Yukon Conservation Society INC. 1968
302 Hawkins St. Whitehorse, Yukon Y1A 1X6 (867)668-5678 fax: (867)668-6637 ycs@ycs.yk.ca

March 16, 2010

# Yukon Conservation Society Intervenor Evidence for the Yukon Utilities Board Application for Energy Project & Operation Certificates Regarding the Proposed Mayo Hydro Enhancement Project

**The Minister's Terms of Reference**
Minister Hornes' Letter Dec 18, 2009 states:
*General purpose of review and hearing*

1. *The general purpose of the review and hearing is to obtain the YUB's report and recommendations on the potential benefits, costs, risks and customer impacts that influence whether Mayo B should proceed as proposed by YEC.*

The Yukon Conservation Society will outline in this Evidence the costs and risks it perceives with the Mayo B project as it has been presented. The first set of risks that we are concerned with are those associated with fish habitat and the financial and environmental cost implications for damaged fish habitat. The second risk associated with Mayo B is that by further developing another Hydro electric project, YEC risks our energy future by putting all its energy eggs in one basket – Hydro. Diversifying our energy sources reduces risk.

## Risks to aquatic habitat in Mayo Lake and Mayo River.

The Mayo B project will dewater approximately 4 kilometres of the Mayo River through diversion of 30 to 75 percent of existing flows to a new powerhouse. The dewatered portion of the river contains some of the last remaining chinook spawning habitat as the vast majority was eliminated by the construction of the Wareham Dam that impeded their upstream migration beginning in the late 1940s. The Mayo River, before the hydro facility was installed, supported in the order of 1,000 to 2,000 chinook salmon spawners (Schouwenburg, Chief, Habitat Protection Unit, Fisheries and Marine Service - 1975). Runs of Chinook salmon in the Mayo River are a fraction of what they once were and their outlook in the upper Yukon River basin looks bleak based on recent runs.

Additionally, 1 metre of extra drawdown is being actively pursued by YEC for Mayo Lake. Current water level fluctuation is approximately 2.6 metres and the additional drawdown will increase fluctuations to about 3.6 metres. YEC's supplementary information provided to YESAB concludes that the project could cause significant effects on lake trout, and proposes mitigation to address the issue such as simply stocking the lake with fish! Stocking the lake would not mitigate losses of productive shallow water littoral habitat around the lake. Additional one metre drawdown on Mayo Lake could cause greater water level fluctuations in wetlands that are associated with the lake.

*YCS believes that the mitigations that are still undetermined by DFO, the Water Board and YESAB pose a risk to the tight timeline and unanticipated costs of Mayo B.*

## The present Yukon energy mix is high risk

The old adage that it is unwise to put all of your eggs in one basket holds true for Yukon Energy in their long-term planning. It is unwise to put all of your energy eggs in one (hydro) basket and you need only to look at Figure 1 below. This graph illustrates that Mayo and Aishihik have similar inflow patterns from year to year. Both of these two lake systems suffer from the same drought years.

Whitehorse is different and more stable because its source of water that is stored in the southern lake system is fed by glacial melt at its headwaters. The glaciers provide a more constant and reliable source of water for the southern lakes. It should be noted here however, that with climate change YEC should be studying the risks associated with the changing mass of the glaciers. The question being: how is the total glacial mass feeding the southern lakes changing over time? If those glaciers are shrinking then the Whitehorse hydro generation will become as vulnerable as Aishihik and Mayo.

