Stephen E. Bruneau, Oct. 5th 2018

Speaking notes for witness testimony for the Muskrat Fall Inquiry

Questions prepared by SEB after interview with Crown Counsel May 23rd 2018

1. Please describe your Education and Professional Background
2. Can you describe how you came to be involved in the public discussion about new electric generation for the island?
3. Can you explain the rationale given for excluding natural gas from consideration?
4. In what way did you suggest that this statement or conclusion about excluding natural gas may not be adequate?
5. So can you explain the basic premise of your claims?
6. So you are aware of the Ziff Energy Group report conducted after your public presentation? *and* Would you be willing to comment on the findings of that study as they relate to the assertions you have just made to us?
7. Are you aware of the Wood Mackenzie Report commissioned by NL Dept of natural resources for the purpose of reviewing Ziffs report? Can you comment on their findings?
8. Are you aware that both Ziff and Wood Mackenzie name you specifically in their reports? Can you comment on this?
9. Have you any final comments you would like to make?

| Date / Sequence | Event/Document Referred to in these notes | |
|---|---|---|
| 2001 | Provincial Government - Natural Gas Export Industry Study | |
| 2005 | NOIA Presentation by SB – Natural Gas for Island Electrical Generation | |
| 2006 | NEIA Presentation by SB – Further justification for Island Electrical Generation Using Natural Gas | |
| 2007 | Provincial Energy Plan Published | |
| 2011 | North Amethyst Development Plan Amendment | |
| 2011 | Navigant report for Nalcor – Independent Supply Decision Review – Natural Gas Excluded from consideration | |
| 2012 | SB Submission to the PUB – A case for considering Natural Gas | |
| 2012 | SB Harris Centre Public Forum – Gas for Island Generation | |
| 2012 | Ziff report commissioned | |
| 2012 | SB Article in Newfoundland Quarterly "Natural Gas Better than Labrador Hydro for Island Energy Requirements" | |
| 2012 | Ziff report Tabled | |
| 2012 | Sanction of MF project | |

***Q- Please describe your Education and Professional Background:***

Grew up here in St John's and did a bachelor of engineering – civil at MUN in 1987. I worked for two years in commercial construction and steel design and obtained my Professional Engineering designation. Then undertook a Masters of Engineering Science at Western University in the study of civil aeronautics and hydrodynamics with a focus on offshore oil and gas structures. After completion I returned to Newfoundland to work at C-CORE as a consulting engineer in the ice group. From 1992 to 1997 I worked on ice risks to FPSOs, GBSs, pipelines, etc and obtained a PhD for my work on the Confederation Bridge.

From 1997 to 2002 I worked for North Atlantic Pipeline Partners here in St John's on energy and industrial development proposals, with particular efforts to initiate a natural gas industry for the Province. In 2003 I began working on a number of business ventures with my friend and colleague Ed Maher of Placentia and Long Harbour, in particular, small hydro project proposals and the development of service industries/infrastructure for the Voisey's Bay Nickel Company.

In 2005-6 I joined the Faculty of Engineering and Applied Science as an Assistant Professor and have since that time been involved in a myriad of R&D activities relating to cold ocean and harsh environment resource development. I am presently the Director of Industrial Outreach for the Faculty of Engineering and the principal investigator for a Norway/Canada-sponsored program investigating ice damage to concrete structures in ice-prone ocean environments.

***Q- Can you describe how you came to be involved in the public discussion about new Electric Generation for the Island?***

I had worked on the risk and feasibility of energy projects including Grand Banks pipelines for private interests since the early 90s, but in 2005-2006 I joined Memorial University full-time. So in 2005 I was asked by NOIA representatives to give a talk at their annual conference on the merits and rationale for piping natural gas to the Island of Newfoundland for domestic electricity supply.

It seems that my talk provoked discussion both positive and negative. In response to this I was asked in 2006 by NEIA to give a follow-up talk, which I did, objectively laying out the details and incentives for the Grand Banks-Island-natural gas-for-electricity option. Both of these presentation documents are a part of the public record, and always have been.

In 2007 the Provincial Government Published its much-anticipated and touted Energy Plan, entitled ***Focusing Our Energy***. This Energy Plan can be viewed today on the government's Natural resources website as a major guiding document for energy and resource development for the Province.

In that Plan there is an action statement that says the Government of Newfoundland *will* **"request that all companies provide a detailed assessment of the feasibility and provincial**

**benefits of landing gas in Newfoundland and Labrador prior to submitting a development plan."** The policy goes further and states that all viable options must be fully assessed for the development of our gas resources for amongst other things – *the generation of electricity*. It explicitly states that companies will be asked to provide detailed **"Landing in the Province"** options *when submitting any development plan*.

Four years later, in 2011, Nalcor released what was then called the Independent Supply Decision Review by consultant **Navigant.** The mandate of Navigant was to determine whether the Interconnected Island alternative (Muskrat Falls project) represents the least cost option for providing domestic electricity for the Island of Newfoundland.

