

Ferguson, Susan M MEM:EX

From: Minister, MNGD MNGD:EX
Sent: Friday, August 7, 2015 9:33 AM
To: MEM Correspondence MEM:EX
Subject: FW: [CCPA-BC] LNG and Employment in BC

Draft reply, please

From: Coleman.MLA, Rich [mailto:Rich.Coleman.MLA@leg.bc.ca]
Sent: Wednesday, August 5, 2015 4:25 PM
To: Minister, MNGD MNGD:EX
Subject: FW: [CCPA-BC] LNG and Employment in BC

From: s.22
Sent: July 31, 2015 8:45 PM
To: Coleman.MLA, Rich <Rich.Coleman.MLA@leg.bc.ca>
Cc: Sultan.MLA, Ralph <Ralph.Sultan.MLA@leg.bc.ca>; Andrew Weaver <andrew.weaver@greenparty.bc.ca>
Subject: Fwd: [CCPA-BC] LNG and Employment in BC

Dear Minister Coleman,

I listened to your response to Marc Lee on Tuesday's CBC Early Edition radio program. it seemed to me that you tried to justify your government's forecast employment numbers by including spin-off activities from increased drilling, fracking and the building and maintenance of pipelines associated with the LNG projects. If these spin offs are so significant and important to the success of the projects why aren't the environmental impacts associated with those spin offs (e.g. increased GHG emissions and ground water pollution) being considered in the specific environmental assessments of the LNG projects? Also, what about the increased GHG emissions associated with the shipping and burning of this fossil fuel abroad - another environmental impact of the LNG projects that is not being considered in the environmental assessments?

I wish your government would just maintain the existing level of fossil fuel extraction and export activities and focus attention on the far more employment intensive activities associated with energy conservation initiatives and the development BC's wind, solar, geothermal, bioenergy and tidal power renewable energy resources . This way, we will have a better chance of meeting our GHG emission reduction targets and it could also further protect our natural environment by precluding the need for a Site C dam.

Regards, s.22

s.22

----- Forwarded Message -----

Subject:[CCPA-BC] LNG and Employment in BC; Reader survey

Date:Thu, 30 Jul 2015 00:27:05 -0000

From:Canadian Centre for Policy Alternatives BC Office <bcnewswire@ccpanews.ca>

Reply-To:terra@policyalternatives.ca

To s.22

If you're having trouble viewing this email, you may [see it online](#).

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Frankl, Dave MEM:EX

From: Ash, Christine GCPE:EX
Sent: Wednesday, May 27, 2015 10:17 AM
To: Carr, Steve MNGD:EX
Cc: Woolley, Paul GCPE:EX
Subject: FW: OP-ED_re A Clear Look at BC LNG_DRAFT6 (2) - mg
Attachments: OP-ED_re A Clear Look at BC LNG_DRAFT6 (2) - mg.docx

Steve:

Minister is currently reviewing this op-ed. We've made changes to it, based on your feedback.

Chris Ash

Communications Manager | Ministry of Natural Gas Development

ph: 250-952-0623

cell: 250-812-3616

Mail to: christine.ash@gov.bc.ca

OPINION-EDITORIAL

British Columbia's natural gas supports long-term prosperity

By Minister Rich Coleman

Minister of Natural Gas Development

May 26, 2015

(664 words)

British Columbia has a large, growing supply of natural gas to support economic growth for decades to come, contrary to a report released recently by the Canadian Centre for Policy Alternatives, which used incomplete data.

Today, British Columbia has almost 3,000 trillion cubic feet of natural gas available. In technical terms, this is known as the 'gas-in-place.'

The author of the CCPA report, however, refers to 'gas reserves', which is a subset of 'gas-in-place.'

Technically, 'gas reserves' is estimated at 42.3 trillion cubic feet. This is the recoverable portion British Columbia's total resource base at a certain time, and to suggest it is the total 'gas-in-place' misrepresents the facts.

British Columbia's 'gas-in-place' today is almost 3,000 trillion cubic feet. Using a conservative estimate, if industry recovered 30 per cent of the 'gas-in-place' over the long-term, it would harvest well over 800 trillion cubic feet of natural gas, which is approximately 20 times more natural gas than the recent CCPA report suggests.

That's a substantial amount of gas when you consider only 1.5 trillion cubic feet was produced in the province last year.

To help illustrate the point, if you think of the gas industry as one gas station, you would only have capacity to fill a couple of hundred cars with one tanker of fuel, when in fact, the industry is a network of wells, pipelines, refineries and gas stations which has actually helped to fuel our economy for approximately 100 years.

Just a decade ago, British Columbia was on the verge of reaching peak production from conventional natural gas sources and technology could only recover some of the total available gas. Shale gas – also known as an unconventional gas – was underground in abundance, but it was inaccessible.

Today, with the advent of new technology, production and productivity has improved drastically and industry is able to recover much more gas than they could decades ago. As time progressed, we put strict rules in place to govern industry and ensure it is rigorously monitored and as safe as possible.

Now, some of the world's most promising resource areas are found in B.C. That's why our province is at the forefront of building a new LNG industry. Large, global companies are proposing to invest billions of dollars in B.C. because we have a vast supply of natural gas to sustain exploration and energy trade for hundreds of years, not because our long-term prospects look bleak as the aforementioned CCPA report implies.

I wanted to take this opportunity to assure you that B.C. can and will continue to support a growing natural gas sector for hundreds of years, and we will do so responsibly.

