

**State of Rhode Island Public Utilities Commission**

**In Re: Dispute Resolution Petition of WED Coventry One, LLC, WED Coventry Two, LLC, WED Coventry Three, LLC, WED Coventry Four, LLC, WED Coventry Five, LLC and WED Coventry Six, LLC against The Narragansett Electric Company d/b/a National Grid**

**Docket No. 4547**

**Pre-Filed Testimony of**

**David Colombo**

**February 25, 2015**

**I. Introduction and Qualifications**

1 **Q. Please state your name and business address.**

2 A. My name is David Colombo and my business address is 37 Fox Den Road, Kingston,  
3 Massachusetts 02364-2150.

4 **Q. By whom are you employed and in what capacity?**

5 A. I am the principal of Power Engineers, LLC an electrical engineering company.

6 **Q. When was Power Engineers, LLC formed?**

7 A. The company was founded in 2005.

8 **Q. What was your professional background before starting Power Engineers, LLC?**

9 A. I was an engineer and part owner of another engineering firm (CEG) in the same line  
10 of work, engineering and consulting for utilities and medium-voltage clients. I have also  
11 worked for a small utility in Massachusetts. I have been an engineer in the electric utility  
12 business since 1993. I am presently a Professional Engineer in 12 states.

13 **Q. What is Power Engineers, LLC principal line of business today?**

14 A. Electrical engineering, design and consulting, along with technical studies for Clients  
15 including small utilities, large commercial / industrial facilities and distributed generation  
16 (wind and solar) developers.

17 **Q. How much experience do you have with the interconnection of distributed  
18 generation of renewable energy to the electric distribution grid?**

1 A. I have significant experience with designing interconnections of DG projects to utility  
2 systems in the 12 states in which I am a licensed Professional Engineer. Since 2008 I  
3 have worked on over 100 large scale DG projects.

4 **Q. Have you worked with National Grid on the interconnection of the distributed**  
5 **generation of renewable energy before?**

6 A. Yes, I have worked with National Grid on projects in RI, MA and NY to assist  
7 customers with technical issues and design of interconnections, protection and necessary  
8 requirements for DG on numerous projects.

9 **Q. Do you provide electrical engineering services with regard to the interconnection**  
10 **of the Coventry wind turbines at issue in this docket?**

11 A. Yes, I am an electrical engineer on those projects, assisting with the design of the  
12 interconnection of these projects to the utility grid.

13 **Q. How has the interconnection of these Coventry turbines compared to other**  
14 **projects you have been involved with?**

15 A. The combined projects (COV 1 – COV 6) are one of the largest, but not the largest  
16 DG project I have worked on.

17 **Q. Did you design the interconnection studied for COV 1 and COV 2?**

18 A. I provided a one-line diagram for these interconnections which is common just as a  
19 starting proposal for National Grid to consider with regard to impact on the distribution  
20 system, technical feasibility, cost and schedule. That proposal is only a starting point for  
21 National Grid's consideration and they are free to reconfigure the design as they deem  
22 appropriate to most effectively complete the interconnection of the proposed projects, and

1 minimize the impact on their existing distribution system. As a private engineer, I do not  
2 have access to all information about their system so National Grid is in a unique position  
3 to evaluate the best method of interconnection. The proposal I made was to originally  
4 connect the two wind turbines to the closest existing point on the National Grid  
5 distribution system. This is a common starting point to minimize additional work  
6 required for interconnection and to minimize interconnection costs and time to connect a  
7 new DG project.

8 **Q. Was it your proposal that was ultimately adopted as the foundation for their**  
9 **impact study, estimated cost and schedule?**

10 A. The 4/17/2104 impact study prepared by National Grid indicated that connection of  
11 COV 1 and COV2 to the existing 52F1, 12.47kV circuit in the immediate vicinity of the  
12 site as proposed was feasible. There were some off-site upgrades to substation and feeder  
13 protective equipment.

14 **Q. Did you review the combined Impact Study issued for Coventry 1 and 2 and, if**  
15 **so, what were your conclusions?**

16 A. Yes, I did review that impact study. The original interconnection applications for  
17 COV1 and COV2 were submitted in January 2013. National Grid produced a Feasibility  
18 Study for COV1 in March 2013 citing no issues with voltage, islanding, etc. and  
19 providing a reasonable cost to interconnect based on other similar projects, \$270,502. It  
20 was our assumption that COV2 would be similar, although only a screening memo had  
21 been provided and no feasibility study at that time. After some time the April 2014  
22 Impact Study for COV1 and 2 was released and the two turbines were deemed

1 feasible. The cost to interconnect for the two turbines had risen to \$1.126 million, far  
2 above the \$540k expected. As one example, the cost now included voltage sensing and  
3 relaying at the high side of the substation that was not expected based on the COV 1  
4 feasibility study. The Impact Study now included additional protection work on the  
5 Piggy Lane 52F1 feeder and Coventry substation relay upgrades, known as 3V0  
6 protection at a cost of \$491,000. We typically see the 3V0 upgrade in the \$400-\$500k  
7 range (before the tax gross-up) so this on the higher end of other projects, especially since  
8 the substation is only 23kV on the high side. Many projects required this size investment  
9 in protecting a 115kV transmission substation but that should be much more expensive  
10 than protecting a 23kV substation. It was my opinion that if the approximately forty-  
11 year-old Coventry substation had ever been upgraded the equipment now added for  
12 transmission side voltage protection may not have been required at all. Even more  
13 importantly for the client, the 18 to 24 month schedule for substation relay work for  
14 interconnection was long and this work could certainly have been provided in much less  
15 time if National Grid shared the client's interest in providing interconnection on a timely  
16 development schedule and could apply the resources needed to do so. WED could have  
17 paid the \$1.126 million and interconnected WED 1 and 2 after the April 2014 Impact  
18 Study, but then eight more turbines were added and National Grid's position on this  
19 specific interconnection changed.

