

STATE OF WISCONSIN

**BEFORE THE PUBLIC SERVICE COMMISSION OF
WISCONSIN**

**Application of Wisconsin Power and Light Company for Issuance
of a Certificate of Public Convenience and Necessity for
Construction and Placement in Operation of Docket No. 6680-CE-
170 an Approximately 300 MW Coal-Fired Baseload Facility and
an Application for Approval of Fixed Financial Parameters and
Capital Cost Rate-Making Principles for the Baseload Facility**

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) **DOCKET NO.**
) **6680-CE-170**
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**Direct Testimony of
Robert M. Fagan
Synapse Energy Economics, Inc.**

On Behalf of Clean Wisconsin

August 11, 2008

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13 **List of Exhibits**

14

- 15 Exhibit__(RMF-1): Resume of Robert Fagan
- 16 Exhibit__(RMF-2): U.S. Department of Energy / National Renewable Energy
- 17 Laboratory “Wind Powering America” Update Presentation, June
- 18 11, 2008
- 19 Exhibit__(RMF-3): U.S. Department of Energy “Annual Report on U.S. Wind Power
- 20 Installation, Cost and Performance Trends: 2007”. May, 2008.
- 21 Exhibit__(RMF-4): Analysis and Report of Lanzalotta and Associates.

22

I. INTRODUCTION, SUMMARY AND RECOMMENDATIONS

1

2 **Q. PLEASE STATE YOUR NAME, OCCUPATION, AND BUSINESS**
3 **ADDRESS.**

4 A. My name is Robert M. Fagan. I am a Senior Associate at Synapse Energy
5 Economics, Inc., 22 Pearl Street, Cambridge, Massachusetts, 02139.

6 **Q. PLEASE SUMMARIZE YOUR PROFESSIONAL EXPERIENCE AND**
7 **EDUCATIONAL BACKGROUND.**

8 A. I am an energy economics analyst and mechanical engineer with 20 years of
9 experience in the energy industry. My work has focused on myriad electric power
10 industry issues, including economic and technical analysis of competitive
11 electricity markets development, electric power transmission pricing structures,
12 examination of utility-scale wind power potential and integration, and assessment
13 and implementation of demand-side resource alternatives. I hold an M.A. from
14 Boston University in Energy and Environmental Studies (1992) and a B.S. from
15 Clarkson University in Mechanical Engineering (1981). Details of my experience
16 are provided in my resume as Exhibit___(RMF-1).

17 **Q. ON WHOSE BEHALF ARE YOU TESTIFYING?**

18 A. I am testifying on behalf of Clean Wisconsin.

19 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

1 A. The purpose of my testimony is to examine and critique certain aspects of
2 Wisconsin Power and Light's (WPL) application for a certificate of need for the
3 proposed Nelson Dewey 3 (NED 3) coal plant. I address the following issues:
4 1) the dramatic improvements in utility-scale wind economics that have
5 occurred over the past decade and are insufficiently addressed in WPL's
6 analysis;
7 2) the Midwest region's increased reliance on wind to economically meet a
8 greater share of energy requirements;
9 3) the relatively small role that wind is relegated to in WPL's resource plan;
10 4) WPL's overly conservative treatment of capacity credit for wind;
11 5) the evolution of the Midwest ISO's (MISO) regional power system
12 coordination responsibilities and the resulting impact on WPL's access to
13 capacity, energy, ancillary services and Midwest region wind resources;
14 and
15 6) the unsupported economic benefit of transmission import increase that
16 WPL ascribes to the proposed NED 3 plant, based on WPL's flawed
17 analysis of transmission, energy and financial transmission rights (FTR)
18 market benefits.

19 **Q. PLEASE SUMMARIZE YOUR CONCLUSIONS.**

20 A. I conclude that:

21 1. **Dramatic Improvements in Wind Turbine Technology and Economics**
22 **Have Led to A Much Greater Level of Wind Resource Used to Meet**
23 **Energy Needs in the Midwest.** Technological improvements and scale

1 economies, along with the Federal production tax credit, have resulted in
2 significant increases in utility-scale (i.e., transmission grid connected) wind
3 power resources being installed throughout the Midwest and other regions of
4 the US over the past decade. Wind power is now economical when compared
5 to new and some existing conventional fossil-fueled generation resources.
6 Wind resource integration onto the regional transmission grid remains well
7 below the technical potential for the grid to absorb the varying output nature
8 of the resource. US Department of Energy (DOE) analyses highlight the
9 improved economics and performance of wind resources. The Midwest ISO
10 now carefully studies and plans for future scenarios for the region that involve
11 up to 20 percent or even 30 percent of energy (MWh) needs being met by
12 wind resources by 2020, or thereabouts. In contrast, WPL's base resource
13 plan includes wind power contributing just 4% of energy (MWh) requirements
14 by 2025.

15 **2. WPL Underestimates Wind's Contribution To an Economical Resource**

16 **Plan.** WPL's base resource plan contains just 300 MW of wind resource,
17 meeting 4% of WPL's requirements in 2025. Even in 2010, this level of wind
18 meets only 5.6% of WPL's energy needs. As Mr. Schlissel sets out in his
19 testimony, WPL has not even examined the financial impact of considering
20 NED 3 based on the correct cost estimates that WPL, itself, provides; thus,
21 WPL's current plan includes too low a level of economical wind energy
22 resources. WPL does not support its failure to allow for any wind energy to
23 be part of the resource plan after 2010. At levels of wind penetration based
24 upon current estimates of technical penetration capability, i.e., meeting 20 or

1 25 percent of energy needs, WPL's wind resource level would be more than
2 1,000 MW greater than its current plan. Meeting 25% of energy needs in
3 2025 would require 1,500 MW more installed wind than WPL has in its base
4 resource plan. In general, energy from new wind resources assumed in WPL's
5 projections is too low, especially when compared to adjacent regions where
6 wind energy projections are much higher.

7 Wind is now a cost effective alternative to fossil fuel generation.
8 Wind costs less than energy from new coal resources (especially when
9 considering the effects of anticipated carbon emission regulation), and WPL
10 should focus efforts to install or purchase as much wind as they can (after
11 maximizing energy efficiency and demand response resource implementation)
12 prior to considering conventional resources to meet energy needs. Because
13 WPL provided no updated cost analysis to correspond to its updated \$1.143
14 billion or greater estimated cost of NED 3, the EGEAS results provided by the
15 company are not probative of comparative costs.

16 **3. WPL Underestimates Wind Capacity Contribution to Planning Reserve.**

17 WPL uses a 10% wind capacity credit. This value is too low; MISO currently
18 uses 15% as its planning criteria for wind capacity credit.

19 **4. MISO Coordination of Energy, Capacity and Ancillary Service Resources**

20 **Allows WPL to More Efficiently Access non-WPL Territory Supply**
21 **Resources and Incorporate Greater Levels of Wind Power Integration.**

22 WPL's application fails to acknowledge that the coordination provided by
23 MISO has helped to allow the MISO region planning reserve requirement to
24 be reduced to roughly 15%; and will allow WPL to economically access and

1 integrate more wind as a system resource, and to more efficiently access
2 economical energy, capacity and ancillary service resources. MISO's
3 imminent ability to "balance" the energy needs of the entire MISO region –
4 upon commencement of the ancillary service markets in MISO in September
5 2008 - allows for greater efficiency and economy of wind integration that is
6 not accounted for in WPL's analysis.