To find a more accurate forecast on the natural gas industry, visit the B.C. Oil and Gas Commission's website at www.bcogc.ca/lng-forecast-scenario-0.

The forecast details a number of exploration and production facts including figures on water usage.

For instance, the natural gas industry used 5.3 million cubic metres of water for hydraulic fracturing in 2013. During the same timeframe, Metro Vancouver used 365 million cubic metres of treated water. In fact, water used for hydraulic fracturing represents but a small percentage of the province's annual runoff.

The forecast also shows approximately 2,100 wells being drilled in 2019 if five LNG export plants were in production in B.C., and fewer each year after that. By using well pads, we can keep the total number of wells drilled to a minimum.

Our research shows a promising supply of natural gas which puts British Columbia in an excellent position to develop a new global industry. We have the resource in place to support a growing natural gas sector for hundreds of years, and we are committed to doing it responsibly.

Liquefied natural gas development wasn't an overnight aspiration for B.C. It was and remains a long-term commitment to build on an existing resource. And, the time has come to capitalize on what has historically been a stranded resource to create jobs and future prosperity for British Columbians.

Frankl, Dave MEM:EX

From: Woolley, Paul GCPE:EX
Sent: Tuesday, May 26, 2015 5:17 PM
To: Carr, Steve MNGD:EX; Piccinino, Ines MNGD:EX
Cc: Beaupre, Darren GCPE:EX; Ash, Christine GCPE:EX
Subject: Re: OP-ED_re A Clear Look at BC LNG_DRAFT5

Thx. Analogies are tough. We'll pick up your thoughts in the final.

Sent from my BlackBerry 10 smartphone on the TELUS network.

From: Carr, Steve MNGD:EX
Sent: Tuesday, May 26, 2015 5:14 PM
To: Woolley, Paul GCPE:EX; Piccinino, Ines MNGD:EX
Cc: Beaupre, Darren GCPE:EX; Ash, Christine GCPE:EX
Subject: RE: OP-ED_re A Clear Look at BC LNG_DRAFT5

Not sure if I like the cookie jar analogy, seems to trivialise the issue. The fact is the more we drill the more reserve we prove out and that combined with a massive "gas in place" and better technology means the Province is in good shape, do you think companies would be planning multiple liquifaction facilities if there was barely enough gas for one.

From: Woolley, Paul GCPE:EX
Sent: Tuesday, May 26, 2015 4:40 PM
To: Piccinino, Ines MNGD:EX
Cc: Beaupre, Darren GCPE:EX; Carr, Steve MNGD:EX; Ash, Christine GCPE:EX
Subject: RE: OP-ED_re A Clear Look at BC LNG_DRAFT5
Thx, here is a clean copy with your thoughts addressed. Moving it forward now.

From: Piccinino, Ines MNGD:EX
Sent: Tuesday, May 26, 2015 4:23 PM
To: Woolley, Paul GCPE:EX
Cc: Beaupre, Darren GCPE:EX; Carr, Steve MNGD:EX; Ash, Christine GCPE:EX
Subject: RE: OP-ED_re A Clear Look at BC LNG_DRAFT5

Hi, Paul,

My comments:

- "gas in reserve" is not a concept that exists anywhere – it's called "reserves" ... we should not be too "creative" as these are standard industry terminology and you don't want industry saying that the concept is inaccurate.
- There are a few typos but I'm sure you'll get to those later
- The long term forecast does NOT provide numbers of "gas in place", so that sentence is inaccurate.
- Last one: I would stay away from criticizing the number of wells. If you multiply around 1,500 for 25 years you get close to the total he's suggesting (he actually has a range in the report) – I sent some wording to Darren that is more precise and puts this in context: unconventional activity has much less footprint than conventional. This is a key point to make. The number of wells is irrelevant when you're doing the work in pads.

I'm outside Cabinet now, can't talk but I'm reading emails.

Ines

From: Woolley, Paul GCPE:EX
Sent: Tuesday, May 26, 2015 4:08 PM
To: Piccinino, Ines MNGD:EX
Cc: Beaupre, Darren GCPE:EX; Carr, Steve MNGD:EX; Ash, Christine GCPE:EX
Subject: OP-ED_re A Clear Look at BC LNG_DRAFT5

Thanks for your help on this today Ines. I reviewed it and did some messaging. Anything factually incorrect. Content was there, just needed a little help and think it now reads fairly well.

Am running this version by the MO in the hopes of putting it out to a few media outlets tomorrow.

Cheers,

Paul

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OPINION-EDITORIAL

British Columbia's natural gas supports long-term prosperity

By Minister Rich Coleman

Minister of Natural Gas Development

May 26, 2015

(XXX words)

British Columbia has a large, growing supply of natural gas to support economic growth for decades to come, contrary to a report released recently by the Canadian Centre for Policy Alternatives, which used incomplete data.

Today, British Columbia has almost 3,000 trillion cubic feet of natural gas available. In technical terms, this is known as the 'gas-in-place.'

The author of the CPPA report, however, refers to the 'gas-in-reserve' which is a subset of 'gas-in-place.'

Technically, 'gas-in-reserve' is estimated at 42.3 trillion cubic feet. This is the recoverable portion British Columbia's total resource base at a certain time, and to suggest it is the total 'gas-in-place' misrepresents the facts.

British Columbia's 'gas-in-place' today is almost 3,000 trillion cubic feet. Using a conservative estimate, if industry recovered 30 per cent of the 'gas-in-place' over the long-term, it would harvest well over 800 trillion cubic feet of natural gas, which is approximately 20 times more natural gas than the recent CCPP report suggests.

