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Public Counsel

EO-2011-0271

## **REBUTTAL TESTIMONY**

**OF**

**DR. THOMAS VITOLO**

Submitted on Behalf of  
the Office of the Public Counsel

**UNION ELECTRIC COMPANY D/B/A AMEREN MISSOURI**

**Case No. EO-2011-0271**

October 28, 2011

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Denotes Highly Confidential Information that has been redacted

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1     **1.     INTRODUCTION AND QUALIFICATIONS**

2     **Q.     Please state your name, title, and employer.**

3     A.     My name is Thomas Vitolo. I am an associate at Synapse Energy Economics,  
4           located at 485 Massachusetts Avenue, Cambridge, MA 02139.

5     **Q.     Please describe Synapse Energy Economics.**

6     A.     Synapse Energy Economics is a research and consulting firm specializing in  
7           electricity and gas industry regulation, planning, and analysis. Our work covers a  
8           range of issues, including integrated resource planning, economic and technical  
9           assessments of energy resources, electricity market modeling and assessment,  
10          energy efficiency policies and programs, renewable resource technologies and  
11          policies, and climate change strategies. Synapse works for a variety of clients,  
12          with an emphasis on consumer advocates, regulatory commissions, and  
13          environmental advocates.

14    **Q.     Please summarize your professional and educational experience.**

15    A.     Before joining Synapse Energy Economics, I was a Ph.D. candidate at Boston  
16          University's Division of Systems Engineering. My general area of research was  
17          nonlinear optimization and combinatorial optimization, with a focus on searching  
18          for optimal solutions within a particular resource allocation problem, as well as on  
19          devising metrics to determine the best suited algorithm for solving the problem as  
20          a function of the parameters of the problem. My thesis title was *Efficient*  
21          *algorithms to discover degree constrained spanning trees in sparsely connected*  
22          *graphs.*

23          Concurrent with my graduate studies, I was an intern for Jointown  
24          Pharmaceuticals in Wuhan, China. Prior to that, I was employed as a research  
25          assistant at Lincoln Laboratory.

26          I hold a Doctor of Philosophy in Systems Engineering from Boston University, a  
27          Master of Science in Financial and Industrial Mathematics from Dublin City  
28          University, and a BS in Applied Mathematics, a BS in Computer Science, and a  
29          BS in Economics from North Carolina State University.

1 **Q. Please describe your academic and professional experience as it relates to**  
2 **resource planning, as well as to operations research & management science.**

3 A. At Synapse, I have reviewed and critiqued the analysis of the integrated resource  
4 plans and certificates of public convenience and necessity submitted by utilities  
5 located in Kansas, Missouri, New Mexico, Georgia, and Kentucky. In each case,  
6 my role has been to analyze and critique the utility's numerical analysis,  
7 modeling, and decision strategies.

8 My doctoral studies and my research at Lincoln Laboratory were focused on the  
9 optimal allocation of network resources. These efforts don't relate solely to  
10 transmission and distribution problems; they also directly relate to dispatch,  
11 compliance, and the allocation of demand- and supply-side resources, as well as  
12 the process by which the asset allocation decisions are made.

13 I also have experience solving inventory management problems at Jointown  
14 Pharmaceuticals. I designed a customized inventory restocking algorithm to  
15 determine appropriate order quantities for more than 20,000 distinct products,  
16 subject to numerous hard and soft constraints.

17 **Q. On whose behalf are you testifying in this case?**

18 A. I am testifying on behalf of the Office of Public Counsel (OPC).

19 **Q. Is the Office of the Public Counsel sponsoring other witnesses in this docket?**

20 A. Yes, one of my colleagues at Synapse Energy Economics, Mr. Woolf, is  
21 sponsoring testimony on behalf of the OPC. In addition, Ryan Kind is sponsoring  
22 testimony on behalf of the OPC. Mr. Kind, Mr. Woolf, and I have collaborated  
23 closely in preparing our testimonies.

