PROCEDURE FOR SHUT DOWN OF THE MELANCTHON WIND PLANT IN THE EVENT OF ICING CONDITIONS

Prelude: In order to understand how icing conditions affect wind turbines, we must first understand how wind turbine blades harness the wind.

As with an aircrafts' wings, wind turbines rely upon what is known as Bernoulli's Principle (Ref. Wikipedia, http://en.wikipedia.org/wiki/Bernoulli's_principle) in order to create rotational torque.

To simplify, Bernoulli states that as the velocity of a fluid (air) increases, the resulting pressure of the fluid will decrease.

As you can see in figure 1-1, from the leading edge to the trailing edge of the chord length of an aerofoil, the upper camber has a longer running surface area. As the relative wind passes over the upper surface(upper camber) it is forced to travel at a higher speed in order to reach the trailing edge in comparison to the air passing over the underside of the wing. This speed differential thereby results in a differential in pressure. This lower air pressure on the upper side of the wing is known as "lift."

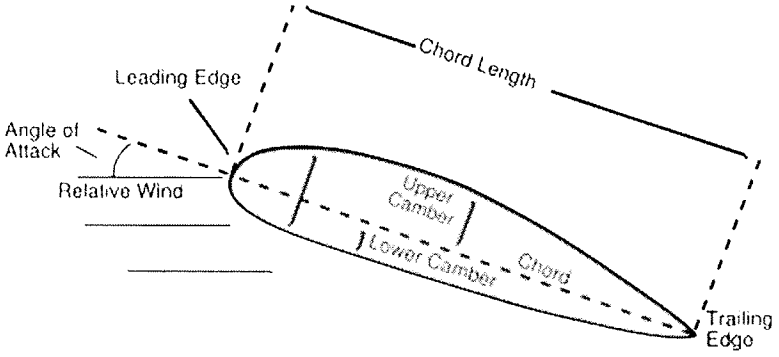

Fig 1-1

Wind generation facilities are inherently subject to all elements of the environment. Structural icing is an environmental factor which does affect the physics of how a wind turbine operates.

As the surface of a wing or in this case a turbine blade changes, varying results may occur. In the event of the upper camber of a blade building with ice there is the possibility of creating more lift than what would normally be produced by the blade during non icing conditions. Typically though, what happens is the ice buildup is not uniform and a disruption of airflow is created. This disruption of airflow results in a loss of lift. The loss of lift on the blades typically results in a loss of rotational torque. To simplify, the wind turbine stops turning.

Types of structural ice

Glaze ice is often clear and smooth. Supercooled water droplets, or freezing rain, strike a surface but do not freeze instantly. Often "horns" or protrusions are formed and project into the airflow.

Rime ice is rough and opaque, formed by supercooled drops rapidly freezing on impact. Forming mostly along an airfoil's stagnation point, it generally conforms to the shape of the airfoil.

Mixed ice is a combination of clear and rime ice.

How icing conditions are recognized

The Melancthon Wind Plant, which includes facilities in both the Township of Melancthon and the Township of Amaranth, is monitored 24 hours per day, 7 days per week. This is done by onsite personnel during regular business hours, remotely by Canadian Hydro Developers staff and through a monitoring contract with the turbine suppliers(GE Wind)

Canadian Hydro Developers staff are continuously monitoring weather forecasts for conditions which are favorable to producing icing events.

Once it is determined that there is a potential for an icing event, Canadian Hydro staff and remote monitoring staff begin to monitor the total aggregate output of the facility in comparison to the actual wind speed. This is otherwise known as the power curve (Fig. 1-2)

