Name: Robert Botterell

Organization: PVLA and PVEA

Date: October 10, 2017

Good Morning Commission Secretary Patrick Wruck

Please find attached three submissions in response to BC Hydro from Peace Valley Landowner Association and Peace Valley Environment Association expert Robert McCullough.

- Problems with BC Hydro's F1.11 Response

- Problems with BC Hydro's F1.7 Response

- Problems with BC Hydro's F 1.6 Response

Please let me know if there is any other information you require or any questions you may have.

Thank you for your assistance in this regard.

Rob Botterell

McCullough Research

Robert F. McCullough, Jr.
Principal

Date: October 10, 2017

To: British Columbia Utilities Commission

From: Robert McCullough

Subject: Problems with British Columbia Hydro's F1.6 Response

British Columbia Hydro has continued to forecast successful completion of the proposed LNG Canada LNG export terminal in spite of clear economic evidence:

> One major justification for including the three LNG projects in the Current Load Forecast is the fact they are requesting electricity service. Service requests from industrial sector customers, including LNG, are generally included in our industrial load forecast.
>
> LNG Canada executed a Load Interconnection Agreement, an Electricity Supply Agreement and a Studies Agreement in November 2014. We have completed a system impact study and are currently doing additional study work pursuant to those agreements.[1]

LNG export terminals are fundamentally a straightforward economic and engineering calculation. Natural gas is delivered by pipeline, refrigerated and compressed, and then loaded onto LNG tankers for delivery.

Industry practice is to compare the cost effectiveness of a proposed LNG facility as the charge per mmbtu. The primary determinant of cost per mmbtu is the capital cost of the facility – dollars per million tonnes per annum (MTPA).

The competitive standard for LNG export terminals is set by the Cheniere corporation at their two rapidly expanding facilities on the Gulf Coast. We have filed expert testimony in this proceeding on September 29, 2017.[2]

LNG Canada has widely publicized its basic cost data. The export facility is expected to cost C$40,000,000,000 and export 26 mtpa. This equals US$1,222,000,000/mtpa.

[1] British Columbia Utilities Commission Information Request No. 2.16.0 Dated: September 20, 2017 British Columbia Hydro & Power Authority PUBLIC Response issued October 3, 2017, page 5.
[2] F35-11, Question 16: LNG Prospects.

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Cheniere is expanding at US$500,000,000 to US$600,000,000/mtpa. Cheniere is able to sell its services at less than half the projected prices at LNG Canada.

The 50% price differential between Cheniere and LNG Canada explains why Cheniere has closed numerous transactions with Asian counterparties in recent years. Economists call this "revealed preference." Counterparties are choosing the enormous price differential even though the location adds an additional week of sailing time.

Our monte carlo analysis of market conditions required to make LNG Canada viable is dour – approximately 3%. In the remaining 97% of cases, LNG Canada is not a viable investment. BC Hydro's response only presents the macroeconomics of future LNG demand. To understand the probability that LNG Canada will even be able to compete successfully for that future demand requires the kind of microeconomic analyses we have provided.

MCCULLOUGH RESEARCH

ROBERT F. MCCULLOUGH, JR.
PRINCIPAL

Date: October 10, 2017

To: British Columbia Utilities Commission

From: Robert McCullough

Subject: Problems with British Columbia Hydro's F1.7 Response

British Columbia Hydro has repeatedly argued that sunk costs should impact on the BCUC's analysis of Site C:

> "The Commission has made preliminary findings that by December 2017, there would be $2.1 billion in sunk costs, and that termination and remediation would cost $1.1 billion.1 The total of $3.2 billion represents roughly 36 per cent of the updated cost to build Site C."[1]

Yesterday, Dr. Richard Thaler, a leader in the field of behavioral economics was awarded the Nobel Prize. In his famous book, *Misbehaving*, he characterizes the Sunk Cost fallacy as"

> When an amount of money has been spent and the money cannot be retrieved, the money is said to be sunk, meaning gone. Expressions such as "don't cry over spilt milk" and "let bygones be bygones" are another way of putting economists' advice to ignore sunk costs. But this is hard advice to follow, as the example . . . Vince and his tennis elbow, illustrate.
>
> To make things clear, let's stipulate that if a friend invited Vince to play tennis (for free) at another club, Vince would say no because of his painful elbow. In economics lingo that means the utility of playing tennis is negative. But having paid $1,000 he continues to play, seemingly making himself worse off every time he does so. Why would he do such a thing?[2]

[1] British Columbia Utilities Commission Inquiry Respecting Site C Executive Summary, F1.7, page 3.
[2] Misbehaving, Richard Thaler, 2015, page 64.