In the conclusion of the Navigant Study they stated that

**"Nalcor appropriately excluded natural gas generation in both generation expansion alternatives because natural gas is not commercially available on the Island and there are, as yet, no firm development plans to bring natural gas to the Island."**

When I became aware that natural gas was ***excluded*** from consideration I felt compelled to inform the PUB that this could not be supported on the basis of evidence and was contrary to the Provincial Energy Plan itself. Thus I submitted a discussion paper to the PUB that argued that natural gas was, in fact, a very realistic option for domestic electricity in Newfoundland and that it ought to be given more serious consideration.

In early 2012 The Leslie Harris Centre at Memorial University asked if I would be willing to give a public talk on the matter of using Grand Banks Gas for Island Generation, to which I agreed. And that is how I came to speak publicly about the topic during the pre-sanctioning process.

***Q - Can you explain the rationale that was given by Navigant or Nalcor for excluding natural gas from consideration?***

The only evidence, statement or research that I could find to support Nalcor's decision to eliminate natural gas from consideration was three paragraphs in the Navigant report. These paragraphs said gas isn't available commercially because a Government Report done in 2001 said this. There was no other evidence of any research, dialog or other consideration given to Natural Gas in the Navigant report.

I am quite familiar with that 2001 report. I can state that the case for using stranded Grand Banks gas on the Island for electricity was not considered. Rather the report concluded that a natural gas ***export industry*** would require 700 MMSCFD to be feasible (more than 20x our domestic needs by comparison) and that *all* operators would necessarily have to work together to initiate it and that our domestic needs alone were too small to support this ***export industry*** on its own.

Further to this, ***the 2001*** report used to exclude Natural Gas from consideration for island power ***in 2020*** had this to say:

> *"It is the purpose of this report to determine the economic feasibility of developing the gas resources (offshore Newfoundland) based on a submarine pipeline system. For the BASE REFERENCE CASE gas sales are projected to start in 2015. This assumes that gas will initially be utilized to enhance oil production. The year 2015 was selected as the Base Case during the resource evaluation as this was the basis for no-loss of oil production.."*
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> 2001 study: Technical Feasibility of Off-shore Natural Gas and Gas Liquid Development Based on a Submarine Pipeline Transportation System, Off-shore Newfoundland and Labrador, Final Summary Report to the Government of Newfoundland and Labrador, Department of Mines & Energy, Petroleum Resource Development Division, submitted by Pan Maritime Kenny – IHS Energy Alliance, October 2001

***Q - In what way did you suggest that this statement or conclusion may not be adequate?***

In the first case it left me wondering where the studies were that we were going to get from the operators according to the action item in the 2007 Energy Plan. The plan said it would request detailed assessments of landing natural gas on the Island yet these were not referenced in the Navigant report and I haven't been able to find them.

Navigant's report also raised the question of Nalcor's own work on this file. Not by what was said, but by what was missing. What evidence was there that any research was done or that any kind of dialog with offshore operators had taken place? Nalcor was at that time on its way to becoming ***a part-owner of three developments*** - some very gas-rich resources like North Amethyst. But there was no evidence given that any kind of overture, proposal or request-for-proposals had been made to any of the operators (or itself) about securing a gas supply for our domestic electric power needs. I did a word check of the 2011 North Amethyst development plan on the CNLOPB website – and found that the word ***pipeline*** was not in the document. Yet the Government Energy Plan from only a few years prior said they would be asked to provide a **"landing in the province"** option for natural gas. The only reference to a development strategy I found in that N.A. Development Plan from 2011 was as follows:

> *"Produced gas from the North Amethyst Hibernia will be re-injected into the Northern Drill Centre (NDC) for storage in the same manner that excess produced gas from the South Avalon, North Amethyst and West White Rose pools is currently being handled. The gas storage area capacity is currently under evaluation and the NDC has one spare drilling slot which is available for expansion. A gas storage strategy (NA-SST-RP-0049) was submitted to the C-NLOPB in June 2009"*

The excess produced gas referred to for all White Rose operations was being stored because it couldn't be used for enhancing oil production and couldn't be flared. We the Province of Newfoundland and Labrador, are part-owners of that resource.

***Q - So can you explain the basic premise of your claims?***

I'd like to say that the over-arching purpose of my work in 2012 was to point out that natural gas had been unfairly excluded from serious consideration as an option for domestic electrical generation. I have good reason to think that I achieved this goal because of the stir it seemed to cause shortly after – and the subsequent rush to commission a study on this natural gas option. The time line of these events is important and I have prepared a small table to help illustrate the sequence in which events took place.

In terms of specific research and evidence the document I presented at the Harris Centre forum set out to inform the audience about a few things:

First I wanted to point out that contrary to some claims made in the media, natural gas was available within the time frame of our domestic needs, for the duration of our needs and in the quantities we needed for domestic Island electricity. I provided referenced articles, sources and reports that proved that this was the case. The repeated position of others that natural gas was not commercially available was an opinion that was not supported on the basis of any evidence. The word commercial was being heavily employed as a substitute for actual values, facts and figures. It would have been equally true to say that Muskrat Falls power was not commercially available in 2012 either. But it doesn't mean that either option wouldn't be if we decided to make it so.

