



30 November 2019

Members of the Renewable Electricity Panel
of Yukon Government and Yukon Energy Corp.

By email: renewableelectricitypanel@gmail.com

Dear Panel Members:

Please accept this letter as input as you prepare your advice on options for providing renewable electricity within Yukon's future system of energy supply. We will also make a submission to the public review process for the Yukon Government's "Our Clean Future" document that includes strategic direction for energy supplies in the light of climate change. However, there are a few points we would concurrently like to emphasize in this letter, given the role of the Panel in advising the Government and Yukon Energy Corporation.

WCS Wildlife Conservation Society Canada is a non-profit, charitable organization working at a national scale in Canada. Our mission is to save wildlife and wild places through science, conservation action, and inspiring people to value nature. WCS Canada scientists have been working in Yukon since 2004 on land use and protected areas planning, land and water management, and wildlife conservation research and policy applications. Our role is to provide long-term site-based research and syntheses of science that inform policy and practice and support the implementation of effective conservation measures by providing technical advice and by engaging relevant decision-makers at all levels, from local to federal. We are interested in renewable energy because the capture of energy from any source will result in some environmental effects including impacts on fish and wildlife and their habitats, and because dealing with the climate crisis is particularly required to stem loss of biodiversity. An understanding of these effects and impacts has to be brought into decision-making.

Hydroelectricity

Electricity generated from hydro-power will continue to be an important, and hopefully growing, part of Yukon's energy supply. There are crucial questions of scale when thinking about this source.

There is accumulating evidence pointing to the conclusion that large-scale hydroelectric dams, with generating facilities, are not a suitable way forward from an environmental point of view. Such an approach was proposed in Yukon as recently as 2015 with the Next Generation Hydro initiative. At that time we published a synopsis of the impacts and risks to fish and aquatic

ecosystems of a large dam on a major Yukon river: “Potential Impacts and Risks of Proposed Next Generation Hydroelectric Dams on Fish and Fish Habitat in Yukon Waters”¹. The blockage of fish movements, creation of large new bodies of water as reservoirs, and disruption to the seasonal patterns of water flow in a river, all produce major negative impacts on aquatic ecosystems and fish populations, many of which cannot be mitigated, with few to no ancillary ecological benefits. We strongly recommend that large-scale hydroelectric development not be considered again in the potential portfolio of renewable electricity sources.

Small-scale hydroelectric power developments can play a substantial role in providing new sources of electricity. Fairly local examples such as the generating facilities associated with Surprise Lake and Pine Creek near Atlin, British Columbia, and with Dewey Lakes near Skagway, Alaska, are good examples. Yes, the ecological character of subalpine and alpine lakes and their outflow streams in headwater circumstances (often first or second order streams) will be impacted by such developments. However, for any one development, the spatial scale of ecosystems affected, the diversity of species impacted, and the intensity of the negative impacts are all likely to be far less than those resulting from a large dam on a major river.

At the same time, care will need to be taken in assessing cumulative impacts of such developments when more than one is planned for a specific drainage. Once again, this is an issue of scale of the overall impacts, a topic which cannot be considered in customary piecemeal decision-making, one project at a time. We can expect impacts, but how these accumulate, and result in indirect effects, will need to be made clear and judged accordingly, as proactively as possible.

You, the Panel members, are already well aware of some of the opportunities in Yukon for such small-scale hydroelectric development. We recommend further exploration, careful watershed-based planning, and hopefully development of some of these options for small-scale hydroelectric development, as relatively “clean” or “green” sources of electricity in the mix of renewables.

Biomass

We focus the remainder of our comments on biomass energy because, in our analysis, it is incorrectly lumped with other renewables in the “low carbon” set of energy sources publicized in Yukon Government’s draft strategic plan for climate change and energy: “Our Clean Future”². In our analysis, biomass energy does not, in many cases, qualify as low carbon, as we discuss below.

¹ von Finster, Al and Donald Reid, 2015. Potential Impacts and Risks of Proposed Next Generation Hydroelectric Dams on Fish and Fish Habitat in Yukon Waters. Wildlife Conservation Society Canada Conservation Report No. 8. Toronto, Ontario, Canada. Available at: <https://www.wcscanada.org/Publications/Conservation-Reports.aspx>

² Yukon Government 2019. Our Clean Future: A Yukon strategy for climate change, energy and a green economy. Draft for public review. Available at: <https://yukon.ca/en/draft-our-clean-future>

This issue may not seem relevant to the Panel’s work, because, in Yukon, biomass (wood residue, wood waste, and whole logs) is primarily used for space heating, not electricity generation. However, it is relevant, first because biomass could conceivably be used to generate electricity in some circumstances. We recommend that biomass not be used for electricity generation. Second, biomass is being promoted to replace use of fossil fuels in space heating and thereby lessen demand for electricity for the same purpose. Yes, burning biomass can lessen the short-term pressure to develop new electricity supplies. However, we recommend that biomass not be encouraged to take up a greater share of the space heating needs than it currently holds, but, instead, that new supplies of electricity that are more aptly termed “low carbon” be sought and implemented with greater haste.