24 **Q. What is the purpose of your testimony?**

25 A. On June 23, 2011 the OPC filed a *Review of Union Electric Company's Electric*  
26 *Resource Planning Compliance Filing*, Case No. E-2011-0271 (OPC Review).  
27 That review identified several significant deficiencies with the Union Electric  
28 Company d/b/a Ameren Missouri (UE or the Company) Integrated Resource Plan  
29 (IRP), and recommended that the Company correct for these deficiencies and  
30 conduct its analysis again to select a more appropriate Preferred Resource Plan

1 and Resource Acquisition Strategy. That OPC review was accompanied by a  
2 technical report entitled *Review of the Union Electric Company Integrated*  
3 *Resource Plan* (OPC Technical Report), authored by Mr. Kind, Mr. Woolf, and  
4 myself. On August 22, 2011 UE filed a *Response to Comments of Parties*  
5 (Response), including responses to the issues raised by the OPC.

6 The purpose of my testimony is to rebut the Ameren Response with regard to the  
7 issues raised by the OPC. In my testimony I focus on those topics that I was  
8 primarily responsible for addressing in the OPC Technical Report, including the  
9 initial screening of alternate resource plans and the final scorecard for these plans.

10 **Q. How is your testimony organized?**

11 A. My testimony is organized as follows:

- 12 1. Introduction and Qualifications
- 13 2. Summary of Conclusions and Recommendations
- 14 3. Analysis of the Screening Metrics
- 15 4. Analysis of the Final Scorecard Methodology

## 16 **2. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS**

17 **Q. Please summarize your primary conclusions.**

18 A. In sum, I find that the Ameren Response does not sufficiently address the  
19 deficiencies identified in the OPC Review and the OPC Technical Report. I  
20 confirm the OPC's original finding that the Ameren IRP is fundamentally flawed,  
21 does not meet the requirements of 4 CSR 240-22, and does not provide the  
22 Company or the Commission with sufficient analysis and information to identify  
23 an appropriate Preferred Resource Plan or a reasonable Resource Acquisition  
24 Strategy.

25 In particular:

- 26 • Ameren's metrics used in the initial screening and final screening of alternate  
27 resource plans contain numerous flaws, resulting in an inappropriate scoring  
28 in each of the two screening iterations.

- Ameren’s scorecard representation of the results introduces a number of avoidable errors. Their detailed analysis with precisely quantified information is replaced with far coarser numbers, thereby introducing illogical results by masking clear differences between the alternate resource plans with layers of obfuscation.

**Q. Please summarize your primary recommendations.**

A. I recommend that the Commission require the Company to conduct its IRP analysis again with the following significant modifications:

- The Company should revise its screening metrics for Economic Development and Customer Satisfaction to appropriately measure each candidate plan with respect to those categories, should revise the weights it assigns to each category so that they are consistent at each phase of the screening, and should revise the unitized score scaling method so that the effective weights of each category after scaling match the nominal weights the Company purports to assign to each category.
- The Company should revise its scorecard to retain the precision of the information calculated in previous steps of the screening process, thereby allowing a more careful comparison between candidate resource plans and perhaps reducing the likelihood of erroneously applying illogical scoring to certain plans based on the Company’s own criteria<sup>1</sup>. While complex and perhaps subjective policy objectives with multiple measures may require some sub-measures to be ranked with a simple 1 to 5 scoring, each of the six policy objectives in the initial screening process (inexplicably reduced to five in the Preferred Plan Selection Scorecard) contain metrics that aren’t subjective. In those cases, the actual values, including their levels of precision, should be used.

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<sup>1</sup> For example, the Company erroneously does not score R3 a maximum score of 5 in the Environmental/Diversity category, claiming that “coal reduction” results in “no additions to fuel diversity,” despite coal being the largest source of energy for the Company.

1     **3.     ANALYSIS OF SCREENING METRICS**

2     **Q.     Please summarize the OPC's concerns about the Company's screening**  
3     **process.**

4     A.     In the OPC Review and the OPC Technical Report, we find that UE failed to  
5             develop a screening process that appropriately evaluates the merits of each  
6             candidate resource plan. (OPC Review, pages 5-7, 9 and OPC Technical Report,  
7             pages 17-21 and page 34.) In particular, we demonstrate significant flaws with  
8             both the Economic Development metric and the Customer Satisfaction metric.  
9             Additionally, we state that re-weighting the different metrics in the second phase  
10            of the screening process is inappropriate. Finally, we show that the Company's  
11            flawed implementation of the unitized score methodology substantially distorts  
12            the results, so much so that the Present Value of Revenue Requirement (PVRR)  
13            has an effective influence of less than 10 percent of a candidate resource plan's  
14            final score under the metrics used by the Company.