The 2007 Provincial Energy Plan included a figure that showed marketable natural gas from Grand Banks becoming available in 2020. Independently, the National Energy Board of Canada used 2020 as its most likely scenario for Grand Banks gas getting to a market. And it was the opinion of the Hibernia Partners (HMDC) that natural gas sales of their Grand Banks gas could be initiated in 2019 and that the sales might benefit their oil production. That information was embedded in an annual report of the CNLOPB. These facts can't be reconciled with the exclusion of natural gas due to its unavailability. I provided details of this evidence in my 2012 presentation.

I also wanted to address the question of the quantity of natural gas that we might need for Island generation. It is an indisputable fact that the quantity of natural gas required to fuel domestic electric needs is being actively stored offshore. It is also a fact that more natural gas is used to generate electricity for the Hibernia, Terra Nova and Sea Rose platforms – than is needed to replace Holyrood. That was the case in 2012 – and I just checked for 2017 – same. More natural gas was flared offshore last year than would have been required to replace Holyrood 2010 (17mmscfd/ vs 13). As stated earlier the produced gas at Whiterose not used for enhancing oil production greatly exceeds our provincial thermal generation needs. The natural gas production from North Amethyst and Hibernia South **alone** (29mmscfd) is actually equivalent to our provincial needs and the Province is now a stakeholder in both.

The second part of my presentation in 2012 was to point out that natural gas developments of the same scale with similar components are commonplace world-wide and that the costs are well within the range that would necessitate a good hard look. I was in no position to give precise cost information on our own potential undertaking, but felt it essential to point out that the approximate costs and schedule were entirely reasonable for us to consider the option more carefully for domestic needs.

Thus in my 2012 presentation I provided a rough estimate of the capital cost of the various parts of infrastructure to transport gas and then to generate electricity with it. These added up to around 2 billion dollars – all in. A repeated criticism of my estimate thereafter was that these capital costs could not be recovered by the oil producers if they were paid just North American market prices for the gas we needed. Of course those who said this misspoke or elected to ignore that in the development example I gave the oil producers *did not* pay the capital cost for the gas transportation system and power generation. In other words, what I said and wrote – and is still on the record on-line for all to see – is that we in the Province of Newfoundland and Labrador could afford to pay for all the key infrastructure ourselves and ***still*** pay the producers for supplying us gas at their platform at a market price - and - that this undertaking would altogether still be billions cheaper than Muskrat Falls in 2012.

***Q - So you are aware of the Ziff Energy Group report conducted after your public presentation?*** Yes. ***Would you be willing to comment on the findings of that study as they relate to the assertions you have just made to us?***

Yes. I'll start by making two comments, then I will speak directly to all of the key findings within their report.

The first comment is that the commissioning and execution of the Ziff work after my talk and within a few months of the final sanction of the Muskrat Falls project confirmed that this work had not already been done.

For the second point I draw your attention to the warranty provided by Ziff on its opening page. It says *"The data contained in this study, although believed to be accurate, is not warranted or represented by Ziff to be so. Ziff expressly disclaims all responsibility for, and liability in respect of all loss and or damage howsoever caused, including consequential, economic, direct or indirect loss, to any party who relies on the information contained in this study"*

Were they paid to do this work? I was working entirely alone, unaffiliated and unsupported yet I was, and still am as a professional engineer willing to take full responsibility for the work I did and because the figures I used are all sourced, cited and referenced I don't need to make any excuses for them.

The Ziff report conveniently listed all of their key finding and I would like now to reply to each of them:

1. *Ziff Finding Number 1 of 9 : while the gas offshore Newfoundland and Labrador is in place, there is currently no viable market for offshore Newfoundland gas; there is no pipeline in place and no commercial contracts in place to sell it.*

   Prior to the sanction of the Muskrat Falls Hydro Electric Project, there was no dam in place, no transmission system to carry the power from it nor were there contracts in place to buy its hypothetical power. In other words the Ziff statement has no meaning in the context of assessing *future* development proposals.

2. *Ziff Finding Number 2 of 9: "Associated gas produced with oil offshore Newfoundland is used to power oil production systems or is reinjected to enhance oil recovery and **is not available**."* Then the next sentence contradicts the first by saying: *"natural gas surplus to fuel needs on the platforms is re-injected into reservoirs to enhance oil recovery OR conserved should a commercial opportunity become available. Using Associate gas to enhance oil recovery is a long term benefit for oil resource owners – **who would be negatively impacted by using gas for Island Electrical generation**."*

   In the months prior to this statement by Ziff the CNLOPB had a very different opinion on this exact point (From the CNLOPB I quote:)
   *"Future exploitation of gas resources will extend the economic life of the White Rose field and permit additional oil recovery. The solution gas resource is either stored, used as fuel or flared. Husky must find additional gas storage in order to produce oil from North Amethyst – they must resolve this storage issue as surplus gas flaring will not be permitted above authorized flaring allowance.. . ."*
   Elsewhere the CNLOPB goes on the say:
   *"Future exploitation of the gas resources may also extend the economic life of the Hibernia field, permitting additional oil to be recovered. According to the proponent Hibernia (HMDC) "Hibernia could support 200-300 million standard cubic feet of gas per day starting after 2020 in order to ensure that optimized reservoir oil exploitation occurs." End of quote*. Our domestic needs now are around 1/10 of the amount that Hibernia said it could make available by ***next year***. And Hibernia's life is certainly going to take us past the 2041 date in which we have an entirely new set of conditions for domestic power.