That's a substantial amount of gas when you consider only 1.5 trillion cubic feet was produced in the province last year.

To help illustrate the point, try thinking of the gas industry as a large cookie jar in front of a child. Years ago, despite all the cookies available in the jar, a child's small hand could only grab a few cookies. Today, that the child is an adult. Their larger hand can grab more cookies than they could when they were a child.

In essence, this was the situation in B.C. Years ago, technology could only recover some of the total available gas. Today, with the advent of new technology, production and productivity has improved drastically and industry is much more gas than they could decades ago.

I wanted to take this opportunity to assure you that B.C. can and will continue to support a growing natural gas sector for hundreds of years, and we will do so responsibly.

To find a more accurate forecast of 'gas-in-place' please visit the B.C. Oil and Gas Commission's website at www.bcogc.ca/lng-forecast-scenario-0.

The forecast details a number of exploration and production facts including figures on 'gas-in-reserve' and water usage.

For instance, the natural gas industry used 5.3 million cubic metres of water for hydraulic fracturing in 2013. During the same timeframe, Metro Vancouver used 365 million cubic metres of treated water. In fact, water used for hydraulic fracturing represents but a small percentage of the province's annual runoff.

The forecast also shows approximately 2,100 wells being drilled in 2019 if five LNG export plants were in production in B.C., and fewer each year after that. This is a lot fewer than the 44,000 wells suggested by the recent CCPA report.

Our research shows a promising supply of natural gas which puts British Columbia in an excellent position to develop a new global industry. We have the resource in place to support a growing natural gas sector for hundreds of years, and we are committed to doing it responsibly.

Liquefied natural gas development wasn't an overnight aspiration for B.C. It was and remains a long-term commitment to build on an existing resource. And, the time has come to capitalize on what has historically been a stranded resource to create jobs and future prosperity for British Columbians.

Frankl, Dave MEM:EX

From: Piccinino, Ines MNGD:EX
Sent: Thursday, April 23, 2015 5:55 PM
To: Beaupre, Darren GCPE:EX
Cc: Thoroughgood, Garth A MNGD:EX; Steilo, Sandra GCPE:EX; Hansen, Brian MNGD:EX
Subject: RE: GCPE: Media Request: Smithers Interior news: Hughes LNG

I think you did a great job with this piece, Darren. I changed one of your sentences (highlighted in yellow) and deleted one bullet that doesn't make much sense (production will not peak and come down... only drilling will). Good to go!

Thanks!

Ines

From: Beaupre, Darren GCPE:EX
Sent: Thursday, April 23, 2015 3:16 PM
To: Piccinino, Ines MNGD:EX
Cc: Thoroughgood, Garth A MNGD:EX; Steilo, Sandra GCPE:EX; Hansen, Brian MNGD:EX
Subject: GCPE: Media Request: Smithers Interior news: Hughes LNG
Importance: High

Hello again. ☺

This one is definitely one of those request where I need to rely on the expertise of the ministry to produce the best response. I'm doing some # crunching here and believe I have this correct but I definitely need your expert analysis and any recommendations for what else needs to be added or changed. It's essentially an argument for how we have the supply.

Also – apparently this guy is doing a report to make his case. Has anyone seen it?

Many thanks in advance. ☺

Date/Time: April 23 10:30 a.m.

Deadline: April 24 noon

Media: Smithers Interior News

Reporter: Alicia Bridges alicia.bridges@interior-news.com

Call in: +1 778 919 8025

Topic: Hughes presentation LNG

Background: I'm writing a story about a presentation in Smithers by geoscientist David Hughes last week. He spoke about his research, which suggests disparity between LNG industry forecasts from the National Energy Board and the provincial government's commitment to have three LNG facilities operating by 2020.

Using the NEB reference case, Hughes researched a scenario with up to five terminals. The report is yet to be released.

He said that if forecasts for LNG production outlined in the NEB's Canada's Energy Future 2013 report were correct, there would not be enough gas to supply more than one terminal. To explain - here's some quotes:

“[The NEB] are suggesting that B.C. will more than triple from what it is today and that would provide enough gas for one terminal,” he said.

“One terminal would essentially wipe out all of Canada’s surplus capacity for exports according to the NEB’s forecast up to 2035.”

He also says if there was more than one terminal, and the NEB figures were correct, he said Canada would need to start importing gas to meet the demand of the processing plants.

“The bottom line is if you believe the NEB is right and we can triple B.C. gas production to build five terminals would mean that Canada would have to import about 70 trillion cubic feet of gas to have enough supply to meet our own requirements plus the needs of those five terminals,” he said. “Anything more than one terminal would push Canada into being a net importer of gas and we’ve been a net exporter for many, many years.”

Questions and Suggested Response:

I'm wondering, does the province have research that shows B.C. could produce enough gas to supply three LNG facilities, or more, which it has committed to having by 2020 (as mentioned here: <http://www.britishcolumbia.ca/invest/industry-sectors/natural-gas.aspx#.VTkhrSRDOE>)? If so, what are the numbers? Are they based on BC Oil and Gas Commission forecasts?

The Province, in conjunction with the BC Oil and Gas Commission, has developed a Natural Gas Production Forecast for LNG that looks at the supply needed to have 5 LNG plants operating.

The scenario is based on the assumption of five new LNG plants on the west coast exporting 82 megatonnes per year of LNG by 2020. The amount of natural gas necessary to produce this amount of LNG would be 11.6 billion cubic feet per day (bcf/d) of marketable gas, or approximately 4.2 trillion cubic feet per year (bcf/y).

