Yukon Conservation Society response to the YUB Information Request on YCS Evidence

March 30, 2010

YUB-YCS-1
Reference: YCS Evidence, pages 1 and 2
Issue/Sub-Issue: Risks to aquatic habitat in Mayo Lake and Mayo River
Quote: *YCS believes that the mitigations that are still undetermined by the DFO, the Water Board and the YESAB pose a risk to the tight timeline and unanticipated costs of Mayo B.*
Preamble: The risks to aquatic habitat in the Mayo River and in Mayo Lake are cited by the YCS in its evidence to the YUB. The YCS also states that the mitigations required pose a risk to the timeline and costs of the Mayo B project.
The Board wishes to better understand the statement quoted above.

Request:
(a) Can the YCS be more specific in terms of what mitigative measures it expects might be imposed on the Mayo B project respecting aquatic habitat and how those measures would impact on the project?

Firstly, the additional one metre drawdown on Mayo Lake may not be permitted by YESAB and or the Yukon Water Board. In this scenario, the net energy produced would be compromised and the economics of the project called into question.

Furthermore, it might be determined that the *existing* licenced operating drawdown range on Mayo Lake is harmful to freshwater fish and habitat. Currently the existing range is rarely exercised, but will be after the installation of a water-hungry new turbine. If it's found to kill fish, that operating range, and consequently the amount of energy the Mayo B facility could generate, would again be reduced.

The new flow regimes on the lower Mayo River may also require a Yukon Water Board Licence amendment. Yukon Energy Corporation, although changing the flow regime, still proposes to work within the existing licenced flow and may believe Mayo B does not require a water licence amendment (until it goes after the additional drawdown in this fall). YCS puts forward that the current water licence refers to the allowance to use water to generate power for the existing Mayo Generating Station, not Mayo B.

In addition, the construction of Mayo B could expose acid generating waste rock. The threat to fisheries of water contamination in the form of Acid Rock Drainage also makes the requirement of a water licence amendment for current project activities likely.

Possible mitigations that may be required by the YESAB and the Water Board could include:

- changing flow regimes in the dewatered section of Mayo River (zone 2) that would limit power generation capacity of the new turbines
- incubation/hatchery facility to enhance fisheries
- trap and truck system to enhance fisheries
- construction, monitoring and maintenance of a salmon spawning channel
- construction, monitoring and maintenance of a salmon rearing channel
- rehabilitation of salmon spawning beds using washed gravel below tailrace
- rehabilitation of the upper Mayo River
- construction of a fish ladder at the Mayo Lake control structure
- assessment, monitoring and safe storage/containment of potentially acid generating waste rock

Because of the rushed timeline, the resulting limited ability of the proponent to collect adequate data, and the fact that adaptive management is being recommended, there may be other mitigations not currently known that must be undertaken once the project is completed. The predicted and actual flows in the Mayo River may be quite different, and the effects on salmon productivity could be disastrous. If this happens from the new facility, changes in flow regimes will need to be regulated as soon as possible, to ensure the once flourishing but already compromised salmon in the Mayo River system are not harmed further.

(b) Can the YCS be more specific as to what amount of time delay might occur due to mitigative measures and in what aspect of the project and how that delay would affect the overall project timeline?

YCS is concerned the Water Board process has not been initiated by the proponent. It is our view that YEC should have obtained its Water Board approvals prior to the YUB hearing, as the Water Board may impose stringent and possibly expensive requirements to mitigate negative effects of the project on fish and fish habitat that would otherwise affect the outcome of the YUB hearing.

The YESAB process is still underway.

YCS would like to hear from the YEC whether it will require a Water Board licence amendment for Mayo B and at what stage (now for Mayo B, and later for the drawdown application only.)

(c) Can the YCS be more specific on what the dollar amount of additional costs might be due to mitigative measures and the overall impact of that additional cost on the Mayo B project?

There are still too many unknowns to understand the costs of mitigation measures. The impacts on the fisheries of projected and actual flow regime changes need to be understood and monitored, immediate flow changes made if required, and other suitable mitigations determined.

Because of these unknowns, we would like to suggest that one to five per cent of the total cost of the project should be reserved and spent on mitigation of the negative impacts the Mayo B project could have to the environment.

When Yukon Energy Corporation first started selling the idea of Mayo B, it claimed that as an enhancement project, the Mayo B project would not only enhance the power generation of the facility, but also enhance the fisheries. This project has the potential to restore fish and habitat, to address some of the wrongs of the past, but unfortunately none are being entertained at this time – despite the fact that so much money ($71M of which is free) is being spent on the project.

