NVDA Wind Study Committee – Meeting #2 – 6:00 p.m., Wednesday, January 29, 2014

In attendance: Jim Greenwood (NVDA – Committee Chair), Dave Snedeker (NVDA – Committee Staff), Robert Croteau (Barton - Committee), Mark Whitworth (Newark – Committee). Also in attendance: Peter Rodin (UTG), Robin Smith (Orleans County Record), Ben Luce (Guest speaker), and Janice Luce.

At 6:45 p.m., D. Snedeker opened the meeting by providing background information on the NVDA Board Resolution of July 2012 and the Study Committee's formation and work accomplished to date.

Dr. Ben Luce began his presentation entitled "Comparing Renewable Energy Options for Vermont and the Northeast Kingdom". The presentation is included as part of these notes.

Dr. Luce began by discussing his past work at the Center for Nonlinear Studies at the Los Alamos National Laboratory in New Mexico. Dr. Luce was part of the New Mexico Coalition for Clean Affordable Energy and was directly involved in the development of the state's Clean Energy legislation which included incentives for both wind and solar.

Much of the presentation was a comparison of renewable energy options with a goal of reducing CO2 emissions. Comparing options is important because there are differences in resources and technologies in terms of potentials, costs, impacts; and, prioritizing the wrong resource can impact efforts to mitigate climate change.

Dr. Luce compared wind and solar resources and used NREL data.

<u>Wind:</u> Greatest wind resources exist in the central U.S. - the great plains states. VT ranks 27th out of all U.S. states for relative wind resource potential. Capacity ranking, however, shows very little potential compared to western U.S. states. NREL estimates should be considered as gross upper bounds on real wind potential because local siting and cost issues were not included.

Dr. Luce indicated that discussions of future wind in the northeast U.S. have not exceeded @ 5 GW. This is equal to @ 80 Lowell wind projects. Multiplying the 5 GW by a capacity factor of .3 (NREL assumption) yields 1.5 GW. This is less than 3% of current peak demand and less than 6% of average demand.

Capacity Factor = Actual Energy Produced / Energy Produced under 24-7 Peak Operation

Capacity factor for 'good wind sites' > .33. Actual for Northeast Wind < .25, which is less than what developers project.
Capacity factor for Photovoltaics is @ .14. Solar is much better correlated than wind with daily and seasonal demand curves.

<u>Solar:</u> Usable solar resource is extremely large and the technology is completely scalable (rooftops, backyards, MW scale and larger).

Rooftop solar potential greatly exceeds onshore wind potential in Eastern U.S. (DOE estimate of 1GW for VT). *Urban Utility-scale* solar potential is 1GW for VT (DOE estimate). Rural Utility-scale solar potential for VT is 35GW (DOE estimate). Even at .1 capacity factor, there exists more than 250 GW of solar potential.

Economics of Wind and Solar:

- Costs of wind and solar are now roughly equivalent, assuming transmission costs for wind are minimal.
- If transmission costs for large build-out of wind are included, wind will be less competitive than solar.
- Solar technology potentially more susceptible to price reduction through innovation and manufacturing scale-up.

Wind Impact Summary:
Potential impacts to topography, hydrology, habitats (fragmentation and loss), birds & bats, noise, aesthetics, social fabric of communities, and effectiveness of and public support for renewable energy investments.

Dr. Luce's conclusions:

- No justification from either a resource or economic point of view to install ridgeline wind projects for the sake of mitigating climate change.
- Continued large investment in NE ridgeline wind will hinder near-term investment in, and long-term success, of more viable solutions.

Other information:
D. Snedeker presented an RSG report to the Committee "*Avoided Emissions from the Antrim Wind Project."* This report was submitted to the Committee by John Soininen of Eolian Renewable Energy prior to the meeting. The report was distributed electronically to Dr. Luce and the Committee prior to the meeting.

Dr. Luce was able to review the report and commented generally that while the models used may be accurate, there was no accounting for "spinning reserve" impacts, life cycle of the plants, or actual capacity factors. (These would lessen emissions reductions)

D. Snedeker noted that the study did not consider transmission constraints. In earlier Committee meetings with VEC and VELCO, transmission constraints in the northern VT region were acknowledged. (These would lessen emissions reductions).

Meeting adjourned at approximately 8:50p.m.

Notes submitted by D. Snedeker (NVDA)