15    **Q.     Please summarize the Company's response to OPC's concerns.**

16    A.     The Company did not respond to specific concerns raised by OPC about the  
17             scoring method used in UE's screening process. Instead, it claimed that the OPC  
18             concerns were the results of "subjectivity [that] cannot be escaped." (UE  
19             Response, page 100.)

20    **Q.     Do you agree with the Company's response on these issues?**

21    A.     No, I do not. The Company did not acknowledge its calculation errors, and did  
22             not address the specific critiques of the metrics. The critiques are not matters of  
23             opinion or subjectivity; the metrics are deeply flawed, the re-weighting is  
24             inappropriate, and the Company's unitized score methodology so significantly  
25             distorts the metrics that it renders them uninformative. These are not issues of  
26             subjectivity.

27    **Q.     Please elaborate on the Company's Economic Development metric.**

28    A.     The Economic Development metric includes 100 percent of the job years created  
29             in the construction of a nuclear power plant, despite the fact that the Company is  
30             only funding a fraction of the plant.

1 Just as the Company is only responsible for its fractional share of the costs and  
2 risks of owning an asset, it is only entitled to its fractional share of the benefits. If  
3 four companies were to co-own the plant and they each used the Company's  
4 metric, commissioners would expect four times the number of full time equivalent  
5 (FTE) job years that the project would actually generate. If the Company  
6 proposed owning 30 percent of a coal fired power plant, would it claim 100  
7 percent of the emissions in their cost analyses? It ought not.

8 This is a significant flaw; if UE were to correctly measure its Economic  
9 Development impact by multiplying the FTE job years created by its fractional  
10 share of ownership in the project, it would have scored three RAP candidate  
11 resource plans significantly higher than the nuclear plans when evaluated under  
12 this metric. Schedule TJV-1 contains the unitized Economic Development scores  
13 for all 14 plans on the Preferred Plan Selection Scorecard. The bar charts  
14 demonstrate that correcting the Economic Development metric reduces the  
15 nuclear proposals by about 30 percent and increases the non-nuclear scores by  
16 over 230 percent.

17 **Q. Please explain the ramifications of the Company's Customer Satisfaction**  
18 **metric.**

19 The Customer Satisfaction metric consists of two components of equal weight:  
20 the average rate increase and the maximum single year rate increase. While both  
21 quantities are described in 4 CSR 240-22.060(2), the regulation does not require  
22 them to be weighed equally. By doing so, the Company has created a metric that  
23 scores plans that are substantially more expensive to rate payers as providing  
24 more Customer Satisfaction than plans that are significantly less costly, a rather  
25 unlikely reality. Consider two scenarios, Scenario A and Scenario B, as shown in  
26 Schedule TJV-2. Scenario A has no rate increase for 9 years, and then a 10  
27 percent increase in the tenth year. Scenario B has a 5 percent rate increase each  
28 and every year. The Company's metric scores Scenario B as preferable to  
29 Scenario A in terms of Customer Satisfaction, even though the customer with an  
30 initial \$100/month electric bill will find that every single bill is higher in Scenario



1 B than in Scenario A, totaling a difference of over three thousand dollars over the  
2 decade.

3 Furthermore, the regulation does not require that the Company weigh a maximum  
4 single year rate increase in a near future year equally with that of a distant future  
5 year. Consider Scenario C (also found in Schedule TJV-2): a 10 percent rate  
6 increase the first year, and no rate increases for the rest of the decade. The  
7 Company's Customer Satisfaction metric scores Scenario C as equal to A and  
8 worse than B. In fact, when compared to Scenario A, the customer in Scenario C  
9 pays higher bills every single year except the final year, for a difference totaling  
10 over \$1,000 in real dollars. Again, the Company's Customer Satisfaction metric  
11 scores Scenario B as more attractive than Scenario C, despite the fact that the  
12 customer in Scenario C pays lower bills in every year but the first one, and over  
13 the span of the decade pays more than two thousand dollars less than in Scenario  
14 B.