YUB-YCS-2
Reference: YCS Evidence, pages 3 to 6
Issue/Sub-Issue: Alternatives to Mayo-B/ Wind Energy
Quote: *YCS ascertains that a 16 MW wind farm on Mt. Sumanik (assuming 20% efficiency) would produce the same amount of 28 Gwh that Mayo B is proposing to generate. This wind project would cost $56 million, (assuming $3.5 million/MW of installed capacity).*
Preamble: In the paragraph following the above quote, YCS cites the Kodiak Electric installation of three 1.5 MW wind turbines for a total cost of $21.4 million US. On a per Megawatt basis this works out to $4.75 million US as compared to the $3.5 million cited by YCS for Mt. Sumanik. The Board wishes to better understand the statement quoted above.

Request:

(a) **How was the cost of $3.5 million/MW of installed capacity arrived at; what is the source of this number?**

When the Vestas wind turbine was installed in 2000, the cost was $2 million for a single 660 kW turbine. We must keep in mind that this was a one of a kind with no economies of scale on road improvements, foundation design, and new blade heating technology. This translates to a cost of $3M per MW at a time when full-sized wind farms in southern Canada were costing about $1.5M per MW.

Now wind farms are costing about $1.8M to $2.5M per MW in southern Canada. This cost includes road access, power line and substation to connect to the grid. For example, the 102 MW Bear Mountain Wind Park at Mile 0 on the Alaska Highway (Dawson Creek) was built at a cost of $200M. This translates to a cost of $1.96M per MW. In their test period they found that the wind park was producing at a plant capacity factor of 27%.

So a reasonable size wind farm in Whitehorse should be doable for something less than double per MW the cost of the Bear Mountain Wind Park. We rounded down our estimate to $3.5M per MW, but decided that $4M per MW would be a more conservative cost estimate.

The capacity factor of 20% is a low-ball estimate based on the Bonus 150 kW turbine at 30 m above ground. The new wind turbines are 60 to 80 m tall with capacities ranging from 1.5 to 3 MW per turbine. The Mt Sumanik Ridge north of Haeckel Hill will likely produce winds that are of order 7.5 to 8.0 m/s at the above hub heights (compared with 6.5 – 7.0 m/s on Haeckel Hill at 30 m above ground). These numbers can be confirmed from four wind monitoring stations that were installed on Sumanik around 2002. With this in mind and with the improvements in the wind technology, we expect the capacity to be at least 25%.

Let us design a wind park for Mt Sumanik:

Directly northwest of Haeckel Hill, there is about 3 km of ridge line on the top of the Mt Sumanik massif that ranges from 1560 m to 1700 m ASL (Above Sea Level). We will choose the GE 1.5 MW SLE, which is similar to the Kodiak Island wind turbines. With allowable spacing of about 150 m between the turbines, we should be able to accommodate the installation of approximately 20 wind generators on this mountain. To produce at 28 GWh/year (equal to Mayo B), we would only need nine of the GE 1.5 MW wind turbines. At 25% capacity, these nine wind turbines will produce 29.6 GWh/year. If we assume our generous cost of $4M per MW, then this project will cost $54M to build. If we use the higher development cost estimation of $4.8M that is equivalent to those of Kodiak Island, then we are looking at total project cost of $64.8M.

(b) YCS cites the Kodiak Electric installation of three 1.5 MW wind turbines for a total cost of $21.4 million US. Doesn't this imply that the costs of 16 MW of wind turbines on Mt. Sumanik would be higher than the $56 million quoted by YCS? Provide reasons with your answer.

As noted above, the Kodiak Island wind park is used as a high cost estimate ($4.8M/MW), which would mean that the proposed wind park on Sumanik might cost as much as $64.8M for 29.6 GWh/yr. Kodiak Island (Alaska) is more remote than Whitehorse so it is unlikely that this project will cost more than the Alaskan case. (see answer **a**).

(c) What additional information can YCS provide respecting the cost of 16 MW of wind turbines at Mt. Sumanik?

The answer in (a) above is an estimate based on real wind projects that are near the Yukon. YCS has not done a detailed feasibility study because it would be a duplication of effort and resources. We understand that YEC has done a study of the Mt Sumanik Wind Project.

YCS recommends that the YUB request that YEC submit its Mt Sumanik wind park study for evidence to be presented before the board.

(d) How was the capacity requirement of 16MW to produce 28 Gwh of energy arrived at?

We use the following:

9 turbines x 1.5 MW = 13.5 MW
13.5 MW x 8760 h/year x 0.25 (capacity factor based on 7.5m/s) = 29.6 GWh/y

(e) How was the figure of an assumed efficiency (capacity factor) of 20% arrived at?