3. *Ziff Finding Number 3 of 9: "The Government of Newfoundland cannot compel the sale of Grand Banks natural gas nor can it mandate a price."*

   I have two articles that neatly answer this. The first from CNLOPB regarding the development proposal by Husky for White Rose:
   *"Concern was also expressed during the Public Hearing that White Rose gas might not be made available for export if gas transportation infrastructure was put in place. The*

*Board, on its part, would expect in such circumstances that access to White Rose gas, subject to conservation considerations, would be realized through normal commercial negotiations. As discussed later, the Legislation does, however, provide the Board with authority to issue a Development Order should such a course of action be required."*

The second article here is from the Globe and Mail (Shawn McCarthy) – August 2008
Entitled **"Partners make peace with Hebron Deal"**

*". . . In April, 2006, the province and the oil companies broke off negotiations over Hebron, accusing one another of making unreasonable* ***demands****. The premier was particularly vitriolic toward Exxon Mobil Corp., the largest shareholder, which he blamed for scuttling talks* ***over his demand for an equity stake****.. . . For all the bitter words and stalled negotiations, the Hebron offshore oil project simply offered too rich a return to both the government and the industry for the two sides to continue warring over the details, Chevron Canada Resources Ltd. president Mark Nelson said yesterday"*

4. *ZIFF Finding Number 4 of 9: Capital cost to develop Grand Banks gas is high and the return is not sufficient to justify the expense:*

Even though Ziff made **extraordinary** burdens on their cost estimate for on-Island gas generation (Like the necessity to put a pipeline in place now that can carry the maximum projected peak demand load for the Island in the **year 2067**, *and* the necessity to carry the cost of replacing the offshore platform and gas plant, *and* the necessity to drill all new wells for obtaining the gas needed – which are all extraordinarily pessimistic assumptions) even though these assumptions are embedded in their costs – Ziff's own figures still don't support their conclusion, rather they appear to favor natural gas over Muskrat Falls between now and 2041. For instance – the total full cycle *all-in* price for gas-fired electricity using an FPSO appears to be under 5 billion dollars (2012) – only rising higher than this if we choose to continue paying for gas generation after 2041 when the 6000 MW of upper Churchill power becomes ours to use or sell (Figures derived from Ziff Page 8, and Pages 13, 14 and 15).

Furthermore, when we break out Ziff's figures for capital costs alone we get the following:

- 400-600 million for FPSO refit and gas plant (Ziff Page 14 )
- 640++ million for pipeline (Ziff page 18 – North American Standard Estimate)
- Nothing for replacement of Holyrood? Curiously missing from Ziff . . ? In any event I'll put in a figure of 700 million for a new dual fuel power plant as this would clearly be needed.

This means that the total capital cost for the infrastructure alone to bring natural gas from Grand Banks to Newfoundland and generate electricity from it – is around 2 billion dollars according to Ziff. This is the same estimate that I presented back in 2012. Everything else;

gas price, royalties, tariffs, taxes, production and well strategy, partnerships etc, was, and still is, negotiable.

Amongst the assumptions made in Ziff's report is the view that oil would run out in 2028 at White Rose. They also assumed all new wells were needed to produce gas and that the natural gas for the Island would need to pay to operate the FPSO from 2028 until 2030 at which time it would then have to buy and operate a new one. Why Ziff assumed that a gas supply for the Island would have to go it alone in the absence of an oil industry is inexplicable. These assumptions are unrealistic and suggest some kind of extreme bias.

It is a shame that the entire Ziff study ignored the simple fact that the excess natural gas that Province could have used for Island power production was stranded and worthless to operators just over the horizon and the cost to get it here was relatively low.

How close, for instance, would Hibernia have to be to the Island before the Ziff study noticed that natural gas might actually be a perfect fit for our isolated needs?

As a thought experiment, I tested Ziff's assumptions by removing the pipeline – which is to say "What if the Island was somehow 330 km closer to Hibernia than it actually is – then what?" According to Ziff's cost figures, regardless of whether Hibernia or White Rose were beside the dock in Holyrood – the cost to use the ***surplus*** or ***flared*** gas for electricity in the plant beside it - was too high and uneconomical ***because it is stranded***.

The point is that Ziff's study might just as well have been about Hibernia supplying gas to Greenland or Thailand because there was no effort to see that gas was NOT stranded from us on the Island. It should be obvious that if gas had been brought to shore its value to us citizens would be spectacularly high compared to any perceived sale value to the operator. For the operators the value of the gas *did not* and *does not* warrant a self-funded development, whereas for us on the Island the value of the gas was equal to the cost of our nearest alternative.