7 **5. WPL Exaggerates the Value of Increased Import Capacity from NED 3.**

8 WPL witnesses Mr. Vesperman and Mr. Bauer's analysis of the value of
9 increased import capability due to NED 3 is fundamentally flawed and vastly
10 overstated. WPL's testimony fails to properly consider the relevant factors
11 and circumstances of how transmission congestion affects the Wisconsin
12 Upper Michigan (WUMS) narrowly constrained area (NCA). First, the WPL
13 witnesses improperly assign 625 MW of increased import benefit to NED 3.
14 Next, they incorrectly compute the resulting economic benefit by failing to
15 properly consider the way congestion affects Wisconsin. Wisconsin has
16 actually had very little exposure to the financial effects of transmission
17 congestion since MISO's inception because of the hedge provided for the
18 WUMS NCA, and because of the existence of FTRs allocated to Wisconsin.
19 Even without the expanded congestion cost hedge (ECCH), which expires in
20 2010, FTRs have provided a financial hedge and have mitigated much of the
21 congestion costs that have arisen. Looking forward, which WPL does not do
22 in its analysis, the new Arrowhead-Weston 345 kV line, along with the new
23 Paddock-Rockdale 345 kV line and other ATC transmission improvements
24 separate from NED 3 will further increase import capacity and reduce

1 congestion impacts on Wisconsin. Any NED 3 effects would be incremental
2 to these effects. This was not accounted for in WPL's analysis, which
3 therefore does not contain a reasonable incremental benefit from NED 3.

4 **Q. WHAT DO YOU RECOMMEND?**

5 A. In my opinion, WPL's application for a Certificate of Public Convenience and
6 Necessity has not shown the proposed coal plant to be a reasonable alternative to
7 meeting energy and capacity needs. WPL's direct testimony provides very little
8 useful information regarding the comparative cost-effectiveness of different
9 resources because WPL failed to use its own updated cost data in the modeling
10 runs it purports to rely upon. Based upon updated cost information and more
11 reasonable assumptions for wind generation, building or buying more wind-
12 powered supplies is a more economical approach to meeting incremental energy
13 supply needs than building a new coal plant after all cost-effective energy
14 efficiency and demand response resources are applied.

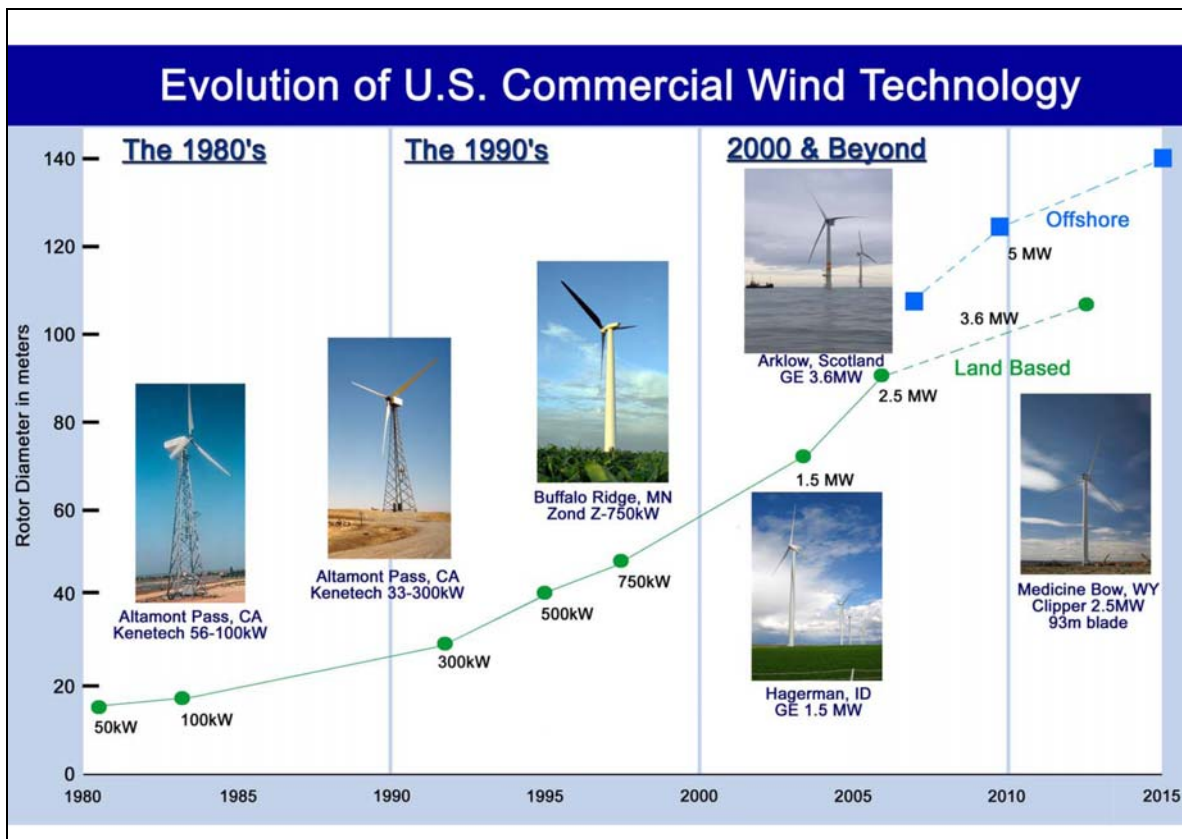
15 **II. WIND POWER TRENDS**

16 **Q. PLEASE SUMMARIZE THE CURRENT STATE OF UTILITY-SCALE**
17 **WIND TURBINE GENERATOR TECHNOLOGY AND ECONOMIC**
18 **ATTRACTIVENESS.**

19 A. Electric utility grid-scale wind technology and economic attractiveness has
20 improved dramatically in the past few decades. This has resulted in increased
21 commercialization of wind power, as technological improvements have led to
22 decreasing costs of energy from wind facilities and improved reliability and thus

1 increased attractiveness as a utility supply resource. The decreasing energy costs
2 from wind facilities can be traced in part to increasing economies of scale. As the
3 industry's technological sophistication advanced, the size of wind turbines
4 increased. This evolution is shown in Figure 1 below, from a US DOE / NREL
5 presentation on wind power. The full presentation, which includes other aspects
6 of development of the wind power industry, is included as Exhibit__(RMF-2).