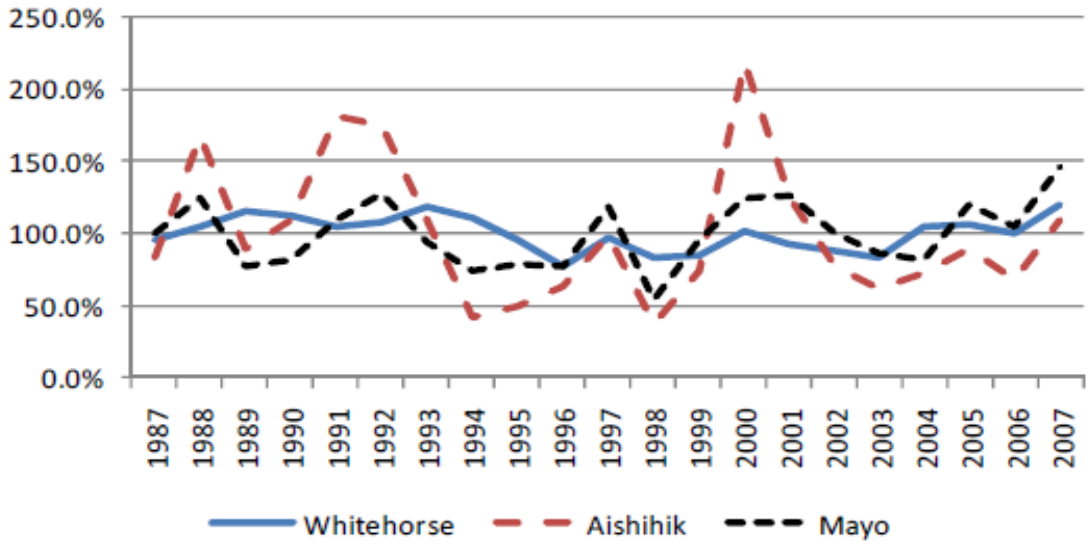



**Figure 1: Hydro inflows available for outflows (as a % of normal IAO) on each hydro system 1987-2007. Chart from YUB-YEC-1-47.**

# Alternatives to Mayo-B

Minister Hornes' Letter Dec 18, 2009:
*d. What, if any, alternatives to Mayo B might be advisable given reasonable load assumptions and risk assessments. In particular, the YUB shall report on:*
*i. possible alternative configurations for timing and structure of the Mayo B as proposed by YEC; and*
*ii. whether it is prudent to build Mayo B at this time.*

The Yukon Conservation Society will outline in this Evidence the alternatives to the proposed Mayo B project. YCS believes that YEC did not properly explore all of the alternatives to meet the growing demand on the electrical systems in the Territory.

## Wind Energy

The Yukon Conservation Society would like to propose that the Yukon Energy Corporation did not properly explore the options for new renewable energy sources when planning for future load requirements.

YCS ascertains that a 16MW wind farm on Mt. Sumanik (assuming 20% efficiency) would produce the same amount of 28Gwh that Mayo B is proposing to generate. This wind project would cost $56 million, (assuming $3.5million/MW of installed capacity)

As a sample of the proven costs of an installed wind farm in the north, YCS submits that in the summer of 2009, Kodiak Electric installed three 1.5 MW wind turbines on Pillar Mountain near the community of Kodiak. The total cost of the 4.5 MW Pillar Mountain project was about US $21.4 million. This wind project complements an existing hydro project that meets 80% of the electricity demand to the community. The other 20% which is met by diesel is being displaced by wind energy. The project has been able to generate electricity at 12 cents(US)/kWh. (From: http://www.kodiakelectric.com/generation.html).

YEC argues that wind does not produce this energy on demand. This is true; wind power will always need other sources to contribute to the power capacity and energy banking on the system. This is why a wind farm complements the existing and expanding Aishihik hydro multi-year storage hydro electric facility.

The complementing advantage of wind energy is that it is more abundant in the winter when there is less hydro energy available in the Yukon. The two charts below illustrate how wind potential is strongest during February, March, April and May when the Yukon's water resources are at their lowest.

