MEMORANDUM

DATE: June 15, 2007

TO: Craig Pospisil

CC: Peter Goldbrunner, Curt Freeling, Doug Baker

FROM: Jeff Mann

SUBJECT: Spanish Fork Ancillary Power

MESSAGE

Craig,

In regards to the ancillary power requirements for the Spanish Fork Wind Project we offer the below.

Discussion:

All power generating facilities require an external power source during periods when the generator is not producing power. Auxiliary loads (lubrication pumps, heating, lighting, etc) can be supplied through the connection to the interconnected utility grid or by an alternate source such as a standby diesel generator or interconnection to a local utility distribution system. Once the generator is on-line and producing power, these auxiliary loads (also commonly referred to as parasitic loads) are typically switched to the local generator bus and the connection to the alternate power source is disconnected.

For a conventional power plant, such as a gas or steam turbine design, the periods when the generator is off-line and not supplying the parasitic (auxiliary) loads are typically planned and rare in occurrence. Power production is typically continuous unless an unplanned equipment outage or a planned shut down occurs. Thus, an alternate source, other than the connection to the power grid, can easily be utilized to serve the auxiliary loads during the relatively rare events.

A typical wind turbine however operates quite differently than a conventional power plant due to the nature of the "fuel" source (i.e. wind). A typical wind turbine must continuously be subjected to wind speeds between 4 – 25 meters per second (9-55 mph) in order to generate power (and supply its parasitic load requirements). Wind speeds outside of this window require that the auxiliary load be served by the

interconnected utility (i.e. back-fed from the grid). Wind turbines often “cut in” and “cut out” due to the cyclic nature of the wind. Thus, regular switching of an alternate source to serve the auxiliary loads is impractical.

In addition, the turbine starts up by turning the rotor blades to an optimum blade angle, thus accelerating the rotor. When the generator speed has reached synchronous speed, it is connected to the grid via a soft starter controlling the inrush current. After starting, a bypass contactor switches on and the bypasses the soft starter to firmly connect the generator to the grid. For this sequence to occur, the wind turbine must be connected to the grid prior to providing an output to the grid. This sequence could not occur if the turbines are not allowed to be connected to the grid under non-generating conditions.