5. Ziff Finding No 5 of 9: *The power market in Newfoundland is demonstrably small, and the load profile fluctuates, with demand spikes in winter months, and very little demand in the summer. This poses a challenge for development:* ***the gas volume required to replace oil and meet load growth would be comparatively small for the size of capital investment*** *and unevenly spaced throughout the year. Due to the low annualized volumes of gas required for Island Power Generation and the high capital cost of developing and transporting Grand Banks gas, the unit cost of the gas landed at the generation plant gate renders this option* ***uneconomic.***

How can one respond to this? Indirectly the Ziff report is saying that a capital cost of under 2 billion dollars cannot be justified on the basis of the demonstrably small market for power on the Island. Were they aware of the alternatives? Something is uneconomical when alternatives are available that are *more* economical. What was Ziff comparing this gas-fired

option to? By analogy one might say that it is uneconomical to rent a car to get from A to B, but this statement is based on the premise that some other means of transport is available and that it is cheaper.

In response to Ziff's warning about the risk of relying on natural gas for power generation I'd like to quote the following from elsewhere in Ziff's report:

*"The expected lead time to construct a natural gas to electricity generation facility is typically assumed to be 2 to 3 years, perhaps 4 times faster than siting a new nuclear or coal fired power plant. Additionally, unique consumer requirement for instant electricity (power needs to be available at the flip of a switch) aligns very well with the ability of natural gas power generation plants to start up or shut-down more rapidly than nuclear or coal fired power plants. Further, gas to electricity plants can be added in incremental steps to better align with market growth opportunities versus building the ultimate sized facility for growth expectations later in the facility life. Combined cycle power generation is an efficient and widely used method of converting natural gas to electricity. The process is well established.*

And a little later Ziff's report states:

*Even after securing natural gas as a feedstock, there will still be a requirement for redundant dual fuel capacity to insure consumers are safe on cold winter days.*

This, of course, is exactly what was done when Tuft's Cove plant in Dartmouth Nova Scotia was converted to burn Natural Gas – the ability to flick over to diesel or heavy fuel remained in place so that dispatchable power is guaranteed via redundant fuel supplies on site. Interesting to note that a recently updated Wikipedia article on the Tuft's cove plant says the following:

> *"Due to low prices in recent years, the entire plant has run largely on natural gas, which has dramatically decreased its emissions profile"*

6. Ziff Finding No 6. *A subsea pipeline is costly and a significant challenge: the length of the pipeline is a balance in cost and risk. A shorter pipeline will be subject to iceberg scour risk and will need extensive trenching and dredging. A route away from icebergs along the edge of the continental shelf will double the length of the pipeline . . .*

Later in the report Ziff pegged the cost of the pipeline to be $640million if it were to take the same Grand Banks route that Exxon has carefully chosen to lay its costly fiber-optic cable – now in operation. I have no objection to Ziff's cost estimate for this pipeline, I'm only mystified as to why they would list this as key finding. In terms of iceberg risk, it is best to defer to the experts on this – they have all in unison agreed that the risk is acceptably low not unlike the risk of hurricane damage in the Gulf of Mexico.

7. Ziff Key Finding no 7 of 9 *As there is currently no low cost natural gas available on the Grand Banks for Island power generation, the most likely scenario to develop gas on the Grand Banks would be a standalone gas project.* Etc etc –

Ziff gives their all-in costs for natural gas developments in units that very few people would understand: "2012 dollars per thousand cubic feet of gas". I converted this to an annual cost using Ziff's "Sea Rose Estimated Natural Gas Supply Option" at 2012$21/Mcf multiplied by 32,000 mcf/d per day which is Ziff's prediction for our average gas consumption to replace Holyrood. This works out to be under $250 million dollars per year – ALL IN. And recall that this is the heavily burdened estimate with assumptions of: new wells, very expensive gas plant, an enormous pipeline, oil runing out in 2028 etc etc.. This $250 million per year figure seems rather affordable to me in light of the alternatives. Remembering that a fundamental reset of the energy equation was going to occur in 2041 (at the latest) I can in no way reconcile Ziff's figures with their own conclusions.

8. Ziff Finding no 8 and no 9 relate to their assessment of LNG as the primary fuel for new thermal generation. I did not represent this option back in 2012 and I don't have updated knowledge to comment on Ziff's findings. I can, however, say that in 2001 NFLD Hydro was approached by a company I worked with (NAPP) with the express interest in buying the Holyrood plant and converting it to natural gas fired generation that would, in the first instance, be fueled by LNG and later by Grand Banks gas when it became available. In that proposal none of the capital costs were to be borne by the consumers except through fair market rates to be judged by the Public Utilities Board.

