 511 |
| Vermont | 464.0 | 362.0 | 102.0 | 0.41% | 78.0% | 510.1 | 2,013 |
| Virginia | 227.9 | 196.7 | 31.2 | 0.03% | 86.3% | 156.1 | 592 |
| Washington | 2,889.1 | 2,571.4 | 317.6 | 0.18% | 89.0% | 1,588.2 | 6,052 |
| West Virginia | 284.4 | 228.4 | 56.1 | 0.09% | 80.3% | 280.3 | 1,066 |
| Wisconsin | 375.6 | 326.8 | 48.8 | 0.03% | 87.0% | 243.8 | 872 |
| Wyoming | 70,268.4 | 17,786.5 | 52,481.9 | 20.72% | 25.3% | 262,409.5 | 1,043,890 |
| | | | | | | | |
| US 48 Total | 1,264,777 | 149,281 | 1,115,496 | 14.34% | 11.8% | 5,577,481 | 21,898,275 |

[1] NREL's wind potential estimates were based on maps produced by AWS Truewind using their MesoMap® system.

[2] Excluded lands include protected lands (national parks, wilderness, etc.), incompatible land use (urban, airports, wetland, and water features), and other considerations. See Table 1 for full listing.

[3] Assumes 5 $MW/km^2$ of installed nameplate capacity

# EXHIBIT B

**3. Refer to page 7 of the Kollen Testimony, lines 4-9. Identify the cases Mr. Kollen relied upon in making the statement regarding the demonstration by a utility that a proposed resource is the least-cost resource, that, "[t]his is the traditional standard applied by <u>this Commission</u> and other state commission...." (Emphasis added).**

**RESPONSE:**

Mr. Kollen has not performed a comprehensive review of all Commission orders, but has identified the following orders and Staff Reports that illustrate the Commission's reliance on the traditional least cost standard as the selection criterion for generation and transmission alternatives.

In Case No. 92-005, KU's Application for a CCN to construct a scrubber at Ghent 1, the Commission approved KU's request and relied on KU's determination of "an optimal compliance plan by using a minimum net present value of revenue requirement criteria over a 30-year period," which was the "least costly alternative."

In Case No. 92-112, EKPC's Application for a CCN to construct certain Smith CTs, the Commission found that "East Kentucky requires 300 megawatts of peaking capacity by 1995 and constructing CTs at the J.K. Smith Power Station without purchasing additional capacity from other sources is the least cost alternative available to East Kentucky to meet this requirement."

In Case Nos. 2005-00467 and 2005-00472, LG&E's and KU's Applications to construct certain transmission facilities, the Commission authorized the least cost alternative despite other factors that may have favored alternative routes.

In Case No. 2006-00206, KU's Application to amend its CPCN and its environmental compliance plans to delay construction of the Ghent 2 SCR and to remove it from the approved ECR compliance plan. The Commission authorized KU's requests and concurred with KU that "construction at this time was no longer the least-cost option" and stated that "[i]f at a future date KU determines that constructing the Ghent Unit 2 SCR is the least-cost alternative it will apply for a new CPCN and request authority to recover the costs through its environmental surcharge."

In Case No. 2007-00375, EKPC's Application for a CPCN to construct an FGD at Spurlock 2, the Commission approved EKPC's request and relied on EKPC's studies that determined "this course of action continues to be the least-cost option available."

In addition, a review of Staff Reports on recent IRP filings by LG&E, KU, and EKPC indicate that these utilities rely on the traditional least cost standard in the selection of supply side and demand side options. For example, in Case No. 2008-00148, the 2008 IRP for LG&E and KU, the Staff Report described the Companies' IRP as follows: "LG&E/KU examine the economics and practicality of supply-side and demand-side options in order to forecast the least-cost options available to meet forecasted customer needs" and summarized the final step in the LG&E/KU resource planning process as "development of the optimal economic plan from the available resource options." More specifically, the Staff noted that "LG&E/KU developed their ultimate resource assessment and acquisition plan based on minimizing expected Present Value Revenue Requirements (PVRR) over a 30-year planning horizon."

As another example of a Staff Report on a recent IRP filing by EKPC in Case No. 2006-00471, the Staff stated that "[t]he goal of the Commission in establishing the IRP process was to ensure that all reasonable options for the future supply of electricity were being examined and pursued and that ratepayers were being provided a reliable supply of electricity at the lowest possible cost." The Staff

Report also stated that its "goals are to ensure that: . . . [t]he selected plan represent the least-cost, least-risk plan for the end use customers served by EKPC and its member cooperatives."