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The answer is that sunk costs should never be part of an economic analysis. The 22% of project costs have been spent and cannot be recovered. If they could have been recovered, the argument for termination of Site C would be stronger, not weaker.

Dr. Richard Thaler has commented that Knee Deep in the Big Muddy was the theme song of the Sunk Costs Fallacy.[3] For those unfamiliar with this famous anti-war ballad, I have placed it in the footnote below.[4] The term "Big Muddy" refers to the Mississippi River, not the Peace River, but the connection seems quite fitting.

[3] https://twitter.com/r_thaler/status/845343303251849216

[4] It was back in nineteen forty-two, I was a member of a good platoon.
We were on maneuvers in-a Louisiana, One night by the light of the moon.
The captain told us to ford a river, That's how it all begun.
We were -- knee deep in the Big Muddy, But the big fool said to push on.
The Sergeant said, "Sir, are you sure, This is the best way back to the base?"
"Sergeant, go on! I forded this river 'Bout a mile above this place.
It'll be a little soggy but just keep slogging. We'll soon be on dry ground."
We were, waist deep in the Big Muddy And the big fool said to push on.
The Sergeant said, "Sir, with all this equipment No man will be able to swim."
"Sergeant, don't be a Nervous Nellie, " The Captain said to him.
"All we need is a little determination; Men, follow me, I'll lead on."
We were, neck deep in the Big Muddy And the big fool said to push on.
All at once, the moon clouded over, We heard a gurgling cry.
A few seconds later, the captain's helmet Was all that floated by.
The Sergeant said, "Turn around men! I'm in charge from now on."
And we just made it out of the Big Muddy With the captain dead and gone.
We stripped and dived and found his body Stuck in the old quicksand.
I guess he didn't know that the water was deeper Than the place he'd once before been.
Another stream had joined the Big Muddy 'Bout a half mile from where we'd gone.
We were lucky to escape from the Big Muddy When the big fool said to push on.
Well, I'm not going to point any moral, I'll leave that for yourself
Maybe you're still walking, you're still talking You'd like to keep your health.
But every time I read the papers That old feeling comes on;
We're, waist deep in the Big Muddy And the big fool says to push on.
Waist deep in the Big Muddy And the big fool says to push on.
Waist deep in the Big Muddy And the big fool says to push on.
Waist deep! Neck deep! Soon even a Tall man'll be over his head, we're
Waist deep in the Big Muddy! And the big fool says to push on!
Songwriter: Pete Seeger

ROBERT F. MCCULLOUGH, JR.
PRINCIPAL

Date: October 10, 2017

To: British Columbia Utilities Commission

From: Robert McCullough

Subject: Problems with British Columbia Hydro's F1.11 Response

> o Wind projects are typically considered at their end of life after 25 years and as each facility approaches its end of life, the owner must decide whether to decommission or repower. The decision whether or not to repower a site will depend on factors such as market conditions for equipment and construction, and environmental and wind resource assessments.
>
> o Repowering will require significant refurbishment costs to decommission and replace existing wind turbines and towers. In addition, continued technology evolution that drives efficiency gains is expected to increase the size of the wind turbines, which likely changes the number and siting of turbines and creates the need to decommission and replace the existing foundations.
>
> o Repowering a wind generation site requires the decommissioning of a significant portion of the original infrastructure (turbines, towers, and possibly foundations) and may result in a significant period of time when the facility is out of service.[1]

The National Renewable Energy Laboratory has undertaken a very detailed study of repowering wind with significantly more favorable conclusions:

[1] British Columbia Utilities Commission
Information Request No. 2.40.0 Dated: September 20, 2017
British Columbia Hydro & Power Authority
Response issued October 6, 2017
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> Both financial analyses concluded that repowering tends to become financially attractive, relative to investing in a nearby greenfield site, after approximately 20–25 years of service. Plants less than 20 years old are expected to be capable of generating a favorable revenue stream for several more years.[2]

[2] Wind Power Project Repowering: Financial Feasibility, Decision Drivers, and Supply Chain Effects Eric Lantz, Michael Leventhal, and Ian Baring-Gould. December 2013, page vi.