The forecast can be found here: <https://www.bcogc.ca/lng-forecast-scenario-0>

Following an assessment of the Montney Formation in November 2013, British Columbia currently has just over 2,900 trillion cubic feet of natural gas-in-place (i.e. total amount of the resource available). Although not all of this natural gas will be recoverable, the marketable natural gas supply even at very conservative rates is plenty to supply current market demands and future demands coming from an 82 MTPA LNG scenario.

With advancements in technology over the last few years, as well as investments made by industry to improve extraction methods in the province, the Ministry of Natural Gas Development believes a 30 per cent success rate is very achievable over the long-term.

2,900 tcf total supply X 30% per cent success extraction rate = 870 tcf
870 tcf marketable supply / 4.2 tcf per year = 207+ years of supply.

Additional notes to consider:

- Gas-in-place estimates will continue to increase as a result of ongoing, technological improvements, so the total supply potential is expected to increase still in B.C.

- The formula above looks at the amount of natural gas supply required in the peak year, and does not account for the fact that extraction activity will actually decrease for each LNG facility after peak years occur. This means the total for 'years of supply' would exceed 207 even further.

Is the need to import gas a possibility?

As detailed above, B.C. has a vast supply of natural gas to meet domestic and international demands for decades to come.

The Province does anticipate some natural gas will be extracted from nearby sources, such Alberta's side of the Montney Formation.

Does the Ministry believe the LNG forecasts outlined in the NEB report (here: <https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2013/2013nrgftr-eng.pdf>) are correct?

Referring to page 17 of the report, it states:

The analysis in EF 2013 assumes 28.3 106m³/d (1.0 Bcf/d) of LNG exports from the B.C. Coast in 2019, increasing to 56.6 106m³/d (2.0 Bcf/d) in 2021 and 85.0 106m³/d (3.0 Bcf/d) by 2023. It is important to note that this is an assumption as opposed to a view on eventual LNG export volumes. This assumption allows for analysis of other key outcomes, such as gas production, energy demand and macroeconomic projections.

Comparing these statistics against the Forecast scenario detailed above in answer 1, it is clear B.C.'s own assumptions are far greater than the one created by the National Energy Board. Simply using the NEB's high estimate (3 bcf/d) would imply the need for approximately 1.1 tcf/y, which B.C. could handle for over 790 years (870 tcf B.C. total marketable supply / 1.1 tcf/y)

Worth noting: Within the federal budget, Canada is also planning to extend the maximum length of natural gas export licences from 25 years to 40 years which will improve long-term regulatory certainty for export projects – there is supply available and the Federal Government acknowledges it also. In reviewing each export application, the National Energy Board ensures the quantity of gas being requested does not exceed the amount required to meet Canadian demand.

Any specifics about the NEB report should be provided directly from the National Energy Board.

Frankl, Dave MEM:EX

From: Steilo, Sandra GCPE:EX
Sent: Thursday, April 23, 2015 3:23 PM
To: Thoroughgood, Garth A MNGD:EX; Beaupre, Darren GCPE:EX
Cc: Piccinino, Ines MNGD:EX; Hansen, Brian MNGD:EX
Subject: RE: GCPE: Media Request: Smithers Interior news: Hughes LNG

We will need to get to MO tomorrow morning latest, reporter's asking for info by noon tomorrow,

Sandra Steilo
250-952-0617

From: Thoroughgood, Garth A MNGD:EX
Sent: Thursday, April 23, 2015 3:23 PM
To: Beaupre, Darren GCPE:EX
Cc: Piccinino, Ines MNGD:EX; Steilo, Sandra GCPE:EX; Hansen, Brian MNGD:EX
Subject: Re: GCPE: Media Request: Smithers Interior news: Hughes LNG

What's the timeframe for a response?

Garth Thoroughgood
Executive Director
Tenure and Geoscience Branch
Upstream Development Division
Ministry of Natural Gas Development

On Apr 23, 2015, at 3:15 PM, Beaupre, Darren GCPE:EX <Darren.Beaupre@gov.bc.ca> wrote:

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Also – apparently this guy is doing a report to make his case. Has anyone seen it?

Many thanks in advance. ☺

Date/Time: April 23 10:30 a.m.

Deadline: April 24 noon

Media: Smithers Interior News

Reporter: Alicia Bridges alicia.bridges@interior-news.com

Call in: +1 778 919 8025

Topic: Hughes presentation LNG

Background: I'm writing a story about a presentation in Smithers by geoscientist David Hughes last week. He spoke about his research, which suggests disparity between LNG industry forecasts from the National Energy Board and the provincial government's commitment to have three LNG facilities operating by 2020.

Using the NEB reference case, Hughes researched a scenario with up to five terminals. The report is yet to be released.

He said that if forecasts for LNG production outlined in the NEB's Canada's Energy Future 2013 report were correct, there would not be enough gas to supply more than one terminal. To explain - here's some quotes:

“[The NEB] are suggesting that B.C. will more than triple from what it is today and that would provide enough gas for one terminal,” he said.

“One terminal would essentially wipe out all of Canada’s surplus capacity for exports according to the NEB’s forecast up to 2035.”

He also says if there was more than one terminal, and the NEB figures were correct, he said Canada would need to start importing gas to meet the demand of the processing plants.

“The bottom line is if you believe the NEB is right and we can triple B.C. gas production to build five terminals would mean that Canada would have to import about 70 trillion cubic feet of gas to have enough supply to meet our own requirements plus the needs of those five terminals,” he said. “Anything more than one terminal would push Canada into being a net importer of gas and we’ve been a net exporter for many, many years.”