7 **Figure 1. Evolution of US Commercial Wind Technology**

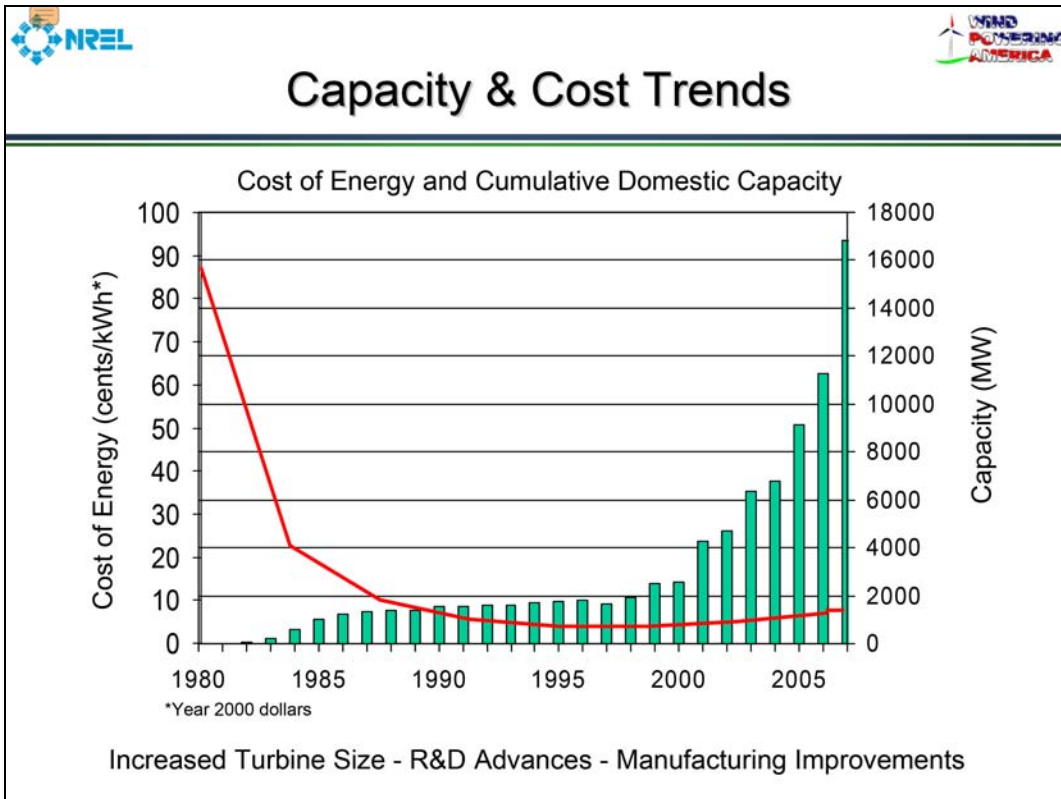


8 Source: US DOE / NREL "Wind Powering America" update, 6/11/08. Full presentation available
9 at http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=746
10 and included as Exhibit__(RMF-2).
11

12 The overall trend of decreasing unit costs and increasing cumulative
13 installed wind capacity is shown in Figure 2 below. The increasing cumulative
14 installed capacity is likely due to decreasing energy costs from wind coupled with

1 the presence of renewable portfolio standards in the US and the federal production
2 tax credit for renewable generation. According to the American Wind Energy
3 Association, as of August 5, 2008 there was 19,549 MW of installed wind
4 capacity in the US.¹

5 **Figure 2. Installed Wind Capacity and Cost Trends**



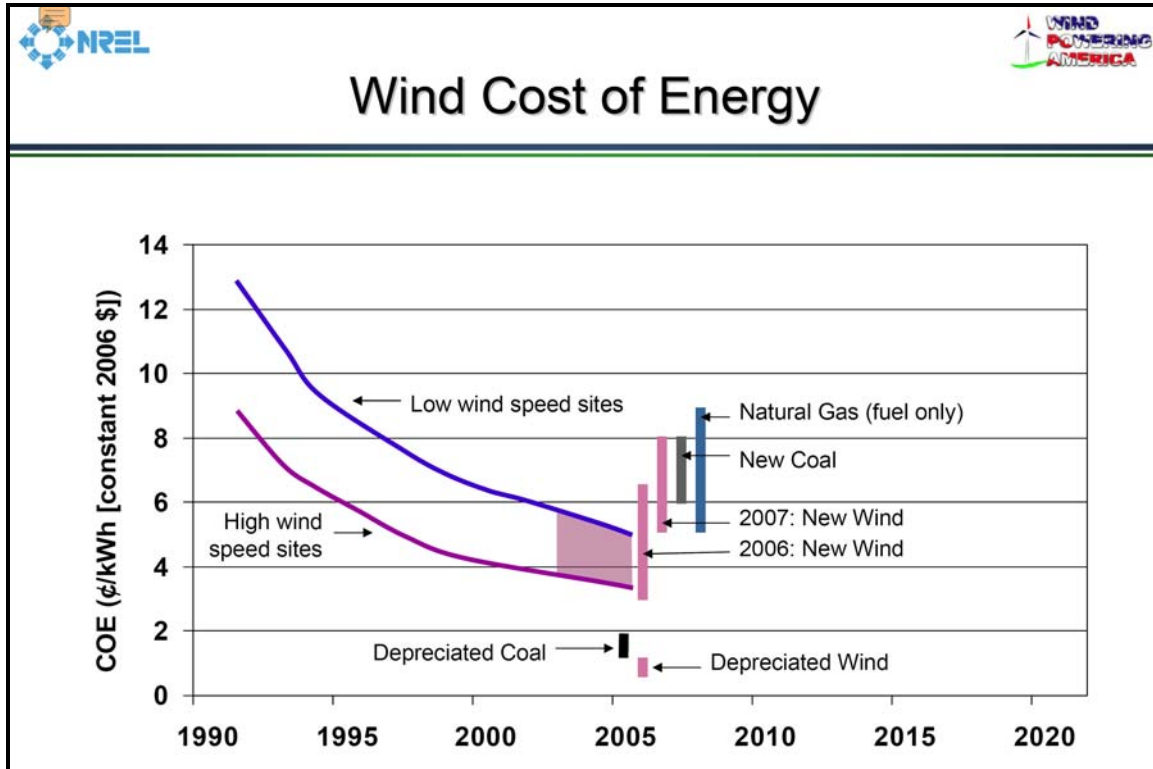
6
7 Source: US DOE / NREL “Wind Powering America” update, 6/11/08. Full presentation available
8 at http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=746
9 and included as Exhibit__ (RMF-2).

10 Wind power energy costs have seen significant declines since 1990, though they
11 have also been subject to the base material cost increases that have driven up the
12 cost of power from all sources. Figure 3 below illustrates these trends.

13

¹ <http://www.awea.org/projects>.

1 **Figure 3. Wind Cost of Energy Trends**



2
3 Source: US DOE / NREL "Wind Powering America" update, 6/11/08. Full presentation available
4 at http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=746
5 and included as Exhibit__(RMF-2)..

6 **Q. PLEASE SUMMARIZE THE SIZE, PERFORMANCE AND**
7 **RELIABILITY OF CURRENT UTILITY-SCALE WIND**
8 **TECHNOLOGIES AND POWER PLANTS.**

9 A. As seen in Figure 1 above, the size of wind turbines has steadily increased since
10 the 1980s, allowing the capture of scale economics and contributing significantly
11 to lower per unit costs. On-shore utility scale wind farms currently utilize
12 megawatt or multi-megawatt scale turbines on towers extending 60 to 100 meters
13 high. Additionally, in contrast to earlier wind turbines that utilized simple
14 asynchronous induction generator technology with little reactive power or voltage
15 control, current technology includes more advanced turbine-generator

1 components with greatly improved reactive power and voltage control and thus
2 increased reliability.² The mechanical availability of generator technologies has
3 also improved, allowing for higher energy production and reduced forced outage
4 rates. The overall impact of these improvements is the decreased cost and
5 increased energy available from wind resources.