**Q - Are you aware of the Wood Mackenzie Report commissioned by NL Dept of Natural Resources for the purpose of reviewing Ziffs report? Can you comment on their findings?**

Wood Mackenzie's conclusions were that they endorse Ziff's conclusions, would themselves have even raised some of the costs used and they finished by saying the following:

> *"Additionally, we believe that the Government of Newfoundland may find it difficult to enter a contract for that gas that would make the producers interested in producing the gas for market due to the costs of production and the low level of requirements that Newfoundland will have for power generation."*

I guess my response to this is how staggeringly uninspired and superficial it is. Wood Mackenzie fails to question any of Ziff's fundamental assumptions, and then fails to notice the obvious: Rather than assuming that natural gas must somehow be prized, stolen or coerced at some grievous loss to the offshore operators – there is an opportunity here to help solve the gas storage problem for operators while at the same time satisfy a dire need for domestic power on the island of newfoundland. It is as simple as that and they failed to see it.

**Q - Are you aware that both Ziff and Wood Mackenzie name you specifically in their reports? Can you comment on this?**

I was aware of it, but to be honest didn't see these reports until late in 2012 after the project was sanctioned – and by that time I removed myself from further debate. Ill admit that when I learned they had attributed a full chapter of their report to a critique of my Presentation I was at first concerned. However, after reading their criticisms and comments I could see there was no danger to the substance of my arguments, rather it raised serious questions for their client.

If I may, I'd like to respond now (for the first time in these intervening 6 years) to the critique of my work by Ziff:

> *#1 ZIFF vs Bruneau*
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> *Dr. Bruneau asserts that: "According to the CNLOPB and Husky Energy, natural gas cannot be used for enhanced oil recovery at White Rose or North Amethyst, thus a marketable gas opportunity arose in 2006 and continues through today and will continue until the end of life of that project." His Conclusion 1 states that: "Natural Gas is available for domestic import now and for a long time into the future, but no plans or efforts have been made to access it."*
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> *• Ziff Energy's discussions with representatives of Husky reveal that the operator has studied monetizing the gas resource and this analysis is ongoing. The Operator wishes to maintain the optionality to use White Rose natural gas for enhanced oil recovery as in Hibernia and Terra Nova. The Operator asserts that, at time of writing, White Rose natural gas is not being considered for any use other than enhanced oil recovery as they assess the technical and commercial viability. This situation may change in the future as the oil resource is depleted. Husky representatives indicate that the most likely commercial option for development of gas resources offshore Newfoundland involve LNG liquefaction and export to oil-referenced markets*
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> *• It is Ziff Energy's opinion that if the natural gas is not commercially available because the Operator may have a use for it in enhanced oil recovery, there can be no consideration of Grand Banks natural gas when required for Island Generation option.*

This is an extremely important piece of evidence. Ziff actually says that they spoke to someone within Husky. I believe it should be a matter of public record to know who this was and what was said because the significance of this evidence cannot be understated. Ziff takes such great care and uses such delicate language to try and convey a message ***that they did not get*** from Husky. Husky did not say that gas was not available, on the contrary, Husky said that they were open and interested in studying ways of monetizing natural gas at that precise moment in time! Ziff also appears to suggest that Nalcor had not spoken to Husky about any such opportunity or they would certainly have said so.

Ziff says it is their opinion that natural gas is not commercially available because the operator may have use for it in enhanced oil recovery *some time in the future*, thus there ***can be no consideration*** (their words) for Island generation going forward. Yet we know for a FACT that Hibernia said gas could be available for Island generation when we needed it and that for them

selling gas may actually enhance oil recovery! So Ziff is in disagreement with Exxon about how to manage their resources offshore Newfoundland. And we know from the evidence I gave earlier that the CNLOPB said the same thing as Exxon and Husky on this matter. Why Ziff's opinion disagrees with the chorus of opinions cited above is for Ziff to explain.

Ziff did not find an executive amongst all the operators willing say that selling gas to the Island ***cannot*** be done. In fact, they didn't even provide the name of the source that gave them the vague an uncommittal information they received.

> *#2 ZIFF vs Bruneau*
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> *Dr. Bruneau's Conclusion 2 states that: "Natural Gas is being produced at a rate that exceeds our domestic electrical needs – can sustain our requirements for a long time." • Ziff Energy finds that the small domestic power generation requirements are a barrier to commercial viability as the **massive** costs of production and pipeline infrastructure would need to be recovered from a very small rate base, rendering the natural gas feed costs (and generated power) uneconomic (from 2012C$21/Mcf to $33/Mcf for the most likely standalone gas development).*

I cannot be alone in finding this to be another extraordinarily biased statement. Oddly, the quote that Ziff drew from my work was untouched - not refuted at all. Instead, Ziff condemned my efforts on the grounds that our domestic needs for electricity in Newfoundland were so small that they could not justify the MASSIVE (their word) MASSIVE costs of the infrastructure required to deliver the gas. As far as I can tell the ZIFF capital costs of the HUSKY FPSO gas development option was under 2 billion dollars, and mine were the same.