20 **Q. Please describe what you mean when you say that National Grid's position on**  
21 **these specific interconnections changed.**

1 A. When they issued that first impact study, we met with National Grid at its offices on  
2 May 1, 2014, and John Kennedy told us that if COV1 and 2 invested in improving the  
3 system as the Company proposed, the two closest 12.47kV circuits should have the  
4 capacity to feed ten more turbines. So we designed and submitted projects assuming that  
5 capacity existed. On December 18, 2014, National Grid issued its interconnection impact  
6 study for all ten turbines to be fed from two substations, the Coventry 54F1 substation  
7 studied for COV1 and 2 and another 15kV circuit from the Hoppin Hill substation. This  
8 Impact Study said that no more than one turbine could be connected to the Coventry  
9 54F1 Substation, in direct conflict with the conclusion from their earlier impact study that  
10 interconnecting COV1 and COV2 at that substation was acceptable. When questioned on  
11 this, National Grid said they used additional dynamic modeling tools to determine that no  
12 more than one turbine could be interconnected. I question why those same tools would  
13 not have been used for the previous impact study . The new study estimated the cost to  
14 connect a maximum of 3 wind turbines on the 52F1 feeder circuit from Coventry  
15 substation at \$5.166 million, and included a total line reconstruction and Direct Transfer  
16 Trip (DTT), which was not mentioned in the previous Study for the two turbines. The  
17 other 12.47kV circuit could connect up to 4 wind turbines, again if the distribution  
18 system was totally rebuilt all the way back to the substation. The December 2014 Impact  
19 Study stated that only seven wind turbines could be connected to the 2 x 12.47kV circuits,  
20 as opposed to the 10 turbines proposed. It did not consider use of the 23kV or 34.5kV  
21 circuits at the two substations, instead only looking at a re-build of existing 12.47kV  
22 circuits back to the two substations. This would replace existing aged infrastructure , as

1 opposed to bringing higher voltage circuits directly to the site to provide more capacity  
2 and allow all ten turbines to be connected to a 23kV circuit from the Coventry Substation,  
3 as is now evidently a better option for the developer based on capacity and  
4 interconnection cost.

5 **Q. Did you design a proposed interconnection plan for National Grid to study for**  
6 **the joint impact study for COV1-6?**

7 A. Yes. I produced proposed plans for the interconnection of COV1 –COV6, based on  
8 the best information available. Only National Grid has complete information about its  
9 distribution system and it is presumed that through the feasibility/impact study process,  
10 National Grid will determine the most effective and efficient means of interconnection.  
11 Through discussions with National Grid we were led to believe that the developers  
12 proposed 10 turbines could be interconnected to the two nearby 12.47kV circuits, of  
13 course with some upgrades, and once the system was rebuilt we could interconnect up to  
14 ten turbines on that circuit. So, in order to distribute the cost, we proposed to  
15 interconnect 10 turbines on two circuits. When they ultimately released the study of  
16 those turbines, they concluded that only one turbine could interconnect to the circuit  
17 studied for COV 1 and 2 (contrary to their prior impact study and its follow up), and that  
18 the interconnection of the seven turbines would require almost \$13 million of  
19 improvements to their system. The December 2014 study did not discuss connection to  
20 the higher voltage circuits that existed at both substations, or provide any alternatives  
21 analysis to connect all 10 turbines.

1 **Q. Please explain what DTT is and how that concern has been handled in**  
2 **association with the proposed interconnection of these Coventry turbines?**

3 A. DTT is direct transfer trip and is a protection scheme to trip a generator off line if an  
4 upstream substation breaker opens. This prevents the DG from feeding power into a fault  
5 or creating an island of customers once the utility breaker is open. DTT was not required  
6 for the April 2014 COV1 and COV2 study.

7 **Q. Please explain what anti-islanding is and how that concern has been handled in**  
8 **association with the proposed interconnection of these Coventry turbines?**

9 A. Islanding is a concept where a DG project can feed local customers power for a short  
10 period of time after the upstream utility device opens, creating an island in the power grid.  
11 This is unlikely with most DG projects and would occur with a close match of customer  
12 load and generation in the island areas. Theoretically an island could damage customer's  
13 equipment due to voltage and frequency variations not under the control of the utility.  
14 Wind and Solar projects typically have internal protective controls to sense this and shut  
15 down the DG. Additional protection can be installed with high-end solid-state protective  
16 relays to provide another layer of protection; which the Coventry projects have proposed.

17 **Q. Have you reviewed the latest version of National Grid's impact study issued on**  
18 **February 18, 2015, and if so, what are your impressions of that study?**

19 A. The Study appears to address the proposed interconnection of the 10 turbines at a cost  
20 less than previously provided to connect and upgrade 2 local circuits. The estimated cost  
21 of the proposed overhead utility work appears to be similar to my experience with other  
22 projects based on a dollar per mile. The proposed time line is longer than expected .

1 Overall, I am very surprised they did not come up with this alternative much earlier in  
2 their analysis of interconnecting these ten turbines. It is clearly the preferred approach  
3 and National Grid must have understood that based on its better understanding of the  
4 distribution system

5 **Q. Does this conclude your testimony?**

6 Yes.

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