6 **Q. HOW HAS WIND POWER PERFORMANCE FARED OVER THE PAST**
7 **DECADE?**

8 A. Wind power plants' performance has steadily increased. For example, Table 1
9 below, from a recent Lawrence Berkeley Laboratory report, indicates that
10 "Heartland" region wind project capacity factors have steadily increased, from
11 less than 30% for projects built over a decade ago, to an average greater than 40%
12 for projects from 2006. The full report is included as Exhibit___(RMF-3).

13

² "Doubly-fed asynchronous generators" and "synchronous or induction generator with full-size power converter" are two of the more advanced categories of wind generators. See page 30 of "Making Connections", by Robert Zavadil, Nicholas Miller, Abraham Ellis, and Eduard Muljadi in the November/December 2005 issue of IEEE Power and Energy.

1 **Table 1. Wind Plant Performance from LBL Report**

Table 7. Capacity-Weighted-Average 2007 Capacity Factors by Region and COD

Capacity Factor	Heartland	Texas	California	Northwest	Mountain	East	Great Lakes	Hawaii	New England
Pre-1998	28.9%	11.9%	22.3%	—	—	—	—	—	19.8%
1998-99	30.2%	28.2%	29.8%	32.1%	34.4%	—	23.4%	—	—
2000-01	33.4%	29.6%	34.5%	28.7%	29.3%	22.5%	23.5%	—	27.0%
2002-03	34.4%	33.5%	32.6%	30.5%	30.3%	28.5%	21.2%	—	—
2004-05	36.8%	34.5%	37.5%	34.0%	38.9%	26.7%	31.0%	—	—
2006	40.8%	30.4%	36.9%	31.3%	34.7%	29.4%	—	45.0%	22.1%

Sample	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW	#	MW
Pre-1998	1	26	1	34	17	870	—	—	—	—	—	—	—	—	—	—	1	6
1998-99	8	470	3	139	5	190	1	25	3	68	—	—	3	22	—	—	—	—
2000-01	10	229	7	911	1	67	3	388	4	123	6	78	2	32	—	—	1	1
2002-03	20	628	2	198	4	287	2	105	3	510	3	161	1	50	—	—	—	—
2004-05	16	1,086	4	461	3	130	5	434	3	208	2	349	1	54	—	—	—	—
2006	7	386	3	944	2	188	4	538	2	150	1	26	—	—	2	41	3	3
Total	62	2,825	20	2,686	32	1,732	15	1,440	15	1,059	12	613	7	158	2	41	5	10

2 Source: Wiser, Ryan and Mark Bolinger, Lawrence Berkeley Laboratory, US DOE Energy Efficiency and
 3 Renewable Energy, “Annual Report on U.S. Wind Power Installation, Cost and Performance Trends:
 4 2007”. May, 2008.
 5

6 **Q. HOW ARE THESE WIND INDUSTRY TRENDS RELEVANT TO THE**
 7 **APPLICATION FOR A CPCN FOR NED 3?**

8 A. These trends demonstrate that wind is highly economical in comparison to new
 9 conventional resources. These reports do not include the effect of anticipated
 10 carbon regulation on relative price differences between wind and coal resources,
 11 which can reasonably be expected to increase wind’s economic advantage. The
 12 data show that wind energy costs have declined considerably, and that
 13 performance has increased. They also illustrate the importance of fundamental
 14 scale economies and technological improvement to wind costs.

15 **III. WIND POWER IN THE WISCONSIN AND UPPER MIDWEST REGION**

16 **Q. HOW MUCH WIND POWER IS BEING CONSIDERED FOR**
 17 **COMMERCIAL OPERATION IN THE MIDWEST REGION?**

1 A. The MISO generation queue contains over 87,000 MW of active wind generation
 2 requests. In Wisconsin, the queue contains over 1,900 MW of interconnection
 3 requests. While this does not represent the amount of wind generation that will
 4 ultimately be connected to the grid, it does indicate a level of commercial
 5 potential for Midwest region wind power.

6 **Q. HOW MUCH WIND CURRENTLY EXISTS AND IS UNDER**
 7 **CONSTRUCTION IN THE MIDWEST REGION?**

8 A. Based on American Wind Energy Association data, a total of 7,389 MW of wind
 9 is either in place or under construction in the eight states. A total of 4,471 MW of
 10 installed wind now exists across the states of Wisconsin, Minnesota, Iowa,
 11 Illinois, Indiana, North and South Dakota, and Nebraska. Another 2,918 MW is
 12 under construction. So far, Wisconsin has not kept pace with neighboring states.
 13 The table below shows the quantities by state.

14 **Table 2. Wind in the Midwest**

State	Existing MW	Under Construction MW	Total Near-Term MW
Wisconsin	347	122	469
Minnesota	1,366	249	1,615
Iowa	1,375	1,427	2,802
Illinois	736	171	907
Indiana	131	400	531
North Dakota	345	327	672
South Dakota	98	141	239
Nebraska	73	81	154
Total	4,471	2,918	7,389

1 **Q. HOW MUCH WIND CAN BE INTEGRATED ONTO THE MISO-REGION**
2 **GRID, WHICH INCLUDES WPL'S TERRITORY?**

3 A. The 2006 Minnesota Department of Commerce Wind Integration Study examined
4 in detail the level of wind integration possible in the region. The report contains
5 an impressive amount of information concerning the technical factors associated
6 with integrating wind into the region's grid. One key conclusion is that up to 25%
7 of the region's annual energy needs can be reliably accommodated by wind
8 power, at relatively minimal ancillary service cost increases.³ For the WPL
9 service territory, the same percentage of wind power (i.e., meeting 25% of WPL's
10 energy requirement) in 2025 equates to approximately 1,700 to 1,800 MW,
11 depending on the average capacity factor. While this is the amount that WPL
12 should reasonably be expected to achieve, as discussed in the next section, WPL's
13 current base resource plan includes just 300 MW of wind by 2025.

14 **IV. WPL UNDERESTIMATES WIND'S POTENTIAL CONTRIBUPTION TO**
15 **AN ECONOMIC RESOURCE PLAN**

16 **Q. HOW MUCH WIND POWER DOES WPL HAVE IN ITS PLANNED**
17 **RESOURCE PORTFOLIO?**

18 A. WPL's base case plan contains 300 MW of wind, on-line in the 2008-2010 time
19 frame.

20 **Q. DOES WPL'S BASE CASE INCLUDE ANY WIND ADDITIONS AFTER**
21 **2010?**

22 A. No. WPL does describe, under its so-called "carbon reduction plan," a
23 circumstance where they would add 200 MW of wind after NED 3 comes on-line

1 in 2013⁴. The amount of wind that WPL proposes to add, even with the
2 additional 200 MW that WPL says it will add contingent upon approval of NED
3 3, does not begin to approach the economic wind potential available in the region,
4 and the level that WPL should be expected to meet by 2025 (1,700 to 1,800 MW).

5 **Q. WHAT FRACTION OF WPL’S LOAD IS PROJECTED TO BE SERVED**
6 **BY WIND RESOURCES OVER THE 2010-2025 TIME FRAME?**

7 A. In 2010, WPL’s wind resources would provide only approximately 5.6% of its
8 energy requirements. By 2025, if WPL does not add any more wind, this fraction
9 would decline to 4.0%. If WPL were to add 200 MW over the 2013-2014 time
10 frame, as its so-called “carbon reduction plan” speculates, WPL’s fraction in 2014
11 would increase to only 9.0%.