15 Both of these comparisons produce absurd results. Scenario A is clearly  
16 preferable to Scenario B with respect to Customer Satisfaction, yet the  
17 Company's metric scores Scenario B higher. Likewise, Scenario C is clearly  
18 more satisfying to customers than Scenario B, yet the Company's metric claims  
19 Scenario B is preferable. Finally, despite Scenario A's obvious superiority to  
20 Scenario C, the Company's metric scores them an exact tie. A Customer Service  
21 metric that produces such nonsensical results must be revised.

22 **Q. Why is using different scoring weights for the first and second phases of the**  
23 **screening process inappropriate?**

24 The Company used one set of weights when totaling the scores of each candidate  
25 resource plan in the first round of screening, and then used a different set of  
26 weights when totaling the scores of each finalist candidate resource plan in the  
27 second round of screening to create the Scorecard. There are at least two  
28 problems with this process.

1 Firstly, by re-weighting the categories without making the changes explicit in the  
2 IRP, the Company creates a false impression of the relative import it is placing on  
3 the Policy Objectives. For example, the Company created a false impression that  
4 Energy Efficiency (EE) was a Policy Objective under full consideration. In the  
5 initial screening process, EE scores were worth 10% of the candidate resource  
6 plan's final score, as shown in Table 9.2 of the IRP. In the second phase of the  
7 screening, however, the Company re-weighted the EE metric to 0 percent without  
8 explicitly mentioning that significant change in its consideration of that policy  
9 objective. One must rely on a confidential worksheet to discover the new  
10 weights<sup>2</sup>. Other metrics were changed as well – the Cost metric was changed  
11 from 25 percent to \*\* \*\* percent and the Customer Satisfaction metric was  
12 altered as well, from 15 percent to \*\* \*\* percent. Furthermore, UE never  
13 provided a reasonable justification for its use of different scoring metrics and  
14 weights for the first and second phases.

15 The second critique is technical in nature. In real world applications such as this  
16 one, applying a different objective function in the second phase of the selection  
17 process than the one used in the first phase results in the selection of a suboptimal  
18 resource plan. Consider this admittedly silly example: if your first phase chooses  
19 the 14 tallest runners and your second phase selects the fastest of those 14, have  
20 you selected the fastest runner overall? You probably didn't, because the fastest  
21 runner isn't likely among the tallest. You probably didn't end up with the tallest,  
22 either. By reweighing the six categories (including reweighing EE with a weight  
23 of 0 percent), the Company almost certainly didn't choose the candidate resource  
24 plan that performed best under *either* set of criteria.

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<sup>2</sup> \MRM - HC\Preferred Plan Selection Scorecard FINAL.xlsx

1 Using a two-phase screening process is sensible because compiling detailed  
2 analyses for 216 plans is burdensome; detailed analyses for between 10 and 20  
3 plans is appropriate. However, by changing the criteria between the first and  
4 second phases of the screening process, UE fostered a false understanding of the  
5 Policy Objectives used, and furthermore almost certainly selected a candidate  
6 resource plan that wasn't optimal under either of their scoring criteria.

7 **Q. Please explain the unitized scoring system used by UE, its flaw, and how it**  
8 **can be corrected.**

9 A. The Company utilized a unitized scoring system so that the candidate resource  
10 plans that perform better or worse when scored using different metrics could be  
11 compared holistically. The metrics used to compare each candidate resource plan  
12 in each of the six Policy Objective categories produce numbers that can't be  
13 compared directly because the metrics result in numbers of vastly different sizes,  
14 and that are measured in dollars, percent, number of FTE job years, and even unit-  
15 less numbers. Unitized scoring maps each score, regardless of unit, to a real  
16 number between 0.000 and 1.000 inclusive, thereby allowing a holistic direct  
17 comparison of plans that perform better or worse in each of the categories.