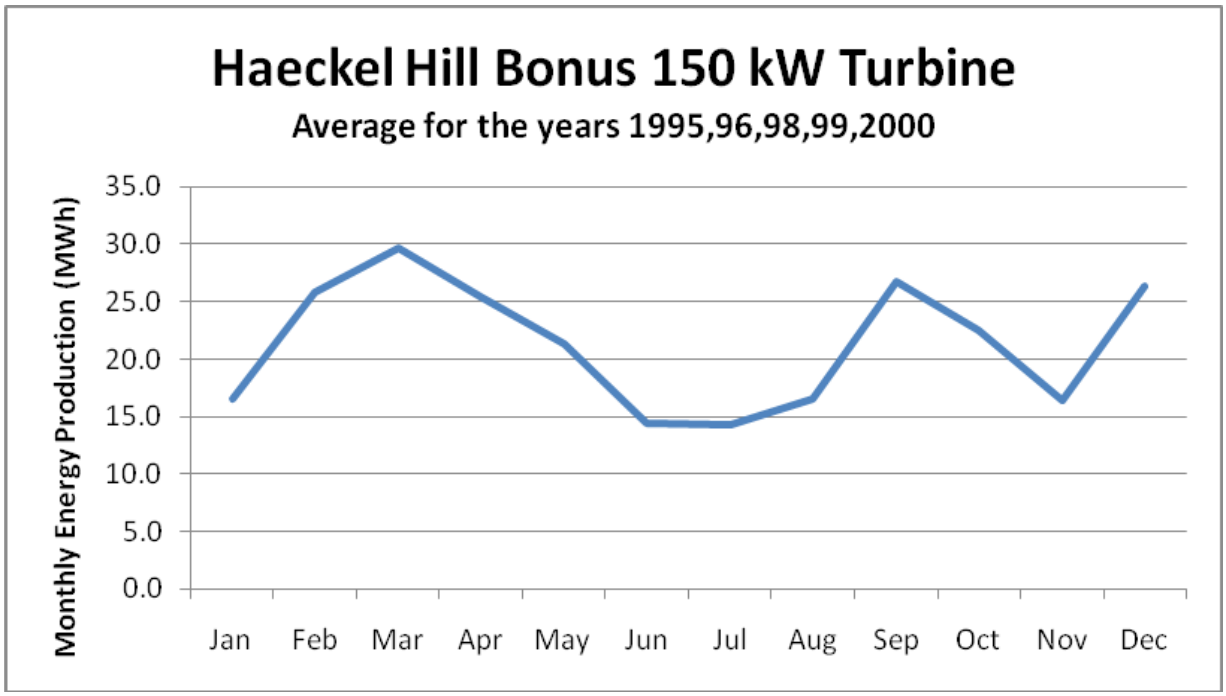



**Figure 2: This chart shows the monthly output of wind energy based on metered energy production data from the Bonus 150 kW wind turbine. From Maissan 2001, Wind Power Development in Sub-Arctic Conditions with Severe Rime Icing**