Questions and Suggested Response:

I'm wondering, does the province have research that shows B.C. could produce enough gas to supply three LNG facilities, or more, which it has committed to having by 2020 (as mentioned here: <http://www.britishcolumbia.ca/invest/industry-sectors/natural-gas.aspx#.VTkhxrSRDOE>)? If so, what are the numbers? Are they based on BC Oil and Gas Commission forecasts?

The Province, in conjunction with the BC Oil and Gas Commission, has developed a Natural Gas Production Forecast for LNG that looks at the supply needed to have 5 LNG plants operating.

The scenario is based on the assumption of five new LNG plants on the west coast exporting 82 megatonnes per year of LNG by 2020. The amount of natural gas necessary to produce this amount of LNG would be 11.6 billion cubic feet per day (bcf/d) of marketable gas, or approximately 4.2 trillion cubic feet per year (bcf/y).

The forecast can be found here: <https://www.bccog.ca/lng-forecast-scenario-0>

Following an assessment of the Montney Formation in November 2013, British Columbia currently has just over 2,900 trillion cubic feet of natural gas-in-place (i.e. total amount of the resource available). Not all of this natural gas is accessible. The marketable natural gas supply – gas that can be extracted and processed for the market – would be less than the total potential.

With advancements in technology over the last few years, as well as investments made by industry to improve extraction methods in the province, the Ministry of Natural Gas Development believes a 30 per cent success rate is very achievable over the long-term.

2,900 tcf total supply X 30% per cent success extraction rate = 870 tcf
870 tcf marketable supply / 4.2 tcf per year = 207+ years of supply.

Additional notes to consider:

- Gas-in-place estimates will continue to increase as a result of ongoing, technological improvements, so the total supply potential is expected to increase still in B.C.
- The formula above looks at the amount of natural gas supply required in the peak year, and does not account for the fact that extraction activity will actually decrease for each LNG facility after peak years occur. This means the total for 'years of supply' would exceed 207 even further.

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Worth noting: Within the federal budget, Canada is also planning to extend the maximum length of natural gas export licences from 25 years to 40 years which will improve long-term regulatory certainty for export projects – there is supply available and the Federal Government acknowledges it also. In reviewing each export application, the National Energy Board ensures the quantity of gas being requested does not exceed the amount required to meet Canadian demand.

Any specifics about the NEB report should be provided directly from the National Energy Board.

Frankl, Dave MEM:EX

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“One terminal would essentially wipe out all of Canada’s surplus capacity for exports according to the NEB’s forecast up to 2035.”

He also says if there was more than one terminal, and the NEB figures were correct, he said Canada would need to start importing gas to meet the demand of the processing plants.

“The bottom line is if you believe the NEB is right and we can triple B.C. gas production to build five terminals would mean that Canada would have to import about 70 trillion cubic feet of gas to have enough supply to meet our own requirements plus the needs of those five terminals,” he said. “Anything more than one terminal would push Canada into being a net importer of gas and we’ve been a net exporter for many, many years.”

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The forecast can be found here: <https://www.bcogc.ca/lng-forecast-scenario-0>

Following an assessment of the Montney Formation in November 2013, British Columbia currently has just over 2,900 trillion cubic feet of natural gas-in-place (i.e. total amount of the resource available). Not all of this natural gas is accessible. The marketable natural gas supply – gas that can be extracted and processed for the market – would be less than the total potential. With advancements in technology over the last few years, as well as investments made by industry to improve extraction methods in the province, the Ministry of Natural Gas Development believes a 30 per cent success rate is very achievable over the long-term.

2,900 tcf total supply X 30% per cent success extraction rate = 870 tcf

870 tcf marketable supply / 4.2 tcf per year = 207+ years of supply.

Additional notes to consider:

- Gas-in-place estimates will continue to increase as a result of ongoing, technological improvements, so the total supply potential is expected to increase still in B.C.
- The formula above looks at the amount of natural gas supply required in the peak year, and does not account for the fact that extraction activity will actually decrease for each LNG facility after peak years occur. This means the total for ‘years of supply’ would exceed 207 even further.

Is the need to import gas a possibility?

As detailed above, B.C. has a vast supply of natural gas to meet domestic and international demands for decades to come.

The Province does anticipate some natural gas will be extracted from nearby sources, such as Alberta’s side of the Montney Formation.

Does the Ministry believe the LNG forecasts outlined in the NEB report (here: <https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2013/2013nrgftr-eng.pdf>) are correct?

Referring to page 17 of the report, it states:

The analysis in EF 2013 assumes 28.3 106m³/d (1.0 Bcf/d) of LNG exports from the B.C. Coast in 2019, increasing to 56.6 106m³/d (2.0 Bcf/d) in 2021 and 85.0 106m³/d (3.0 Bcf/d) by 2023.

It is important to note that this is an assumption as opposed to a view on eventual LNG export volumes. This assumption allows for analysis of other key outcomes, such as gas production, energy demand and macroeconomic projections.

Comparing these statistics against the Forecast scenerio detailed above in answer 1, it is clear B.C.’s own assumptions are far great then the one created by the National Energy Board. Simply

using the NEB's high estimate (3 bcf/d) would imply the need for approximately 1.1 tcf/y, which B.C. could handle for over 790 years (870 tcf B.C. total marketable supply / 1.1 tcf/y)

Worth noting: Within the federal budget, Canada is also planning to extend the maximum length of natural gas export licences from 25 years to 40 years which will improve long-term regulatory certainty for export projects – there is supply available and the Federal Government acknowledges it also. In reviewing each export application, the National Energy Board ensures the quantity of gas being requested does not exceed the amount required to meet Canadian demand.