12 **Q. WHAT LEVEL OF WIND RESOURCE PENETRATION AS A SHARE OF**
13 **RETAIL ENERGY REQUIREMENTS IS REQUIRED OR**
14 **TECHNICALLY POSSIBLE IN THE MIDWEST REGION?**

15 A. As noted above, 25% is reasonable for the region and for WPL. Minnesota and
16 Illinois each require 25% of retail energy to be supplied by renewable resources
17 by 2025, including but not limited to wind resources. While Iowa has a
18 renewable portfolio standard that requires only 2% of its energy to come from
19 renewables, Iowa has over 1,200 MW of existing wind resources already in place

³ Final Report – 2006 Minnesota Wind Integration Study, Volume I. Prepared for the Minnesota Public Utilities Commission by EnerNex Corporation. The full report, Volume I, Volume II, and the accompanying presentation material, is available online at <http://www.uwig.org/opimpactsdocs.html>.

⁴ Bauer Direct, 29: 21-22.

1 and is on track to have over 2,500 MW of wind in place when existing “under
2 construction” wind plants come on-line.⁵ The Midwest ISO’s Transmission
3 Expansion Plan for 2008 (MTEP 2008) contains a “Renewable Future” scenario
4 that evaluates meeting 20% of energy needs with wind by 2020, and is
5 considering, for the MTEP 2009, a 30% wind future scenario.⁶ This represents
6 the current outlook on feasible wind generation penetration, given current
7 technologies, experience and research. The recent Wisconsin Governor’s Global
8 Warming Task Force recommendation of an Enhanced Renewable Portfolio
9 Standard includes targets of 20% renewable energy by 2020 and 25% by 2025.⁷
10 This is in line with what I conclude is achievable in the region through wind
11 generation, alone.

12 **Q. WHAT WOULD A WPL FUTURE WITH 20% OF 2020 ENERGY NEEDS**
13 **SERVED BY WIND RESOURCES LOOK LIKE?**

14 A. If WPL were to meet 20% of its 2020 needs with wind energy, it would require
15 approximately 1,200 to 1,300 MW of wind in total, assuming WPL’s forecast
16 energy need, and depending on the aggregate capacity factor assumed for the
17 wind resource. This is 700 to 1,000 MW more than WPL currently plans for,
18 depending on whether you count the so-called “carbon reduction” scenario where
19 WPL installs another 200 MW of wind above its base case after 2013. Under a

⁵ <http://www.awea.org/projects/projects.aspx?s=Iowa>.

⁶ MISO MTEP 2009 planning assumptions. Available at http://www.midwestmarket.org/publish/Document/66d196_115dc8fa4a2_-7cd80a48324a?rev=1 .which include summaries of the MTEP 2008 scenarios.

⁷ See http://dnr.wi.gov/environmentprotect/gtfgw/documents/Final_Report.pdf at page 25.

1 lower energy needs scenario, such as a 1.5% per year energy growth rather than
2 WPL's 2.37% growth scenario, 20% by 2020 would equate to roughly 1,100 MW
3 to 1,200 MW of wind. In other words, WPL would need to add significantly
4 more renewable energy resources, which would likely include significant amounts
5 of wind, if it were to reach a reasonable assumption of 20% of energy needs with
6 renewable sources in 2020.

7 **Q. WHAT WOULD A WPL FUTURE WITH 25% OF 2025 ENERGY NEEDS**
8 **SERVED BY WIND RESOURCES LOOK LIKE?**

9 A. If WPL were to meet 25% of its 2025 needs with wind energy, it would require
10 approximately 1,700 to 1,800 MW of wind in total, assuming WPL's forecast
11 energy need, and depending on aggregate capacity factor for the wind resource.
12 This is 1,200 MW to 1,500 MW more wind than WPL currently is planning for.

13 **Q. BASED ON THIS ANALYSIS, WHAT IS YOUR CONCLUSION ABOUT**
14 **WPL'S BASE CASE SCENARIO?**

15 A. WPL's assumptions vastly underestimate the amount of wind energy that is cost-
16 effective and technologically feasible.

17 **V. WPL UNDERCOUNTING OF WIND CAPACITY CREDIT**

18 **Q. WHAT ARE THE CAPACITY CREDIT VALUES ASSIGNED BY WPL**
19 **FOR NEW WIND GENERATING PLANTS?**

1 A. WPL indicates that they use a 10% capacity credit value⁸.

2 **Q. IS A 10% CAPACITY CREDIT REASONABLE?**

3 A. No. MISO's practice is more reasonable and would significantly increase the
4 credit that can be assigned to wind. MISO uses 15% capacity credit for wind for
5 planning purposes.⁹ Once a wind facility is in place, actual data is then used to
6 determine the capacity credit given for the facility.

7 **Q. HOW DOES WPL JUSTIFY ITS USE OF 10% CAPACITY CREDIT FOR**
8 **WIND RESOURCES?**

9 A. WPL states that its use of 10% is "consistent with MAIN Guide 3B, Procedure for
10 the Uniform Rating and Reporting of Non-Conventional Resource Capability"¹⁰.

11 **Q. IS IT APPROPRIATE TO USE MAIN GUIDE 3B, AS WPL DOES, AND**
12 **TO USE A 10% CAPACITY CREDIT FOR WIND RESOURCES?**

13 A. No. First, MAIN Guide 3B is no longer in force.¹¹ Second, even when it was in
14 force, it described a process for assessing the output from wind facilities to
15 determine the capacity credit that will be assigned. It did not provide a static 10%
16 as WPL implies. As noted above, MISO, in its planning assumptions, has

⁸ Direct Testimony of Randy Bauer, 12: 6-8; Ng Direct, 11: 9-10.

⁹ MISO (Midwest Transmission Expansion Plan (MTEP) 2009 planning assumptions. Available at http://www.midwestmarket.org/publish/Document/66d196_115dc8fa4a2_-7cd80a48324a?rev=1 .

¹⁰ Direct Testimony of Randy Bauer, at page 12, lines 9-10.

¹¹ MAIN Guide 3B has been "retired" by the Midwest Reliability Organization, which has superseded MAIN as the reliability organization for the region. New standards are available at http://www.midwestreliability.org/ABO_mro_manual.html.

1 indicated that 15% is the value that will be used – for planning purposes – for new
2 wind facilities.

3 **Q. HOW DO WPL'S WIND ASSUMPTIONS AFFECT WPL'S CLAIMED**
4 **CAPACITY NEED?**

5 A. For every 100 MW of new wind capacity, WPL is undercounting at least 5 MW
6 of capacity that it should count towards planning reserve needs. Thus, for WPL's
7 300 MW of wind proposed as a new resource between 2008 and 2010, they are
8 undercounting by at least 15 MW the contribution this wind would make to
9 planned capacity reserve.