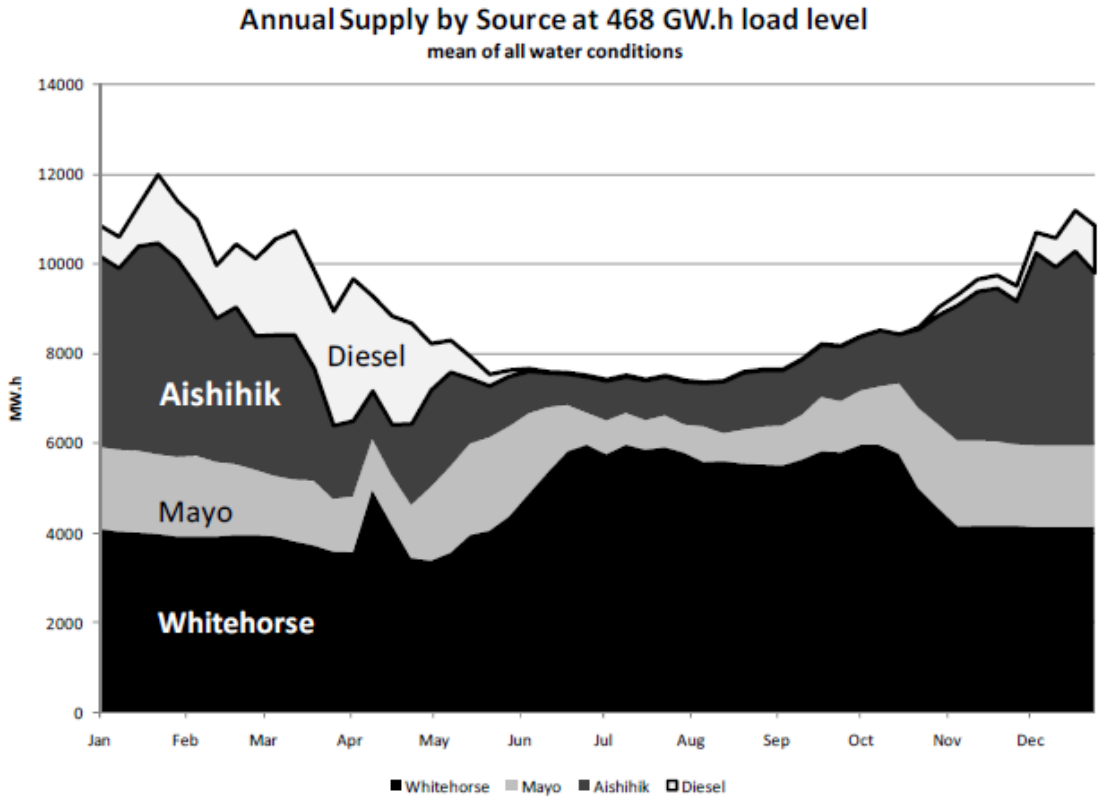



**Figure 3: In this chart the energy supply includes Mayo B and the Aishihik 3rd turbine. Note that diesel-electric generation are required from November to June with the maximum requirements occurring in February to April, when wind energy is most abundant. Chart source from: YUB-YEC-1-37**

## YUB-YEC-1-30A line 16-23

By way of example, under the present situation on WAF (e.g., 2009 test year loads), there is typically surplus hydro generation. Were a new wind turbine to be installed, for example, under these load conditions, the "net" contribution to the grid would be basically zero. However given the very inflexible nature of wind generation, the new wind turbine itself would be very high priority in the dispatch order and would typically generate its full "gross" potential, but the "net" effect would solely be to drive increased spillage typically at Aishihik compared to what would have been the case without the new wind turbine.

YCS disagrees with this statement. In the winter, there is no surplus hydro generation. This is obvious with the diesel generators making up for the shortfall and contributing to the system. We understand that there are minimum flow requirements on the Aishihik system, but the winter wind energy generation would allow more water to be conserved in Aishihik Lake. YCS believes it would be much more beneficial for the ecology of Aishihik Lake if YEC managed water levels to minimize dramatic water fluctuations. Aishihik storage can be used for winter peaking.

Aishihik's increased power capacity and efficiency with the new 3rd turbine will also become an ideal complement to a large scale wind farm.

The wind energy potential of the Yukon has been actively researched since the early 1990s. From the very start Haeckel Hill was considered a test/demonstration site as YEC had no idea how it would perform.

It was the cheapest place YEC could do such a project because there was already a road and an upgradeable power line up there. The purpose of the project was to determine how turbines would operate under icing conditions and to find ways to mitigate the negative impacts of the heavy rime icing.

YEC wanted to know whether commercial-size wind farms (built later at suitable sites) would be economic compared to the diesel alternative; they were not built on the expectation the "one off" turbines would of themselves provide lower cost power.

The published literature (Maissan 2001, Wind Power Development in Sub-Arctic Conditions with Severe Rime Icing), shows that in the earlier years when the wind project was given the same operating and maintenance priority as the hydro plants, it operated at an annual capacity factor of over 20 per cent.
It is true that in recent years the Haeckel Hill demonstration turbines have been producing a lot less power, apparently because they have been given a lower priority due to surplus hydro on the system.

YEC has been sitting on its wind research data for years, not doing anything with it to progress a wind farm initiative. Only now we hear of secret reports and feasibility studies being undertaken. Why were these feasibility studies and requisite permitting not done years ago so that when the Federal Government came calling with a generous grant of Green Infrastructure money, YEC could have presented a truly, "shovel ready" and green project. Wind energy projects can be built

in about 2 years from permitting and can be built at any scale and expanded as desired, a benefit when timing is of the essence.

The Haeckel Hill site has proven that there are very little environmental problems with wind energy in the Yukon. You certainly don't have to deal with Water Licences, Fish, or line losses (in the case of Sumanik). Yes, there are rime icing issues, but from the studies that have been undertaken, it is found that rime icing occurs at specific times of the year when there are open bodies of water and clouds on the mountaintops, usually in November, December and early January. These are times of the year as shown on the graph above YUB-YEC-1-37, that hydro can step in and take the bulk of the capacity needed.