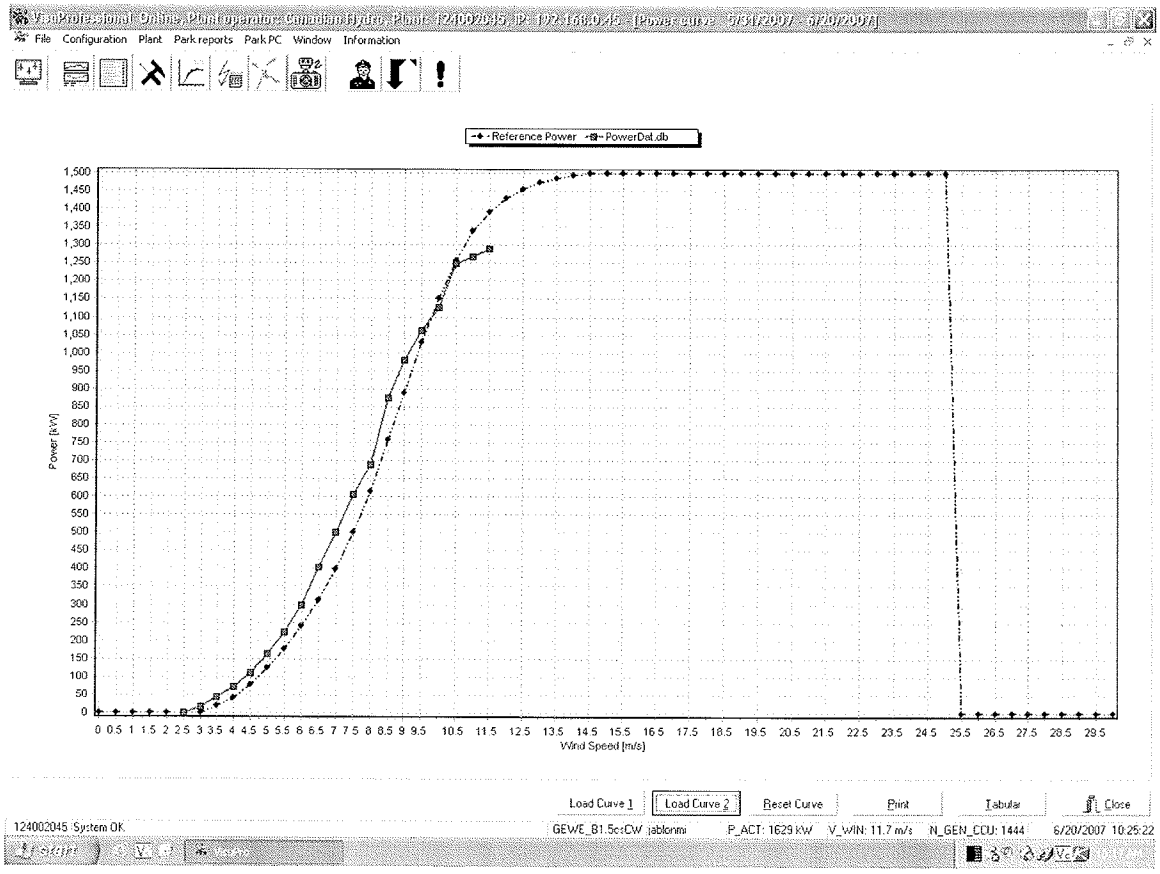

Fig 1-2 Typical power curve.

If it is determined through monitoring that the actual power output of the facility is below the calculated power curve, this will indicate that icing conditions are occurring.

In the event that icing conditions are not identified through the monitoring protocol, operating experience has proven that the turbines typically come to a stop on their own due to the inefficiency of the turbine blades. In addition, each turbine is equipped with several accelerometers placed in critical locations throughout the turbine to detect abnormal drive train and tower accelerations or vibrations. Once the accelerometer parameters reach an exceedance, software built into the individual turbines bring the turbines to a stopped and faulted condition.

The following procedures must also be implemented in the case of an automatic, software-initiated turbine shutdown as well as in cases where icing conditions are detected through monitoring the power curve.

In the event of icing conditions, the following instructions and procedures must be implemented.

Call the IESO at 1-905-855-6410,

Identify yourself as **"Amaranth CTS"** and inform them that the **"The facility is experiencing a forced outage and that all turbines are being shut down".**

Call CSC, Tehachapi at 1-888-439-3435, identify your self as the **"Melancthon Wind Plant"** and inform them you are **"shutting the park down until further advised".**

Access the Visupro software either remotely or from the Operations building main terminal

Locate the window **"Select Plant Group"** (lower right side of the screen)

Select **"All".**

Press **"stop/reset"**

All the turbines will go to the "Stop" status.

Double check that all turbines have reached "Stop".

Once the towers have reached "Stop" access each turbine individually and initiate "Load Shutdown"

Restarting the Melancthon Wind Plant once an icing event has ended:

It is very important to Canadian Hydro to ensure that wind turbines are free of ice prior to restarting the turbine.

In addition to ensuring that there is no danger to persons or property from falling ice Canadian Hydro will not restart the turbines while there is a risk that the blades are out of balance due to ice accumulation as this places unnecessary stress and causes wear and tear on the turbines.

The process of restarting the turbines after the detection of an icing event is as follows:

- Any turbine is inspected prior to its being restarted.
- In the case of turbines that are less than 450 metres from any public road or residential dwelling, a visual inspection of each blade is conducted to determine that they are free of any visible ice. As the blades are painted in a non-reflective colour ice tends to reveal itself readily as a reflective surface.
- The start up will be closely monitored.
- If, upon the blades starting to rotate, ice is observed to fall (or if the sensors detect the blades to be out of balance) the turbine will be stopped again and the restart will only be attempted after weather conditions and further visual inspection indicate that no further ice is likely to be present.
- This process will be repeated with all care and caution until safe, ice free operation of the turbine is re-established.

Call the IESO at 1-905-855-6410,

Identify yourself as **"Amaranth CTS"** and inform them that the **"The facility is prepared to enter back into service and that we will be ramping back up slowly".**

Call CSC, Tehachapi at 1-888-439-3435, identify your self as the **"Melancthon Wind Plant"** and inform them you are **"Bringing the plant back into service".**

Access the Visupro software either remotely or from the Operations building main terminal

Contact CHD personnel via two way radio and ensure turbine sites are being visually monitored by CHD staff.

Access turbines one by one and enable **"Start"**

Turbines will now automatically come on Line.

Continue to monitor turbines for abnormalities referencing the calculated power curves.

Notification of Potential Icing Conditions

Canadian Hydro Developers will provide public notice of potential icing in the following manner:

- By posting a permanent notice on the project website advising of the potential for icing on tall structures;
- By posting similar notice in the Orangeville Citizen and the Orangeville Banner each November and January for the first two years of commercial operation.