18 However, the Company's implementation of unitized scoring distorts the results  
19 to the point of uselessness. The flaw is this: while the best unitized score in each  
20 metric is always 1.000, the worst score varies across the criteria. The worst score  
21 is as small as 0.000 (in the Economic Development and Energy Efficiency  
22 categories) and as large as 0.858 (in the PVRR category). This means that the  
23 candidate resource plan with the *worst* PVRR gets 86 percent of the score of the  
24 candidate resource plan with the *best* PVRR, whereas the candidate resource plan  
25 with the worst Economic Development score gets 0 percent of the score of the  
26 candidate resource plan with the best Economic Development score.

1 The ramification of the Company's unitized scoring flaw is that the **effective**  
2 weights of the six Policy Objectives are radically different than the nominal  
3 weights the Company purports to use. Calculating the effective weight is a two-  
4 step process. In step 1, for each of the six Policy Objectives, subtract the  
5 minimum unitized score from 1.000, and multiply the result by the weight of that  
6 Policy Objective. Secondly, add the six products together. To calculate the  
7 effective weight of a Policy Objective, divide the result of the first step by the  
8 sum calculated in the second step. The results are shown in Schedule TJV-3.

9 One result of the Company's inappropriate method of unitized scoring is that the  
10 Cost metric has the smallest range between worst and best scores, and therefore a  
11 much smaller effective weight than its nominal weight. In fact, in the first phase  
12 of the screening process the effective weighing of PVRR is 7.5 percent. Because  
13 the Company didn't report the complete scoring data of the 14 candidate resource  
14 plans in the second screening phase I cannot calculate the exact effective  
15 weighing of PVRR in the second stage. However, using the Cost and Economic  
16 Development scores from the second phase, and the first-phase scoring ranges for  
17 the other three Policy Objectives, one can calculate an estimate of the effective  
18 weighing of PVRR: 7.1 percent. This result can be found in Schedule TJV-3.

19 **Q. You have identified a number of flaws with the models, metrics, and**  
20 **calculations. Can they be easily fixed?**

21 A. Yes, they can. The Economic Development metric can be fixed by simply  
22 multiplying the number of FTE job years created by the Company's proposed  
23 share of ownership. The Customer Satisfaction metric should be changed to  
24 discount maximum rate increase values that occur further into the future, and  
25 should weigh average rate increase more heavily than the maximum increase;  
26 both are straightforward changes. When applying a two-stage screening process,  
27 the weights of the categories should not be changed, also a simple change to the  
28 model. Finally, the unitized scores should be scaled by the lowest raw score in  
29 the category, so that the worst score always gets a value of 0.000 and the highest

1 score always gets a value of 1.000. Like the other flaws, the unitized score flaw is  
2 easily corrected.

3 These are not matters of inescapable “subjectivity”; these are matters of correct  
4 and accurate measurements, which are necessary both if “the decision makers  
5 charged with managing the company on behalf of both customers and investors”  
6 are to do so effectively, and if the Company is to follow the requirements detailed  
7 in 4 CSR 240-22.

8 **4. ANALYSIS OF FINAL SCORECARD METHODOLOGY**

9 **Q. Please summarize the OPC’s concerns about the Company’s Final Scorecard**  
10 **methodology.**

11 A. The concerns about the Company’s final scorecard methodology and  
12 implementation detailed in the OPC Review and the OPC Technical Report are  
13 numerous. (OPC Review, pages 7-9 and OPC Technical Report, pages 27-40.).  
14 Firstly, a number of scores on the scorecard defy explanation. Secondly, the  
15 scorecard uses whole numbers ranging from 1 to 5, thereby eliminating the  
16 precision provided by the unitized scores. Finally, the Company eliminates even  
17 more precision by grouping ranges of scores together, simply representing the  
18 range as a green circle, a yellow triangle, and a red diamond. The Final Scorecard  
19 methodology is a step backward in the planning process because it replaces  
20 careful numerical analysis and study with guesswork and subjectivity.

21 **Q. Please summarize the Company’s response to the OPC’s concerns.**

22 A. The Company did not address the OPC’s concerns directly, instead stating that  
23 “there is subjectivity in the use of scorecards,” and that “scorecards, while helpful  
24 tools in informing decision-making, cannot themselves be the primary  
25 determinant for decisions.” (UR Response, page 100.)