## Hydro Potential at the Faro Mine

The Federal Government is planning on spending about 750 million over 10 years to "reclaim" the Faro Mine site and YEC has not really considered various opportunities for the generation of power at this highly contaminated site. There are at least two very good candidate streams that flow through the property that are in need costly mitigation work to prevent future groundwater contamination. Both Vangorda Creek (fishless) and the North Fork of Rose Creek are slated for reconstruction that will result in kilometres of lined channels to convey water. As an alternative, some of these flows could be easily piped into hydro turbines to generate energy for both onsite remediation and local communities. Combined, these two streams alone could potentially add 1 to 3 MW of power (without storage) for the grid, provide local jobs and additionally save energy from current line losses that occur in bring energy to the Faro/Ross River area. The Town of Faro is supportive and conceptual support has been expressed by the Ross River Dena.

YCS believes this is an excellent example of innovative energy development. YCS realizes that such a project has neither timeline nor the capacity that would meet near future demands, but YCS feels that is important that the YUB sees there are many good and alternative ways to meet the energy challenges ahead for the Yukon.

## Demand Side Management (DSM)

YCS would like to see YEC, YECL and YG explore and implement Demand Side Management strategies and technologies to reduce our demand for energy. There are jurisdictions in North America who are meeting most of their future energy demand with conservation, efficiency, innovation and progressive price signals. "New Power Plan Says 85 Percent Of Electricity Demand Next 20 Years Can Be Met With Efficiency", Posted on Friday, February 12, 2010 . reference; http://www.cbbulletin.com/376644.aspx

Technologies such as the penguin hot water heater timers that defer energy intensive water heating away from peak consumption times help manage the load and reduce peak requirements.

Smart meters and time of use pricing can get consumers on board, to be aware of their consumption and manage their use focusing on off peak times.

Another potential demand side management technique that would help the Yukon when we need power the most (in the cold and dark winters), would be to charge industrial customers – most

specifically mines – the true cost of power in the winter. Mines already enjoy a number of subsidies from government before accounting for deals they receive for power. Yukon Energy counters the suggestion of winter industrial rates by saying it can't choose who is most deserving of the power in winter.

The people of the Yukon are the permanent residents of this territory, whereas mines are not. If mines shut down in winter because power was too expensive, a few potential benefits would arise. First, the life of the mine would be extended. Secondly, it would encourage mining companies to operate more efficiently and develop their own clean, renewable power. Imagine if after a mine was finished production and everything of value was dug up and gone, the mining company left the Yukon a legacy of green energy in the form of wind turbines or other small renewable energy generators, rather than only an environmental liability.

If the Yukon is beholden to provide power to mining companies every month of the year, the utility should be required to charge mines the real cost of burning diesel to keep them online. This may help mining companies make the decision to slow or halt production in winter, and therefore eliminate the need to burn diesel to meet demand in winter.

## Solar

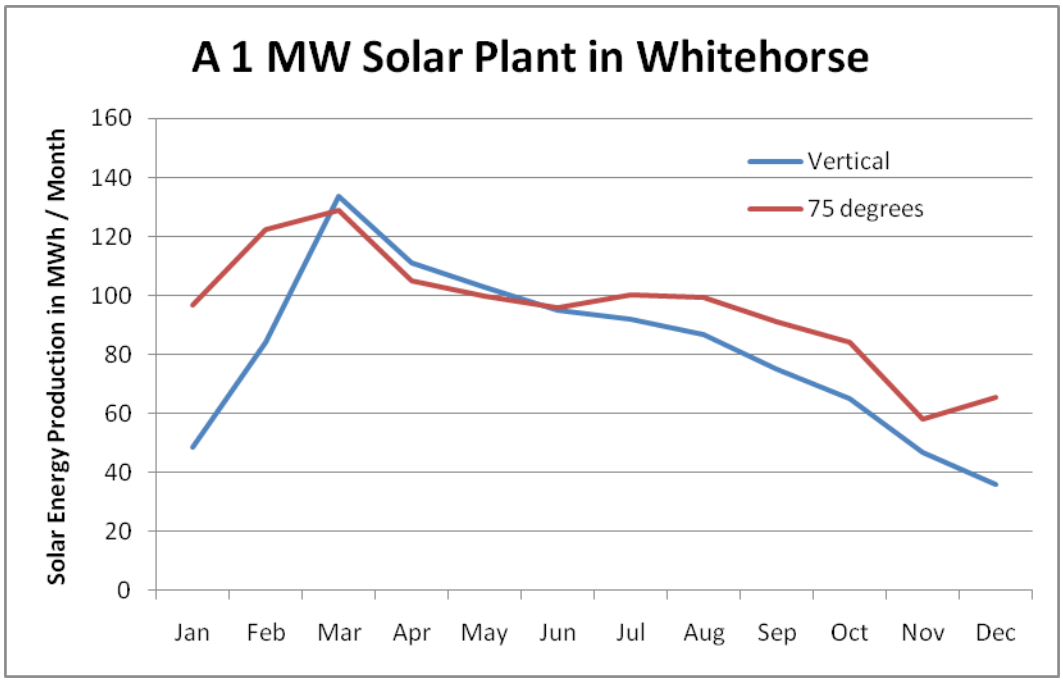
To further expand on Energy alternatives for the Yukon's energy future, YCS will conclude its evidence with an enlightening idea.