10 **Q. FOR SCENARIOS OF 1,300 MW AND 1,800 MW OF TOTAL WIND**
11 **RESOURCE, SUCH AS WITH INCREASED RPS STANDARDS, WHAT IS**
12 **THE EFFECT OF UNDERCOUNTING THE CAPACITY VALUE OF**
13 **WIND?**

14 A. The effect of undercounting capacity value, as WPL has done, is to undercount
15 wind's contribution to planning reserve by 65 MW (1,300 MW scenario) and 90
16 MW (1,800 MW scenario), assuming a capacity credit of 15%. If capacity credit
17 is higher, obviously the effect of WPL's undercounting is even greater. While
18 wind is predominately an energy resource, it nevertheless has capacity value and
19 should be properly accredited for planning purposes, especially given WPL's use
20 of the EGEAS model and its focus on capacity expansion requirements.

21 **Q. WHAT IMPACT WOULD YOU EXPECT IF EXPANSION PLANNING**
22 **MODELS WERE RE-RUN BASED ON THE 15% CAPACITY CREDIT**

1 **ASSUMPTIONS MISO USES AND YOU RECOMMEND, RATHER THAN**
2 **THE 10% ASSUMED BY WPL?**

3 A. While PSC staff have demonstrated that WPL’s proposed coal plants (NED 3 and
4 COL 3) are not the least cost option under any reasonable scenario, I would
5 expect the coal plants to be even less cost effective if full capacity credit is given
6 to wind.

7 **VI. MISO POWER SYSTEM COORDINATION AND INCREASED**
8 **ABILITY TO INTEGRATE WIND POWER**

9 **Q. PLEASE DESCRIBE THE UPPER MIDWEST BULK ELECTRIC POWER**
10 **SYSTEM.**

11 A. The Upper Midwest bulk electric power system includes transmission systems,
12 generation connected to transmission systems, and the operational control of those
13 facilities in the Upper Midwest region. It includes a geographical expanse
14 covering at least the six states of Minnesota, North Dakota, South Dakota,
15 Wisconsin, Iowa and Nebraska, and at least the connections to Manitoba, Upper
16 Peninsula Michigan, and Illinois.¹² It includes MISO and non-MISO controlled
17 transmission facilities, in particular the non-MISO facilities controlled by the
18 Upper Great Plains region of the Western Area Power Administration (“WAPA”).

¹² There is no need to define exact boundaries of the “Upper Midwest” bulk power grid for the purposes set out in this testimony. The important point is to understand that coordination of the electrically-interconnected region, including the Upper Midwest, extends across state and provincial boundaries and certainly includes at a minimum the whole of the MISO region and the Upper Great Plains region of the Western Area Power Administration. Furthermore, MISO’s seams agreements and day-to-day communications with neighboring systems illustrate that coordination actually takes place across the entire Eastern Interconnection, which extends from the Canadian Maritimes to Florida to Texas and to the Rocky Mountains.

1 **Q. WHO IS RESPONSIBLE FOR CONTROL OF THE BULK ELECTRIC**
2 **POWER SYSTEM?**

3 A. Overall coordination of the bulk power system is the responsibility of the
4 Midwest ISO and the transmission owners and operators in the region who are not
5 members of MISO, such as WAPA and the Nebraska Public Power District.
6 Transmission-owning MISO members are responsible for localized operations of
7 their individual systems.

8 **Q. WHAT ARE SOME OF THE KEY CIRCUMSTANCES THAT SHAPE**
9 **THE NATURE OF THE CONTROL OF THE BULK ELECTRIC POWER**
10 **SYSTEM IN THE UPPER MIDWEST?**

11 A. The existence – since April of 2005 – of MISO spot electricity markets, the
12 planned introduction of MISO-administered ancillary service markets in
13 September of this year, and MISO’s role as a NERC regional reliability
14 coordinator collectively provide MISO with a greater degree of coordination and
15 control of the Upper Midwest power grid than existed prior to April 2005.

16 **Q. WHAT IS THE EFFECT OF MISO’S INCREASED COORDINATION**
17 **ABILITY AND RESPONSIBILITY WITH RESPECT TO WIND POWER**
18 **INTEGRATION?**

19 A. MISO’s increased coordination ability and authority enables greater technical
20 penetration of wind power resources onto the bulk power system, compared to
21 what would be achievable absent such broad regional coordination: i.e., compared
22 to an Upper Midwest bulk power grid control structure that relied upon individual

1 control area coordination, provided no hourly spot energy markets, and that
2 balkanized ancillary and transmission service provision. WPL has not properly
3 accounted for this increased coordination when considering the expanded
4 opportunities that the MISO market provides for capacity, energy, resource
5 integration and ancillary service needs.

6 **Q. HOW HAS CENTRALIZED COORDINATION BY MISO IMPROVED**
7 **THE TECHNICAL INTEGRATION OF WIND RESOURCES IN THE**
8 **REGION?**

9 A. The benefits of spatial diversity of wind resources can be more readily captured
10 with a common dispatch of resources, and especially so given the imminent start-
11 up of MISO’s ancillary service markets and the associated aggregation of
12 “balancing authority” from the individual control areas to the full MISO region.¹³
13 Wind forecasting information could be delivered directly into control rooms to
14 improve real-time system operation. For example, future control improvements
15 could allow for MISO to obtain real-time wind forecasting and scheduling
16 information for all wind resources in the Upper Midwest region, reducing
17 prediction errors and thus reducing operational costs.¹⁴

¹³ MISO’s ancillary service markets are planned to commence in September 2008. The FERC approved this change to the MISO market structure in an Order on February 25, 2008 2008 in Docket ER07-1372-000.

¹⁴ See for example *Wind Forecasting: Wind Forecasting Tools and Methods for Improved System Operation and Control*, presented by Mark Ahlstrom of Wind Logics, at “A Short Course on the Integration of Wind Power Plants”, September 26-29, 2006.

1 **Q. HOW DO THE MISO ENERGY MARKETS, MISO PROPOSED**
2 **ANCILLARY SERVICE MARKET DEVELOPMENT AND GENERAL**
3 **TRENDS TOWARDS GREATER REGIONAL COORDINATION**
4 **IMPACT THE ABILITY TO INTEGRATE AND SELL WIND POWER IN**
5 **THE REGION?**

6 A. There has recently been a sea change in the way the Upper Midwest regional
7 power grid is dispatched and transmission use is coordinated. Prior to April,
8 2005, individual utilities controlled their own generation dispatch and unit
9 commitment, and arranged all import and export transactions themselves. The
10 region consisted of 35 somewhat self-contained control areas, roughly
11 representing each utility or groups of utilities. The commencement of MISO spot
12 electricity markets in April of 2005, in conjunction with transmission operations
13 seams agreements with neighboring regions and the imminent implementation of
14 co-optimized energy dispatch and ancillary service markets heralds unprecedented
15 technical coordination opportunities. Such coordination can lead to more efficient
16 use of regional capacity reserves, including more efficient use of regulating and
17 load following capacity, and thus will create greater opportunity for wind power
18 plants to reliably integrate and sell their output.

19 The evolution will continue, as MISO and PJM explore “joint” markets¹⁵,
20 MISO gains experience with its commitment and dispatch operations, and as the
21 new ancillary service market matures once in place.

¹⁵ MISO and PJM continue to discuss the potential development of a “joint and common market”. The status of these efforts is documented in regular reports to FERC.