26 **Q. Do you agree with the Company’s response to these issues?**

27 A. There certainly can be subjectivity in the use of scorecards. However, because  
28 the scorecard includes measures for Environmental Impact, Energy Efficiency,

1 Financial and Regulatory considerations, Customer Satisfaction, Economic  
2 Development, and Cost, I disagree with the claim that the scorecard cannot be the  
3 primary determinant for decisions. I don't know what other considerations,  
4 individually or in total, the Company would weigh more heavily than the six  
5 Policy Objective categories used to create the scorecard. Additionally, 4 CSR  
6 240-22.060 (2) explicitly requires that when assessing the performance of  
7 alternative resource plans, the utility must use "quantitative measures." Assigning  
8 somewhat arbitrary scores with only some regard to the actual data would seem to  
9 stretch the definition of "quantitative." Furthermore, given that UE is altering the  
10 PVRR data in a somewhat arbitrary manner, obscuring it by using a 1-5 scoring  
11 system,  
12 effectively weighing PVRR to be less than 10 percent of the final scoring, and  
13 then not using the scorecards to comply with the requirement in the IRP rules to  
14 use minimization of PVRR as the primary plan selection criteria (4 CSR 240-  
15 22.010 (B)), UE does not demonstrate compliance with the rules requiring the  
16 minimization of PVRR.

17 **Q. Please elaborate on the Scorecard scores that are unreasonable.**

18 A. Consider the Economic Development metric. The Company justified its assigned  
19 Scorecard scores using statements like "score lower due to loss of jobs at  
20 Meramec with minimal offsetting job creation," and "Meramec retirement plans  
21 with supply side replacement score low due to loss of jobs at Meramec offset by  
22 near-term construction jobs for combined cycle." To illustrate the problem with  
23 assigning precise data an integer between 1 and 5 using qualitative methods when  
24 actual quantities exist, I've created Schedule TJV-4. For each of the 14 finalist  
25 candidate resource plans, Schedule TJV-4 compares the actual number of FTE job  
26 years as reported by the Company with the score the Company assigned that  
27 resource plan. Notice that if the actual number of FTE job years as reported had  
28 been used to assign Scorecard scores, the scores for plans R0, R3, B4, and H2  
29 would have to differ by a full point, and depending on the rounding scheme  
30 employed, plans R1, R2, C1, C3, and H3 would have different scores as well.  
31 More succinctly, how can it be that plans R0 and R2 both purport to generate

1 11,991 FTE job years, but R0 is scored a 4 and R2 only a 3? How is it that  
2 candidate resource plans C2, B1, and B3 are all scored a 1, yet each of those plans  
3 creates more jobs than plans C3, H3, and H2, which were each awarded a score of  
4 2? These are all examples of unreasonable Scorecard scores.

5 The Economic Development metric isn't the only Policy Objective that suffers  
6 from the Company's assigning qualitative subjective scoring to a quantitative  
7 issue. The Company makes the same error with Cost (PVRR), using qualitative  
8 and subjective explanations like "RAP DSM plans with Meramec controlled,  
9 converted or retired score "moderate advantage" due to higher cost compared  
10 with Meramec retiring." Schedule TJV-5 contains the actual PVRR reported by  
11 the Company and the Scorecard scoring for each finalist candidate resource plan.  
12 Using either the Company's flawed unitized scoring system or the corrected  
13 unitized scoring system, the errors are clear. On the Scorecard, R1, R2, and R3  
14 are assigned a 4, but their actual values align below a score of 3. H1 is the worst  
15 performing plan with respect to PVRR, but it gets a score of 2 instead of 1,  
16 alongside the poorly performing H2, C3, and H3.

17 In both cases, the problem isn't just that the Company chose the wrong integer –  
18 the problem is that they shouldn't be using integers in the first place. The correct  
19 way to score Policy Objectives with straightforward metrics like jobs or PVRR is  
20 to simply use the actual result of the analysis, scaled to a value between 1.000 and  
21 5.000. In this way, a plan with a slight advantage preserves that advantage on the  
22 Scorecard, and it removes subjectivity and unreasonableness from the process of  
23 assigning a Scorecard score to an actual number of FTE jobs or an actual PVRR.