The capacity factor 20% was based on the actual production data from the Bonus 150 kW turbine on Haeckel Hill (data from 1995 to 2000). The data is from the report *Wind Power Development in Sub-Arctic Conditions with Severe Rime Icing* by John Maissan, 2001. However, the wind speeds on Mt Sumanik are expected to be at 0.5 m/s higher than on Haeckel Hill. This slight increase in wind speed translates into an approximately 23% increase in energy production, and we should therefore expect the capacity factor to be at least 25%. If we factor in taller towers, then this capacity factor will be higher still.

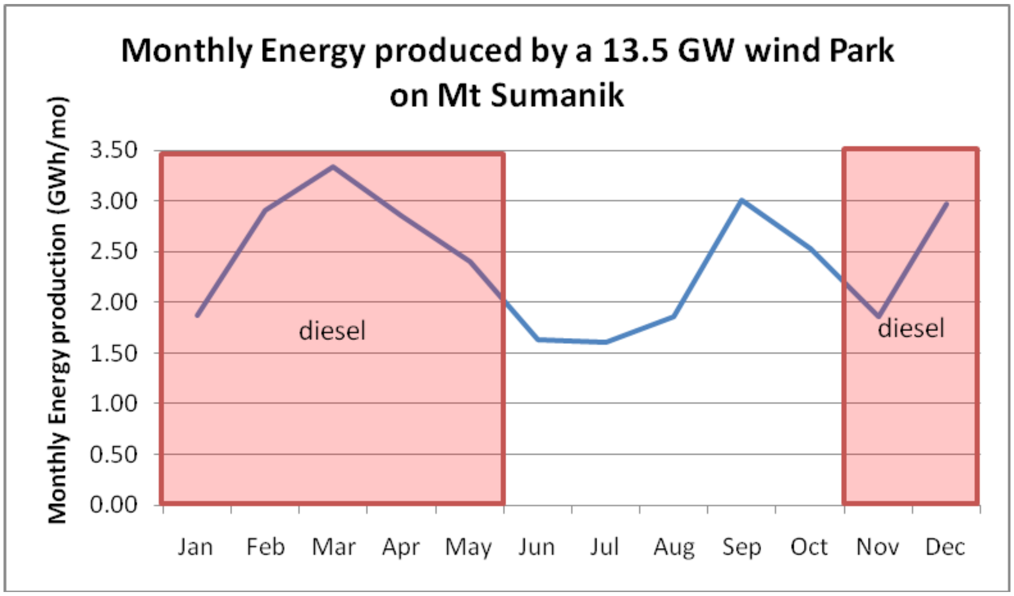
(f) Would the wind energy output of the wind turbines be intermittent and non-dispatchable and if not why not?

The energy from the wind park will be non-dispatchable.

(g) How would the wind turbines' ability to produce energy as needed by the system when needed by the system, i.e. its dispatch ability, compare with that of Mayo B?

The Sumanik wind project along with the Aishihik third turbine added OR a 5MW diesel generator would provide the firm capacity comparable to Mayo B at a far lower capital cost. Aishihik 3rd turbine is dispatchable and has the energy storage to complement the wind park.

The figure below shows that the months with the highest wind energy production coincide with the months when diesel will be most needed (based on 468 GWh load level).



The energy modelling can be done and we believe that YEC has the modelling tools, the information and the ability to provide such analysis.

(h) Has YCS done any study to determine if a wind turbine installation might have to be greater than the 16 MW cited to give a wind power project greater comparability to the dispatch ability of a Mayo B project?

We have not done any detailed studies to that matter.

However, we believe that the greater Mt Sumanik massif has room for at least 20 wind turbines totalling 30 MW. Such a wind park could produce 65 GWh/year at 25% power capacity. Of that energy produced, 40 GWh would be produced from November to May when diesel is on the margin. The whole project should cost no more than $120M to build (at $4M/MW).

Perhaps Yukon Energy's study for the Mt Sumanik wind park would shed some light on this matter.

YUB-YCS-3
Reference: YCS Evidence, pages 5 and 6
Issue/Sub-Issue: Alternatives to Mayo-B/ Wind Energy
Quote: *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.*

Preamble: The Board wishes to better understand the statement quoted above.
Request:
(a) Is the YCS requesting that the YUB recommend that the Mayo B project not proceed at this time?

Yes.

(b) Is the YCS requesting that the YUB recommend that YEC pursue a comparable wind farm project at Mt. Sumanik instead?

Yes.

(c) If that is the case then how does the YCS propose that YEC balance off the need to serve new load (including industrial load) and the time lag that would ensue in obtaining the necessary regulatory approvals and permits and the additional 2 years it cites as the time required to build a wind farm? What role does the YCS see existing diesel units playing during that time period?