The carbon cycle context. The scientific consensus is that overheating of the atmosphere is caused by large increases in greenhouse gases, especially carbon dioxide. Before the industrial revolution and the exponential growth of human population in the last four centuries, carbon dioxide concentrations in the atmosphere were mostly between 180 and 280 parts per million throughout the ice ages of the Pleistocene and Holocene. They are now around 410 ppm and have been increasing fast in parallel with our massive burning of fossil fuels. It is clear that absorption of carbon dioxide in the planet’s oceans and lakes, and into plants, is not keeping up with what we send into the air from the various fuels we burn, the huge numbers of animals we raise, and our continued removal of native vegetation. This imbalance is the heart of the climate crisis, and leads to two principal policy imperatives: (i) reduce and stop the net emissions of carbon dioxide to the atmosphere and (ii) find ways to remove carbon from the atmosphere more quickly.

What is the carbon budget of burning biomass for energy? Biomass energy is created by burning organic materials that have quite recently been alive. These can range from annual crops, to the annual growth increment of perennial crops, to the standing crop of long-lived plants such as canopy trees. All of these contribute substantial carbon dioxide to the atmosphere by burning alone, let alone through other emissions as a result of the harvesting, transportation, and processing of the biomass. So all forms of biomass are immediately suspect as “low carbon” fuel sources.

The effect of this burning on the carbon budget depends on the time and spatial scales of accounting; that is, a full life-cycle analysis. When all of the carbon dioxide released from burning can be absorbed by new growth of plants *at the same sites in the same annual cycle*³, there is not net contribution to the atmospheric carbon pool from the burning (i.e., the energy source is carbon neutral). This can be achieved only when one year’s worth of growth is burnt in the annual cycle (i.e., carbon payback time of one year). In this case, the benefits of the biomass are evaluated based on the carbon emissions incurred during its harvest, transport and

³ An annual accounting period should be applied to biomass as this is the accounting period applied to all other forms of human activity that create carbon emissions, such as burning of fossil fuels and raising livestock. New growth of plants “at the same sites” is required because carbon absorption at all other sites is already maximized given that the atmospheric carbon pool keeps increasing.

processing relative to emissions from alternative fuel sources. This is not achieved, however, when the biomass fuel stock has many years and often decades of carbon accumulation through growth. Such is the case with burning whole trees (whether green or already dead), or wood residue and slash, as we do in Yukon. New plant growth, on sites where the fuel trees previously grew, cannot absorb all of the many years and often decades of tree growth in one annual cycle. The net effect is a large net contribution of carbon dioxide to the atmosphere annually, creating a “carbon debt” that has to be recovered in the future⁴, with carbon payback time of many years and even many decades⁵. This is in direct contradiction to the major policy imperative to reduce such contributions year by year.

Policy direction towards biomass globally and in Yukon. Jurisdictions as large as the European Union and the USA have promoted biomass energy as carbon neutral⁶. Policy initiatives here in Yukon such as the Biomass Energy Strategy (2016) and the draft Whitehorse and Southern Lakes Forest Resources Management Plan (2019) have also made this assertion. The most recent Yukon Government action plan to deal with energy in the context of climate change – “Our Clean Future”⁷ – has dropped the word “neutral” and now labels biomass as “low carbon”, lumped in a category with solar, wind, hydro, and geothermal.

The notion that burning biomass for energy is carbon neutral is increasingly challenged by scientists and policy makers⁸. The Scientific Advisory Board to the U.S. Environmental Protection Agency stated in March 2019 that emissions created by burning recently living wood stocks cannot be assumed to be carbon neutral⁹. The Science Advisory Council of the European Academies warned the European Commission in 2017 and 2018¹⁰ that burning wood harvested from forests cannot be considered carbon neutral for the purposes of meeting carbon emissions targets, and that classifying biomass energy as carbon neutral was actually inducing major increases in conversion of the carbon in mature forests to carbon dioxide in the atmosphere at a time when exactly the reverse is required.

Although biomass energy is not promoted as carbon neutral in Yukon Government’s latest policy document (*Our Clean Future*), the fact that it is labelled as “low carbon”, in the same category as wind, solar, and hydro, implicitly assumes this to be the case. The kinds of feed stocks (waste wood, live and dead trees) we have in Yukon to fuel biomass installations, and individual homes, require years if not decades to grow back. The carbon debt happens in the current year; the carbon payback is many years and often decades into the future, varying with factors such as

⁴ Fargione et al. 2008. Science 319:1235-1238.