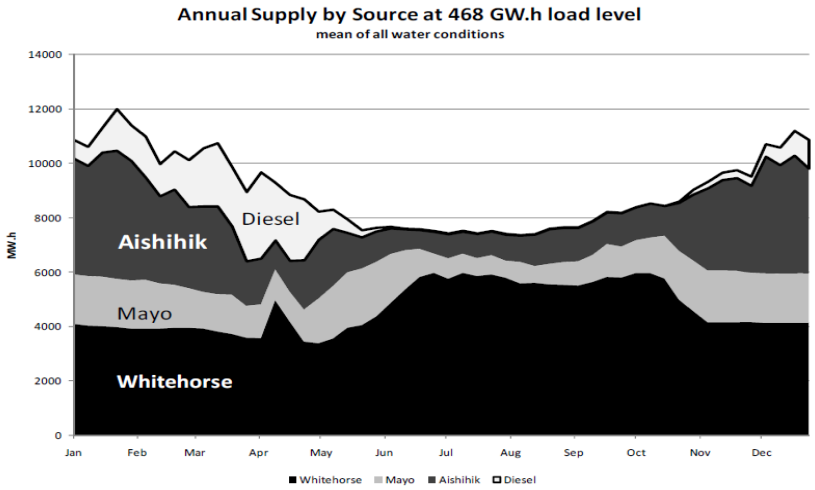
The Utility Solar Assessment Study from Clean Edge, Inc reports that:

- *For the first time solar power is beginning to reach cost parity with conventional energy sources. As solar prices decline and the capital and fuel costs for coal, natural gas, and nuclear plants rise, the U.S. will reach a crossover point by around 2015.*
- *Installed solar PV prices are projected to decline from an average $5.50-$7.00 peak watt (15-32 cents kWh) today to $3.02-$3.82 peak watt (8-18 cents kWh) in 2015 to $1.43-$1.82 peak watt (4-8 cents kWh) by 2025.*(prices in US$)

Source: http://www.cleanedge.com/reports/reports-solarUSA2008.php

The following graph shows the monthly production a 1 MW solar energy plant that could be installed in the Whitehorse area. This scenario is based on the RETScreen (NRCan) model using climate data from Whitehorse. This case shows two possible south-facing array orientations that are tilted vertically and at 75 degrees from horizontal. In Canada solar projects like this are expected to cost about $6M to $8M per installed MW (reference: Josef Ayoub and Lisa Dignard-Bailey 2009. National Survey Report of PV Power Applications in Canada 2008. prepared for International Energy Agency). Solar plant shows that most of the solar energy production occurs when diesel is used the most.




**Above Chart ref YUB-YEC-1-37**

## Concluding Remarks

In conclusion, YCS realizes the federal contribution to Mayo B has made what was a fiscally unviable project, now viable. However, building more hydro projects only perpetuates the problem of limited hydro supply in the winter compounded by the problem of unexploited excess hydro supply in summer. YCS therefore recommends to the YUB that in the near-term, YEC only develop projects that address the limited energy supply in winter. YCS submits that this must be addressed through certifiable green renewable energy sources. These include micro-hydro, wind, geothermal, biomass and solar. A strong focus on demand side management will also help to allow flexibility to diversify YEC's energy source options.