1 All of these developments have improved, and will continue to improve, the
2 ability to efficiently integrate greater amounts of wind resources into the system,
3 primarily by expanding the scope of the marketplace, removing institutional
4 barriers to wind power transactions and using transmission and dispatch systems
5 more efficiently. In summary, the increased coordination capability of MISO
6 allows for the following:

- 7 1. **Reduced wind integration costs.** Centralized dispatch and the
8 forthcoming creation of MISO-wide regulation and operating reserve
9 markets across a roughly 116,000 MW peak load region allows for greater
10 operational flexibility across a system with variable output resources. In
11 particular, the cost impact of variable output wind on the power system's
12 need for regulating and load following resources is lessened when an
13 aggregate of many individual wind plants across the entire MISO system
14 is considered, as is done under centralized dispatch.
- 15 2. **Increased utilization of the existing transmission system.** MISO's
16 security-constrained dispatch internalizes all transmission constraints and
17 allows for increased utilization of the existing transmission system.
18 Inefficient curtailment practices in place prior to spot market start-up are
19 minimized, thus allowing wind resources greater access to at least non-
20 firm transmission availability. Furthermore, recent tariff reforms under
21 FERC Order 890 enhance increased transmission system utilization, e.g.
22 the availability of "conditional firm" transmission service for wind
23 resources.

- 1 3. **Access to spot energy imbalance markets without penalty.** Prior to the
2 start-up of MISO’s markets, wind resources faced imbalance penalties tied
3 to each transmission owner’s area and open access transmission tariff
4 (OATT). MISO’s OATT exempts intermittent resources from such
5 penalties¹⁶, and thus reduces the financial risk faced by wind power. This
6 allows for more favorable economics facing wind plants due to reduced
7 risk and thus will tend to increase the amount of wind power available for
8 sale to the market.
- 9 4. **Access to Ancillary Service Markets.** Those who choose to rely on wind
10 power need access to both energy and ancillary service resources to
11 complement the intermittent nature of the wind resource. Currently, and
12 until MISO ancillary service market commencement (September of 2008)
13 consumers of wind energy need to arrange for ancillary services within
14 individual control areas in the Upper Midwest region. After
15 commencement of these markets, it will be easier to obtain those services
16 through the MISO markets. MISO-wide coordination of ancillary services
17 will greatly enhance the ability of wind to integrate reliably and
18 economically onto the region’s transmission grid.
- 19 5. **Fewer barriers to interregional energy exchange.** The seams
20 agreements in place between MISO and its neighbors will give Upper
21 Midwest wind generation a greater reach into markets adjacent to the
22 region in which the wind plant is installed. For example, wind resources

¹⁶ Midwest ISO Open Access Transmission Tariff, section 40.3.4.d.i.

1 locating in the non-MISO, MRO region will have improved access to
2 MISO markets because of the MISO-MAPP seams agreement. The
3 ongoing discussions between PJM and MISO on development of a “joint”
4 market between the region portends an even greater degree of access and
5 coordination, and thus gives wind resources from the Upper Midwest an
6 even larger marketplace to consider selling to.

7 **Q. WHAT DOES THE IMPROVED COORDINATION CAPABILITY OF**
8 **MISO IMPLY FOR WPL’S CPCN APPLICATION FOR NED 3?**

9 A. WPL needs to more carefully analyze the MISO region opportunities and
10 associated costs for capacity, energy and ancillary service resources to meet WPL
11 system needs that are less expensive than the costs of the proposed NED 3. In
12 particular, wind power opportunities, regional capacity resource availability, and
13 improved ancillary service structures in MISO can serve to help meet needs less
14 expensively than with NED 3.

15 **VII. CLAIMED BENEFITS FROM CLAIMED NED 3 IMPORT**
16 **CAPABILITY INCREASE**

17
18 **Q. DOES WPL ESTIMATE ECONOMIC BENEFIT FROM THE CLAIMED**
19 **IMPORT CAPABILITY IMPROVEMENT ASSOCIATED WITH NED 3?**

20 A. Yes. Mr. Vesperman estimates a \$22 million per year benefit.¹⁷

21 **Q. WHAT IS THIS ESTIMATE BASED ON?**

¹⁷ Vesperman Direct, KDV-1 Schedule 3.

1 A. This estimate is based on: 1) attributing the entirety of a modeled 625 MW import
2 capability increase to NED 3, and 2) using estimates of MISO LMP differentials
3 (between Wisconsin, and MN and Northern Illinois) based on historical data to
4 calculate the economic benefit of a 625 MW import capability to Wisconsin. Mr.
5 Vesperman multiplies the increased import capability (split between MN and IL
6 tie lines) by the LMP differential and 8,760 hours (shown in KDV-1 Schedule 3
7 page 2).

8 **Q. IS THIS PROPER?**

9 A. No, it is not. It fundamentally fails to address basic conditions and circumstances.
10 Consequently, Mr. Vesperman ignores or omits four critical elements in his
11 analysis:

- 12 1. An increase in import capability of 625 MW does not arise directly from NED
13 3 and, therefore, it is incorrect to attribute it all to NED 3. The actual
14 increase, if any, attributable to NED 3 is more likely to be under 300 MW,
15 based on an analysis done for Synapse Energy by Lanzalotta and Associates.
16 That analysis is attached as Exhibit ___(RMF-4).
- 17 2. The sustained congestion differentials between Wisconsin and the west
18 (\$2/MWh) and south (\$5/MWh) that Mr. Vesperman relies on are wholly
19 unsupported. Mr. Vesperman uses historical LMP differences, and is vague
20 about the periods over which they are sourced. Mr. Vesperman does not
21 attempt to account for the going-forward effect of new transmission recently
22 online or currently being constructed (that increase import capability into
23 Wisconsin) on MISO region price differences. ATC transmission

1 improvements such as the new Arrowhead -Weston line and the planned
2 Paddock-Rockdale line will have an effect on the patterns of congestion into
3 Wisconsin once both are in place.¹⁸ It is reasonable to expect that these two
4 improvements, coupled with other ATC transmission projects that will be
5 completed by 2013, will significantly change congestion patterns (i.e., lower
6 congestion into Wisconsin) relative to the time periods Mr. Vesperman
7 sourced his LMP data from. In fact, that reduced congestion is one of the
8 intended benefits from those transmission projects. However, Mr. Vesperman
9 makes no attempt to incorporate the effect of these changes when considering
10 what the LMP differentials might be at the time that the proposed NED 3 plant
11 would be in service. In other words, Mr. Vesperman's LMP differentials are
12 inflated because he relies on historical inflated prices caused by a constrained
13 system; whereas the future he attempts to predict will include known
14 transmission improvements that will lower LMP differentials.

15 3. Mr. Vesperman's analysis completely ignores the critical and fundamental
16 role that financial transmission rights (FTRs) play in the MISO energy
17 markets. FTRs mitigate the congestion charges that Mr. Vesperman assumes
18 would only be avoided with the increased import capacity he attributes to
19 NED 3. Wisconsin entities benefit from the allocation of FTRs for electricity
20 imported into Wisconsin, and these FTRs serve to protect Wisconsin load
21 from the lion's share of the overall effects of congestion – i.e., higher
22 locational marginal prices (LMP) in Wisconsin relative to surrounding areas.