⁵ Birdsey et al. 2018 Environmental Research Letters 13. <https://doi.org/10.1088/1748-9326/aab9d5>

⁶ For example: <https://www.scientificamerican.com/article/congress-says-biomass-is-carbon-neutral-but-scientists-disagree/>

⁷ Yukon Government 2019. op.cit.

⁸ Booth. 2018. Environmental Research Letters 13. <https://doi.org/10.1088/1748-9326/aaac88> and <https://www.euractiv.com/section/energy/opinion/need-for-a-scientific-basis-of-eu-climate-policy-on-forests/>

⁹ [https://yosemite.epa.gov/sab/sabproduct.nsf/0/B86C81BACFAF9735852583B4005B3318/\\$File/EPA-SAB-19-002+.pdf](https://yosemite.epa.gov/sab/sabproduct.nsf/0/B86C81BACFAF9735852583B4005B3318/$File/EPA-SAB-19-002+.pdf)

¹⁰ EASAC 2017. Multi-functionality and sustainability in the European Union’s forests. https://easac.eu/fileadmin/PDF_s/reports_statements/Forests/EASAC_Forests_web_complete.pdf and in 2018 https://easac.eu/fileadmin/user_upload/180108_Letter_to_President_Juncker.pdf

decay rates of dead wood left on site¹¹. By analogy, when one accrues debt year after year it will take longer and longer into the future to pay it off. Balancing the account (i.e. stabilizing atmospheric concentrations of carbon dioxide by getting rid of sources of emissions) is exactly what we have to do as a first step in dealing with the carbon crisis. Burning biomass in Yukon goes directly against that need to balance the account by getting rid of major sources of emissions.

Consequently, we recommend that the policy direction put forward by Yukon Government of investing in new biomass energy infrastructure¹² be dropped from the government's priorities, and that the equivalent financial and other resources be directed towards development of energy from renewables that are more aptly described as "low carbon", such as wind, geothermal, hydro, and solar.

Burning biomass for energy can also create considerable additional environmental impacts. These make it suspect as a "clean" or environmentally-friendly source of fuel. Depending on the wood type and combustion process, it can produce higher carbon emissions per unit energy obtained than some fossil fuels¹³. Burning wood, especially as cord wood, generally produces other emissions, such as particulates and volatile organic compounds, which are already creating negative health impacts in Whitehorse¹⁴. Salvaging of fire- or beetle-killed wood can have negative impacts on biodiversity¹⁵, and an industrial-scale application of salvage logging for dead wood in Yukon would make these risks higher.

Burning wood for space heating is well established in Yukon, and will continue to contribute to our energy supply and annual emissions. These emissions from biomass need to be in the Yukon Government's reporting of annual emissions; they cannot be ignored as being "low carbon" or "carbon neutral". However, biomass is best viewed as a "bridging" form of energy supply, to be phased out as we progress to truly cleaner sources of energy¹⁶. To hasten this phase out, incentives are needed to make cleaner electricity a more favourable source of heat than burning wood, so that carbon emissions from burning wood can gradually be eliminated.

Thank you for the opportunity to provide input to your Panel.

¹¹ Mansuy, N. et al. 2018. Salvage harvesting for bioenergy in Canada: From sustainable and integrated supply chain to climate change mitigation. WIREs Energy Environ. 2018;7:e298.

<https://doi.org/10.1002/wene.298>

¹² Yukon Government 2019. op.cit. and Renewable Energy and Energy Efficiency Update (2016-2018) <http://www.energy.gov.yk.ca/pdf/emr-energy-strategy-update-2016-2018.pdf>

¹³ Mäkipää, R. et al. 2015. Canadian Journal of Forest Research **45**: 217–225 dx.doi.org/10.1139/cjfr-2014-0120

¹⁴ Yukon Initiative for Healthy Air. http://www.yukoncmoh.ca/files/YIHA-CMOH-Recommendations_2019.pdf and Yukon Government 2019. Actions 50 and 103. op.cit.

¹⁵ Cooke, H. et al. 2019. Fire and Insects: Managing naturally disturbed forests to conserve ecological values. Conservation Series Report No. 12, Wildlife Conservation Society Canada, Toronto, ON.

¹⁶ Project Drawdown. <https://www.drawdown.org/solutions/electricity-generation/biomass>

Yours sincerely,

A handwritten signature in black ink that reads "Donald G Reid". The signature is written in a cursive style. Below the signature, there is a faint, illegible watermark or text.

Donald Reid, PhD
Conservation Zoologist