> *#3 ZIFF vs Bruneau*
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> *Dr. Bruneau's Conclusion 3 states that: "Natural Gas reserves and resources on the Grand Banks are in quantities that exceed domestic electrical requirements for the foreseeable future."*
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> *• Ziff Energy agrees that natural gas reserves and resources are physically available in quantities in excess of domestic electrical requirements. Ziff Energy finds that natural gas, at time of writing is not commercially available. Further, the cost of bringing natural gas to the Island for power generation is punitive (from 2012C$21/Mcf to $33/Mcf for the most likely standalone gas development), given the low volume requirements now and in the future. These factors militate against commercialization of the natural gas solely for power generation.*

Rather than using facts and well referenced sources, Ziff's answer to basically everything is to forward the OPINION that gas wasn't commercially available, therefore it couldn't be studied for commercial availability. Recall that only two paragraphs ago Ziff said that Husky was actively looking for ways to commercialize (their word was monetize) their gas. This sounds more like two lonely soulmates that somehow failed to meet at the prom.

*#4 Ziff vs Bruneau*

*Dr. Bruneau asserts that icebergs were considered too risky for Grand Banks pipelines 30 years ago. Further that: "Today, 30-Platform-years later, the safe and reliable production and operation has proven the effectiveness of management practices and the relatively low risks that icebergs pose – particularly to seabed equipment, flowlines and offshore loading pipelines."*

*• Ziff Energy notes that offshore operators have chosen to transport Grand Banks oil via marine shipping rather than pipeline. The iceberg risk to a platform are considerably less than risks to a pipeline which has a longer and larger footprint and therefore a higher risk of impact over the term of use. Even with trenching, the assertion that iceberg risk for a several hundred kilometre pipeline can be managed is questionable and this practice is unproven on the Grand Banks. Dr. Bruneau cites other projects analogous to a Grand Banks pipeline, including Australian, Norwegian, Vancouver Island and Tobago projects. Some are in harsh climates, however, Ziff Energy notes that none of these other projects face the unique risk associated with icebergs off Newfoundland. Security of supply and economic and environmental consequences from a pipeline failure required for powering homes and businesses cannot be understated. Current operators with expertise in harsh conditions have been unwilling to undertake such a project. The Government of Newfoundland and Labrador, or an agent thereof, would be well-advised not to attempt such an undertaking based on theory and not sound and tested practice*

Ziff is out of bounds on this statement in the following ways:

- Hibernia was the first of its kind in iceberg infested waters – according to Ziff it shouldn't have been done. Fortunately the operators didn't see it that way - they pioneered - did it and it seems to be working out just fine.
- I have a great deal of personal experience in this particular area and my colleagues and I believe that the risks are manageable – in the same way that Exxon judged that it was an acceptable risk to lay fiber optic cables to shore from Hebron.
- Lastly, Ziff neglected to say that the Muskrat Falls project was predicated on engineering and mitigating the risks of iceberg and sea ice damage to the subsea cables in the Strait of Belle Isle. I can assure Ziff that the icebergs in the Strait are very much like the ones further to the East and the engineers that worked on the cable challenge would do the same for a pipeline.

*#5 Ziff vs Bruneau*

*Dr. Bruneau concludes that: "Capital costs are very low relative to the alternatives presently under consideration for domestic electricity supply."*

- *Dr. Bruneau excludes the "Platform modification" component, saying such costs are "to be considered in the context of gas price." Ziff Energy does not agree with Dr. Bruneau's conclusion, and finds the total costs of gas resource development and transmission are punitive given the small domestic electric generation load.*
- *Ziff Energy estimates costs to refit the White Rose FPSO at 2012C$600 MM, with a replacement of the FPSO vessel required in 2030 costing an additional $450 MM*
- *Natural gas development would have to bear all of the capital and operating costs once the oil reserves have been produced, possibly by 2028, close to the end of the useful life of the existing FPSO. Thus, operating costs are split oil, gas until the oil runs out, then gas carries all the cost. Currently, oil production operating costs are in the order of $250 MM/year (these costs equate to about $18/Mcf based on 37 MMcf/d of initial annualized gas flows in 2017).*

The Ziff report once again says that domestic electric generation load is so small that the cost of gas-fired generation cannot be justified. Was Ziff made aware that in the context of the day, the natural gas option was being directly compared to the Muskrat Falls option? Did they know that the whole point of the exercise for Navigant and Nalcor was to determine the lowest cost option for NEW generation for the Island?

In any event, Ziff did not like the fact that I was unwilling to suggest what the costs would be to modify a platform for gas export. Of course I had good reason to not do this in 2012 in my presentation – because it could be so easily disputed and seen as meddling in the affairs of the operators. Unlike Ziff, I did not have a mandate from Government with some kind of allowance, contract, or even right to interview or ask offshore operators what would be the preferred manner in which they would make a gas stream available to us.

What I did know at that time is that in 2004 Husky said in their White Rose proposal that they estimated a cost of $100 million to prepare their platform for gas export if need be. And that figure was for gas quantities far greater than our domestic needs on the Island. Ziff disagreed with Husky on this point and inflated the figure to $600 million.

I must point out at this juncture that the ***scale*** of things here is quite important to understand. The platforms off our coast in 2012 and more so today - use more gas to power themselves that would be required to replace Holyrood. They, in fact, produce more than ten times the quantity we would need and they already have the on-board capability to process and compress it all.