¹⁸ See, for example, American Transmission Company, "ATC Planning Analysis of the Paddock-Rockdale

1 FTRs protect, or hedge, against congestion costs, up to the level of import
2 capability provided by the transmission system between Wisconsin and
3 surrounding MISO territories. In other words, Wisconsin entities are able to
4 source less expensive power from out of state and are reimbursed for
5 congestion effects of moving that power to Wisconsin, up to the level of firm
6 import capability. This is the case because Wisconsin customers generally
7 have paid for the transmission lines that make up the existing import
8 capability, and therefore they retain the benefit those lines provide by
9 allowing access to less expensive resources. Therefore, Mr. Vesperman's
10 analysis vastly overstates cost benefits because he incorrectly assumes that
11 Wisconsin consumers pay LMP-based costs that historically have been
12 avoided and which should reasonably be avoided in the future.

- 13 4. Wisconsin entities benefit from a FERC-approved "expanded congestion cost
14 hedge" (ECCH) put in place at the time of commencement of the MISO
15 marketplace on April 1, 2005. It is in effect until 2010. The ECCH generally
16 mitigates the effect of congestion (i.e., higher LMP differentials) above and
17 beyond the congestion hedge provided by FTRs. Mr. Vesperman mentions
18 the ECCH but does not address its effect on the validity of using historical
19 LMP differences as an appropriate proxy when the ECCH is in place. The
20 existence of the ECCH, in addition to FTR coverage, invalidates the use of
21 historical LMPs when attempting to assess the value of increased import
22 capability. The paragraph reproduced below (highlighted added) is from an

Project", April 5, 2007.

1 ATC planning report on the planned Paddock-Rockdale 345 kV line. It
2 illustrates that the effect of the ECCH, combined with FTRs, frees Wisconsin
3 ratepayers from congestion effects associated with external network resources.
4 Mr. Vesperman's citation of recent LMP values from Wisconsin, Northern
5 Illinois and Minnesota (KDV-1 Schedule 3, pages 1-2) and his implication
6 that the price differential between Wisconsin and other areas has lead to
7 congestion costs that are actually borne by Wisconsin LSEs is thus not only
8 unsupported, but is incorrect.

3.2 The New Regional Market

In 2005 the Federal Energy Regulatory Commission (FERC) approved the MISO's Transmission and Energy Markets Tariff. This tariff included a system of security-constrained economic dispatch for generators in the MISO region, with pricing based upon Locational Marginal Price (LMP). The LMP is comprised of bid-based energy costs, marginal congestion costs, and marginal losses.

At the same time FERC recognized the Wisconsin Upper Michigan System (WUMS) and Northern WUMS load pockets as Narrow Constrained Areas (NCA). WUMS and Northern WUMS comprise the ATC service territory. As such, the ATC loads are subject to a higher risk of congestion costs and increased energy prices than loads in other MISO regions. For this reason FERC imposed bid caps on the ATC service territory. Load-Serving Entities (LSEs) within ATC also sought temporary special protection from congestion costs and indicated that they would use the additional time to build transmission facilities that would reduce congestion costs and more fully realize the benefits of the MISO market. In response FERC approved an Expanded Congestion Cost Hedge (ECCH) for ATC LSEs. With some restrictions, the ECCH frees ATC LSEs from having to pay for any shortfall in their congestion hedge (i.e. allocated Financial Transmission Rights (FTRs)) for existing network generating resources outside of ATC for the first 5 years of MISO market operation (i.e. through April 2010).

9 Source: American Transmission Company, "ATC Planning Analysis of the Paddock-Rockdale Project", April 5, 2007, p 14.
10
11

12 **Q. WHAT IS THE RESULT OF THE FOUR ERRORS YOU IDENTIFY IN**
13 **WPL'S TRANSMISSION BENEFIT ANALYSIS?**

14 A. The result is an analysis by WPL that is disconnected from reality. In order to
15 properly gauge the impact of NED 3 on claimed increased import capability,
16 WPL would need to first isolate the effect of unrelated transmission

1 improvements, and then assess the future congestion effects arising from NED 3.
2 This would be a number much lower than the 625 MW WPL assumes. Then,
3 WPL would need to account for the effect of new “into-Wisconsin” transmission
4 such as Arrowhead-Weston and Paddock-Rockdale; and WPL would also need to
5 account for both existing FTRs and new FTRs that will be made available from
6 new transmission projects that increase import capability into Wisconsin. This
7 would significantly decrease the economic benefit of any transmission benefit
8 attributable to NED 3. While WPL did not do this analysis, it can reasonably be
9 assumed that each of these (e.g., lower LMP differential and less transmission
10 import, if any, attributable to NED 3 rather than other transmission projects)
11 would drastically reduce any financial transmission benefit attributable to NED 3.
12 The transmission benefits, if any, would likely be minimal compared to the
13 significant cost projected for the NED 3 plant.

14 **Q. DO MR. FORTENBERRY AND MR. DELLER ALSO ADDRESS THE**
15 **CLAIMED IMPORT INCREASE BENEFITS?**

16 A. Yes, they purport to. They rely upon Mr. Versperman’s analysis, and thus their
17 testimony on this point is redundant to Mr. Vesperman’s, but, like Mr.
18 Vesperman, they incorrectly state that Wisconsin utilities will be exposed to
19 100% of congestion charges after the expiration of the Expanded Congestion Cost
20 Hedge.¹⁹ They also purport to look only to gross benefits, and ignore the cost to
21 ratepayers of building NED 3. Additionally, they do not look to determine if

¹⁹ Direct Testimony of Fortenberry and Deller, at page 17 lines 2-4. “With the expiration of that five year moratorium, the Wisconsin utilities will be exposed to 100% of those congestion charges with a commensurate cost to the rate payers”.

1 other, alternative projects would provide more transmission benefit at a lower
2 cost.

3 **Q. PLEASE EXPLAIN WHY FORTENBERRY AND DELLER'S**
4 **STATEMENT, AND MR. VESPERMAN'S STATEMENT²⁰, ABOUT**
5 **WISCONSIN UTILITIES' EXPOSURE TO CONGESTION COSTS IS**
6 **INCORRECT.**

7 A. These witnesses failed to account for the effect of FTRs, a fundamental piece of
8 the transmission congestion equation. FTRs provide a hedge against the financial
9 effects of congestion, up to the limit of exiting transmission import capability.
10 Thus, Wisconsin utilities are not exposed to 100% of the congestion charges that
11 arise when LMP's are higher in Wisconsin than in surrounding areas, but only to
12 the net congestion charges after accounting for the amount of FTRs held by
13 Wisconsin utilities. Neither Mr. Vesperman nor Mr. Fortenberry /Deller have
14 analyzed this effect, for either the past or going forward under the new regime
15 without the Expanded Congestion Cost Hedge and including the effects of other
16 new transmission into Wisconsin, such as the Arrowhead -Weston line (now in
17 service) and the Paddock - Rockdale line (in service in 2010). WPL has not
18 conducted any formal analysis of the effects of congestion costs to WPL
19 customers after 2010, when the ECCH is expired, based on LMP differentials
20 after the increased import capability that will result from the new Access Initiative

²⁰ Direct Testimony of Vesperman, at page 11 lines 9-11.

Direct Testimony of Robert M. Fagan

1 projects and other system-wide changes. Therefore the benefit of NED 3, if any,
2 to transmission charges is vastly overstated by all three WPL witnesses.

3 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

4 A. Yes, it does.