YCS believes there are efficiencies and energy conservation initiatives that can be undertaken on the WAF grid to reduce the use of diesel as the load increases while the proposed wind park is being created.
First and foremost, the new industrial loads need to be run in an efficient manner. Ideally, YCS would like to see energy intensive workings at mine sites reduced during the winter months.

Energy efficiency and conservation has a very important role to play in the Yukon's future prosperity and sustainability. There is a selection of opportunities that the YEC, YECL and YG can use to reduce demand. Some opportunities are home weatherization (insulation, windows), improved efficiency in appliances, commercial lighting, improved home water efficiency (fewer leaks, more efficient pumps, lower water pressure), industrial motors, and lighting (installation of compact fluorescent lights, and LED lights).

As an example, in 2000, as part of the Yukon Development Corporation's Energy Efficiency Initiative, "penguin" hot water tank timers were installed in several households (along with a low flow showerhead and a hot water tank blanket to help residents realize a reduction in energy costs from reduced use, which they wouldn't see from the penguin timers themselves).

Electric hot water heaters are one of the most energy intensive appliances in the household, and automatically switch on to heat water in storage during times of day when households are already using a lot of energy. The penguins prevent the hot water tanks from switching on until a few hours later, when the load was not peaking.

This requires no effort by people. It is a simple piece of technology installed in a house. The total cost for 50 penguins installed in Whitehorse households was $13,080.
The evaluation report of the Penguin Pilot Project concluded that if penguins were to be installed in 800 Whitehorse households (only 10 per cent of total residential electrical accounts), the potential shifted load would be 2.4 MW for about $200,000.

Future large savings could come from more efficient televisions, high-performance windows, more efficient clothes washers, fridges, water heaters, and commercial lighting use. There also is a significant potential available from improving the efficiency of utility distribution systems with better voltage management, higher-efficiency transformers, and other utility-level improvements.

The existing diesel units will be used, as they are at this time, when there is not enough Hydro to meet demand.

(d) If the YCS is not requesting that the YUB recommend that the Mayo B project not proceed at this time, then what recommendations is it seeking from the Board?

YCS is requesting that the Mayo B project not proceed at this time.

The Federal Green Infrastructure money that is funding half of this project has a time limit – the project must be completed by March 2012. This deadline is rushing the entire process, from the proposal, to the assessment, to this regulatory review and a Water Board review – to the proponent jumping the gun, hiring the contractor and ordering the turbine before the project has been deemed prudent and approved.

Mayo B is a very expensive infrastructure project in the Yukon with a small energy return and potential negative environmental effects. Design plans for the project were still being figured out while the YESAB process was well underway. Clearly, this was, and is, not a shovel-ready project. YCS fears the rush will mean we do not give the project due diligence before a decision to move forward is made and the facility is built.

When it comes to any development, we need to respect the ecological limits of an area and plan our projects within those limits. It seems this project was planned to get the most power out of it in the hope we can somehow mitigate our way out of detrimental environmental impacts after they have been experienced.

It seems that the decision to move ahead with Mayo B is primarily based on the Federal Government's financial contribution of $71 million. While it is very generous of the Federal Government to give the Yukon this money, its associated deadline is creating a hurried and not well considered project. This is a harbinger of a "White Elephant" and Mayo B could become a "cost opportunity" for the Yukon.

This project could strangle YEC/YDC's future possible projects with the huge debt and the small amount of electricity (compared to the amount spent) that Mayo B will produce.

YCS feels that there are clear and affordable options that don't carry such risk.

YCS supports the inter-connect between the two grids, plan for a wind farm in the meantime and deal with any increase of load with demand side management (DSM).

The economy of scale will make buying a suitable sized crane to service the new and the old turbines, feasible. The cost of buying that crane is included in the $54 million price tag YCS presented in our answer to YUB-YCS-2. As money is available and demand increases, more turbines can be added to the site (Mt Sumanik massif has enough ridge room for 20 1.5MW wind turbines, a total possibility of 65 GWh/year for a total $120 million), a relatively simple and low impact project expansion compared to hydro.

(e) On page 9 of its evidence, the YCS cites a number of renewable energy sources including DSM. What is its preference for the order in which these projects should be pursued in the future?

1. Energy Efficiency and Conservation
2. Change policies about Industrial customers, reduce winter load.
3. Develop wind park on Sumanik (this is developed while the above 2 are happening)
4. Faro micro hydro
5. investigation of biomass and possible landfill generation sites
6. solar installation
7. further research on geothermal needed