24 The Scorecard isn't, as the Company describes it, "just one such piece of  
25 information." The Scorecard the Company created is better described as  
26 misinformation. By removing precision to the point of grouping the candidate  
27 resource plans into three groups differentiated by colored shapes, the Scorecard  
28 implies that a number of candidate resource plans are equivalent in total impact, if  
29 not identically at least approximately so. This is because the Company took high  
30 precision scores and eliminated the fidelity, thereby rendering somewhat similar

1 results (or even not-similar results) identical. Doing so alters and obfuscates the  
2 information, providing the false impression of similarity or equivalence when it  
3 simply isn't so.

4 **Q. If the Scorecard is so flawed, aren't you pleased that the Company doesn't**  
5 **use it as the primary determinant for decisions?**

6 A. Of course not. The Scorecard should correctly encapsulate the different candidate  
7 resource plans' policy objective impacts in a meaningful and useful way for the  
8 benefit of the Company, the Commission, and other stakeholders such as the  
9 OPC. A scorecard can be used as a primary determinant when making decisions  
10 when the scorecard calculations are implemented correctly. The Company's  
11 implementation of its screening process and Scorecard is extremely flawed, as I  
12 have laid out in Sections 3 and 4. However, should the Company revisit its  
13 screening method and scoring metrics to correct the errors contained therein,  
14 preserve the high fidelity gained in the screening process at the scorecard stage,  
15 and present the senior management of UE a scorecard based on correct  
16 measurements and sound methodologies, then the scorecard would become the  
17 *ideal* determinant for deciding which candidate resource plan (or plans) to pursue.

18 **Q. Does this conclude your pre-filed testimony?**

19 A. Yes, it does.



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**Thomas Vitolo**  
Associate  
**Synapse Energy Economics, Inc.**  
485 Massachusetts Avenue, Suite 2, Cambridge, MA 02139  
(617) 453-7036 • fax: (617)-661-0599  
tvitolo@synapse-energy.com

## PROFESSIONAL EXPERIENCE

**Synapse Energy Economics Inc.**, Cambridge, MA. Associate, April 2011 to present.  
Performs consulting, conducts research, and assists in writing testimony and reports on a wide range of issues relating to electric utilities, energy efficiency, electricity transmission and generation, consumer advocacy, environmental policy and compliance, and air emissions.

**Jointown Group Co., Ltd.**, Wuhan, China. Systems Engineer Intern, Summer 2007.  
Developed and implemented a modified ( $s, S$ ) inventory management scheme for over 20,000 warehoused pharmaceutical products, resulting in more orders filled, lower carrying costs, and a reduction in the frequency of product expiration.

**MIT Lincoln Laboratory, Group 65**, Lexington, MA. Research Assistant, 2003–2006.  
Designed algorithm and implemented software to create autonomous wireless point-to-point topologies for aerial, land-based, and nautical vehicles as part of an Optical & RF Combined Link Experiment (ORCLE) funded by the Defense Advanced Research Projects Agency (DARPA).

## EDUCATION

Ph.D., Systems Engineering. Boston University, Boston, MA, 2011.  
M.Sc., Financial and Industrial Mathematics. Dublin City University, Dublin, Ireland, 2001.  
B.S., Applied Mathematics. North Carolina State University, Raleigh, NC, 2000.  
B.S., Computer Science. North Carolina State University, Raleigh, NC, 1999.  
B.S., Economics. North Carolina State University, Raleigh, NC, 1998.

## REPORTS

*Topology Formulation Algorithms for Wireless Networks with Reconfigurable Directional Links*, prepared for the Proceedings of the IEEE Military Communications Conference, 2005.

## PRESENTATIONS

*RPS in the USA: The Present Impact and Future Possibilities of Renewable Portfolio Standards in America*, speaker at the Boston University Energy Club Seminar Series, 2009.

*An ILP Approach to Spanning Tree Problems on Incomplete Graphs with Heterogeneous Degree Constraints*, speaker at the INFORMS Annual Meeting, 2007.

*Topology Design and Traffic Routing for Wireless Networks with Node-Based Topological Constraints*, speaker at the Boston University CISE Seminar Series, 2004.