That is not to say that new equipment and production strategies wouldn't be required to shift into a gas-sales mode, it is just to say that the imperative that a new platform is required, new processing plant is required, all new wells are required and that a pipeline big enough to meet their drastic demand growth projections up to the year 2067 - is not a fair assessment of what was involved in 2012. If one was inclined to look at the requirements in a *highly optimistic* light rather than the *overly-pessimistic* view of Ziff, it is conceivable that NO substantial costs would

be associated with modifying a platform to export gas given that they already possess the compression and gas conditioning equipment required to do so.

The last claim by Ziff is that the gas export-to-Newfoundland arrangement would have to bear all capital and operating costs of the Sea Rose FPSO beginning in 2028 because oil might run out for Husky at that time. At the very same time in 2012 Husky had announced that it was planning to place another platform at White Rose – this one a wellhead GBS (WHP) that they said would have a productive life of 25 years minimum. Husky also said that all well fluids (Oil and gas) will be transported from that new WHP via subsea flowlines *to the Sea Rose FPSO* for processing. So in 2012 Husky said that they plan to offload oil to an FPSO until around 2045. Thus Ziff's extremely costly assumption is invalid.

*#6 Ziff vs Bruneau* (Last one)

*Dr. Bruneau makes the following assumption: "For domestic power production NL pays US utility market price for fully processed, pipeline ready and compressed gas at a metering station/pipeline launch point on the platform...."*

*• Ziff Energy does not agree with Dr. Bruneau's simplifying assumption. Grand Banks natural gas is not physically connected to the North American gas grid (nor is Newfoundland). Grand Banks gas would not be sold on the mainland into a market which has experienced unprecedented supply growth and that is priced off gas on gas competition. The opportunity cost of selling gas to Newfoundland at a North American gas price index is punitive, given the full cycle cost of production. If gas were to be developed for commercial sale, Grand Banks producers would most likely sell into European or Asian markets in the form of LNG. Natural gas in these markets is primarily priced off an oil index, adjusted for BTU content. Newfoundland consumers would therefore pay a price based on these alternative markets, and not a North American utility price. Dr. Bruneau's analysis and demonstrated fuel cost savings are based on this simplistic assumption and are therefore incorrect.*

In this claim Ziff misrepresented what I proposed. I said, we, the province, would save billions of dollars if we bought and paid for a new power plant, a new pipeline and all associated infrastructure up to a platform, AND still paid the operators for natural gas at a price that they would get IF they somehow managed at their own expense to get their gas to market many thousands of miles away. Why would an operator refuse to consider this? Would they say no so that they could continue to use expensive wells to store their gas for an unknown period of time so that they may sell it to a hypothetically better market using their own self-funded transportation scheme? Ziff must know how ridiculous this sounds when it is disentangled from their confusing assumptions. Regardless, when one considers the amounts of gas available to Husky there is absolutely nothing stopping them from doing both. Furthermore we could afford to more-than-match any market price anywhere in the world and still save billions of dollars over the alternative. But how will we ever know what the negotiated price for the stranded gas would have been? It appears that no-one asked.

**Q - Have you any final comments you would like to make**

In 2012 before the Ziff report was ever commissioned and just months before the final project sanction, the Government of the day said in response to my presentation that natural gas wasn't even worth studying (reference the telegram). It was said that the Atlantic Accord didn't allow for it and that economics prevented it anyways because it couldn't be cheaper than Muskrat Falls. A little while later that same Government paid Ziff to do what it said wasn't worth doing. It appears that commissioning ZIFF at that late stage was an admission that this work had not been done earlier by Nalcor or any other organization that should have. It also raised the question of the ability of an involved party to actually get an arms-length objective piece of consulting work. It would have been a nuclear blast to all the protagonists if Ziff had come back saying gas was cheaper than Muskrat. But they didn't. But significantly, nor did they say that Muskrat was cheaper. They simply said that the demand on the Island was too small to justify the costs of a gas project and therefore it was uneconomical.

Although I have laid out the various reasons why I believe the Ziff report is not good value for money, no matter what was paid, I do wish to thank them for not attempting to make personal digs or derogatory comments that stray from the facts of the case. I find it troubling however, that even now people who had the courage in 2012 and earlier to disagree with the grounds for sanctioning the Muskrat Falls project are being deemed by some as unpatriotic and unhelpful. Was the same thing said about similar voices when the upper Churchill contract was signed? Is this name calling and public ridicule the reason why so many people refused to be heard in public opposing the project? I received numerous calls of support "off the record and under the table" from people with substantial credibility and experience that were shocked by the prospect of Muskrat Falls sanctioning but were unwilling to speak publicly about it. I've even read recently from the dwindling supporters of the sanction decision that somehow opinions like mine are serving a serious injustice to the people of the Province! I'd say let the people of the Province decide exactly who has dished them a serious injustice. And to that I would like to say thank you to the Inquiry for providing a respectful and safe platform from which to restate my 2012 research in light of the uncontested work commissioned afterwards that helped clinch the decision to move forward with Muskrat Falls.

END