Any specifics about the NEB report should be provided directly from the National Energy Board.

Frankl, Dave MEM:EX

From: Beaupre, Darren GCPE:EX
Sent: Thursday, April 23, 2015 3:23 PM
To: Piccinino, Ines MNGD:EX
Cc: Thoroughgood, Garth A MNGD:EX; Steilo, Sandra GCPE:EX; Hansen, Brian MNGD:EX
Subject: RE: GCPE: Media Request: Smithers Interior news: Hughes LNG

Sandra raised a good point – do we have the statistics for what we do import from Alberta now? We could add it to answer #2 and provide some additional context for the entire thing....

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Importance: High

Hello again. ☺

This one is definitely one of those request where I need to rely on the expertise of the ministry to produce the best response. I'm doing some # crunching here and believe I have this correct but I definitely need your expert analysis and any recommendations for what else needs to be added or changed. It's essentially an argument for how we have the supply.

Also – apparently this guy is doing a report to make his case. Has anyone seen it?

Many thanks in advance. ☺

Date/Time: April 23 10:30 a.m.

Deadline: April 24 noon

Media: Smithers Interior News

Reporter: Alicia Bridges alicia.bridges@interior-news.com

Call in: +1 778 919 8025

Topic: Hughes presentation LNG

Background: I'm writing a story about a presentation in Smithers by geoscientist David Hughes last week. He spoke about his research, which suggests disparity between LNG industry forecasts from the National Energy Board and the provincial government's commitment to have three LNG facilities operating by 2020.

Using the NEB reference case, Hughes researched a scenario with up to five terminals. The report is yet to be released.

He said that if forecasts for LNG production outlined in the NEB's Canada's Energy Future 2013 report were correct, there would not be enough gas to supply more than one terminal. To explain - here's some quotes:

“[The NEB] are suggesting that B.C. will more than triple from what it is today and that would provide enough gas for one terminal,” he said.

“One terminal would essentially wipe out all of Canada’s surplus capacity for exports according to the NEB’s forecast up to 2035.”

He also says if there was more than one terminal, and the NEB figures were correct, he said Canada would need to start importing gas to meet the demand of the processing plants.

“The bottom line is if you believe the NEB is right and we can triple B.C. gas production to build five terminals would mean that Canada would have to import about 70 trillion cubic feet of gas to have enough supply to meet our own requirements plus the needs of those five terminals,” he said. “Anything more than one terminal would push Canada into being a net importer of gas and we’ve been a net exporter for many, many years.”

Questions and Suggested Response:

I'm wondering, does the province have research that shows B.C. could produce enough gas to supply three LNG facilities, or more, which it has committed to having by 2020 (as mentioned here: <http://www.britishcolumbia.ca/invest/industry-sectors/natural-gas.aspx#.VTkhxrSRDOE>)? If so, what are the numbers? Are they based on BC Oil and Gas Commission forecasts?

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Subject: GCPE: Media Request: Smithers Interior news: Hughes LNG

Importance: High

Follow Up Flag: Flag for follow up
Flag Status: Flagged

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Any specifics about the NEB report should be provided directly from the National Energy Board.

Frankl, Dave MEM:EX

From: Kitchen, Curtis MNGD:EX
Sent: Wednesday, June 17, 2015 9:00 AM
To: s.22
Subject: RE: British Columbia Production and Resource Estimates

Hello Mr. s.22

Thank you for bringing this document and its error to my attention, I will try to find out who wrote it. We do our best over here to ensure that our management as well as other ministries understand fully the definitions of various reserve categories, but unfortunately the numbers and definitions are often changed or misconstrued as documents work their way through government communications departments.

I appreciate your substantial experience with this manner and would like to thank you for your understanding.

If you have any questions on related topics going forward you can contact me directly as I am sure it would be a mutually beneficial relationship.

Kind Regards,

Curtis Kitchen, P.Eng.
Senior Engineering Advisor
Policy and Royalty Branch
Ministry of Natural Gas Development
O: 250-952-0185
C: 250-480-9057

From: s.22
Sent: Wednesday, June 17, 2015 8:48 AM
To: Kitchen, Curtis MNGD:EX
Subject: RE: British Columbia Production and Resource Estimates

Dear Mr. Kitchen

Dear Mr. Kitchen

I am grateful for your response, and the excellent references you have included in it. I will use these references in a lecture I am giving s.22 The information you provided is exactly what I needed.

I've attached one of the brochures that got me thinking about this issue, which I have entitled, "bc govt lng sector 2933 tcf". The author of this document has confused gas in place (and probably original gas in place) and marketable gas. I've highlighted the offending passage on page 2.

May I suggest that someone provide the authors of these press releases with a short fact sheet outlining the differences between

- Undiscovered gas
- Discovered gas
- Gas in place
- Recoverable raw gas
- Marketable gas?

(I think asking the authors to know the distinctions between prospective and contingent resources goes a bit far. The best thing for a speaker who is not a petroleum engineer to do when confronted with a question as detailed as this one is to say, "I'll get back to you!".)

By the way, I find the Petroleum Geoscience Publications referenced in the last link excellent. I was especially impressed with the most recent report on BC's reserves. This is excellent work!

s.22

I thank you again for your valuable work and references. Please feel free to contact me if you have questions about this email and enquiry, or if you'd like to discuss it.

Best Regards....s.22

From: Kitchen, Curtis MNGD:EX [mailto:Curtis.Kitchen@gov.bc.ca]

Sent: Tuesday, June 16, 2015 10:04 AM

To:s.22

Subject: British Columbia Production and Resource Estimates

June 10, 2015 Cliff: 90726

Dear Mr. s.22

Thank you for your email of May 28, 2015, it has been forwarded to me for a response. In answer to your questions on gas resources in British Columbia, I can provide the following information.

The ultimate marketable resource potential in British Columbia is estimated at 460.9 TCF. When the press release you are enquiring about was written production was about 4 BCF/d. The 150 years was derived by dividing the ultimate marketable 460.9 TCF by 3 TCF/yr (8.22BCF/d). The 2,900 TCF referenced in your letter refers to the Resource Estimate of Original gas in Place.

These numbers are based on resource estimates prepared by the Ministry of Natural Gas Development (Ministry) or third parties. I have attached a quick reference table outlining the resource potential by basin/play. Detailed reference sources for the resource potential of British Columbia's resource plays are as follows:

Montney:

http://www2.gov.bc.ca/gov/DownloadAsset?assetId=AA07B01361944DE0A04B905957BC5084&filename=og_report_2013-1_montney_assessment.pdf

Horn River:

http://www2.gov.bc.ca/gov/DownloadAsset?assetId=4CA09C0544974970A207454B40F70C85&filename=og_report2011-1.pdf

Conventional:

http://www2.gov.bc.ca/gov/DownloadAsset?assetId=95F4BD9159F34CC594032E1A655CF52B&filename=og_rpt2006a.pdf

Liard:

<http://www.pennenergy.com/articles/pennenergy/2012/12/apache-calls-liard-discovery-a-worldclass-play.html>

Cordova:

In March 2010, Petrel Robertson Consulting Ltd. prepared a report summarizing the range of assessments of Canada's natural gas resource base ("Assessment of Canada's Natural Gas Resource Base", March 2010) for the Canadian Society for Unconventional Gas (now CSUR). The **Cordova Embayment** resource estimate of 200 Tcf referenced in the attached table was first seen in CSUR presentations in 2010 and in the report AN OVERVIEW OF CANADA'S NATURAL GAS RESOURCES (Figure 16, p. 18 in May of 2010).

You may also be interested in some of the Ministry's Petroleum Geoscience Publications. These are available at: <http://www2.gov.bc.ca/gov/topic.page?id=F239E1073B5B4FDE8927DAAF0F1990F1>

Thank you for your interest, if you have any further questions feel free to contact me.

Sincerely,

Curtis Kitchen, P.Eng.
Senior Engineering Advisor
Policy and Royalty Branch
Ministry of Natural Gas Development
O: 250-952-0185
C: 250-480-9057

Frankl, Dave MEM:EX

From: Kitchen, Curtis MNGD:EX
Sent: Wednesday, June 17, 2015 11:50 AM
To: Stefik, Ron OGC:IN; Davies, Janet
Subject: FW: one more email on BC Gas Reserves

Some nice comments in here from a ^{s.22} e. I have been
corresponding on errors on published resource/reserve estimates.

s.22
s.22 I will use the information contained in the report referenced above to refute any
claims that BC does not have the gas resources for LNG plants. Mr. David Hughes made this claim last
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Frankl, Dave MEM:EX

From: Kitchen, Curtis MNGD:EX
Sent: Wednesday, June 17, 2015 11:44 AM
To: s.22
Subject: RE: one more email on BC Gas Reserves

I am happy to hear about your work. We also read David Hughes' Report, but do not necessarily have the venue to refute his claims or correct errors.

I am also very pleased to read your comments on the OGC's reserves evaluation for tight resources as I was the one who adapted the SPEE methodology for evaluating unconventional resources to the Province's evaluations. It was a big step to convince everyone to move away from conventional evaluation techniques!

Regards,

Curtis

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Dear Mr. Kitchen

I've taken the liberty of attaching a press release from the Premier's office regarding gas reserves in BC. You will see that the first two bullet points on the second page are very confused when it comes to gas reserves and resources, recoverable and so on. This is fair; Premier Clark is not a petroleum engineer. Most people aren't. The terms that the authors of this and other press releases regarding natural gas are all defined in the "definitions" section of the report,

"BC Oil and Gas Commission 2013 Hydrocarbon and By-Product Reserves Report".

An understanding of the definitions in this report is exactly what's needed.

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I expect questions too on induced seismicity. I will refer to the study on the BC Oil and Gas Commission's website, and refer to recent developments in Alberta. On the (slim) chance that you have not seen the most recent report from the Alberta Energy Regulator, I attach subsurface report No. 2 which deals with induced seismicity in the Duvernay in the Fox Creek area.

You have been very helpful. If I can help you in your work, please let me know. You can find out more about me here: s.22 If you did want to contact me, please use this email.

Regards.... s.22

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Frankl, Dave MEM:EX

From: Kitchen, Curtis MNGD:EX
Sent: Thursday, July 16, 2015 9:54 AM
To: Paulson, Ken OGC:IN; Currie, Graham OGC:IN; Hayes, Mark OGC:IN; Stefik, Ron OGC:IN
Cc: Clay, Alan; Johnson, Jeff OGC:IN; Pokorny, Peter; Kennedy, Mayka OGC:IN
Subject: RE: For Review: Graphic - BC Natural Gas Resource
Attachments: Chris Adams Reserves Ref sheet.docx

Hi Ken,

It looks to me like they don't want to use a Reserves number in addition to a Resource number, as people who are not in the industry are not aware that they are two distinct categories. I do not believe the Resource Estimate have been updated, but they could use 2,900 TCF rather than 2,800 TCF.

Below is a response I wrote to a member of the public who is a seasoned petroleum engineer. He was inquiring on previous publications on reserves/resources. Attached is the summary document Chris Adams has compiled as a quick reference for resource numbers.

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http://www2.gov.bc.ca/gov/DownloadAsset?assetId=4CA09C0544974970A207454B40F70C85&filename=og_report2011-1.pdf

Conventional:

http://www2.gov.bc.ca/gov/DownloadAsset?assetId=95F4BD9159F34CC594032E1A655CF52B&filename=og_rpt2006a.pdf

Liard:

<http://www.pennenergy.com/articles/pennenergy/2012/12/apache-calls-liard-discovery-a-worldclass-play.html>

Cordova:

In March 2010, Petrel Robertson Consulting Ltd. prepared a report summarizing the range of assessments of Canada's natural gas resource base ("Assessment of Canada's Natural Gas Resource Base", March 2010) for the Canadian Society for Unconventional Gas (now CSUR). The **Cordova Embayment** resource estimate of 200 Tcf referenced in the attached table was first seen in CSUR presentations in 2010 and in the report AN OVERVIEW OF CANADA'S NATURAL GAS RESOURCES (Figure 16, p. 18 in May of 2010).

You may also be interested in some of the Ministry's Petroleum Geoscience Publications. These are available at: <http://www2.gov.bc.ca/gov/topic.page?id=F239E1073B5B4FDE8927DAAF0F1990F1>

Thank you for your interest, if you have any further questions feel free to contact me.

It is an on-going saga over here with communications and the use of proper terminology.

I hope this information helps, but let me know if there is something more I can do.

Regards,

Curtis Kitchen, P.Eng.
Senior Engineering Advisor
Policy and Royalty Branch
Ministry of Natural Gas Development
O: 250-952-0185
C: 250-480-9057

From: Paulson, Ken [mailto:Ken.Paulson@bcogc.ca]
Sent: Wednesday, July 15, 2015 4:11 PM
To: Currie, Graham OGC:IN; Hayes, Mark OGC:IN; Stefik, Ron OGC:IN
Cc: Clay, Alan; Johnson, Jeff OGC:IN; Pokorny, Peter; Kitchen, Curtis MNGD:EX; Kennedy, Mayka OGC:IN
Subject: RE: For Review: Graphic - BC Natural Gas Resource

If I may suggest, perhaps its time for the Ministry to use the correct language. The estimated OGIP (Original gas in place) is ~2900 Tcf (could be more – this is an older number).

The actual reserves are published in our report. The probable amount of recoverable gas we know about today (Montney and Horn) is ~500 Tcf (believe Mark or Curtis would have better numbers).

Mark/Ron/Curtis - perhaps you could help with the terminology aspects and actual numbers?

Graham, there is a lot in the article that could be critiqued.



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From: Currie, Graham
Sent: July-15-15 3:43 PM
To: Hayes, Mark; Stefik, Ron
Cc: Paulson, Ken; Clay, Alan
Subject: FW: For Review: Graphic - BC Natural Gas Resource
Importance: High

Mark or Ron – any input on this graphic – see the note below from MNGD Communications and the issue they're trying to address from the story below too. Not sure our logo should be on this, but await your input.

Thanks,
Graham



Graham Currie
Executive Director Corporate Affairs
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From: Peters, Melissa GCPE:EX [<mailto:Melissa.Peters@gov.bc.ca>]
Sent: July-15-15 3:31 PM
To: Currie, Graham
Cc: Beaupre, Darren GCPE:EX
Subject: For Review: Graphic - BC Natural Gas Resource
Importance: High

Graham,

We created this graphic to clearly illustrate the natural gas supply in British Columbia. It has OGC's logo as it was created with OGC data. Are you okay with this item? What comments do you have? Are you comfortable with OGC's logo being on here?

We want to post it online, and be able to point to it to respond to items like the below.

Give me a call if that's easier.

Thanks,

Melissa Peters
Ministry of Natural Gas Development
250-387-1373

Natural gas bounty for LNG export: Real or imagined?
Vancouver Sun
15-Jul-2015
Page B04
By David Hughes

Page 38 to/à Page 39

Withheld pursuant to/removed as

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**MINISTRY OF NATURAL GAS DEVELOPMENT
BRIEFING NOTE FOR INFORMATION**

- I PREPARED FOR:** Ines Piccinino, Assistant Deputy Minister, Upstream Development Division,
- II ISSUE:** British Columbia's Oil and Gas Reserves and Resources – A Quick Reference
- III BACKGROUND:**

There have been occasions where quoted or published oil and gas resource and/or reserve values for British Columbia by the BC Ministry of Natural Gas Development and the BC Oil and Gas Commission have differed. This discrepancy is not a reflection of errors by either party, but rather stems from the use of different parameters in collating the data (i.e. time periods, defined area, etc). In addition, other branches of government have misused terms or values such as “reserves”, “resources” or “marketable” in describing British Columbia's oil and gas endowment.

The purpose of the “British Columbia's Oil and Gas Reserves and Resources – A Quick Reference” guide is to co-ordinate reported reserves and resource figures between the BC Oil and Gas Commission (OGC) and the Ministry of Natural Gas Development (MNGD) and other government agencies. In addition, this document provides definitions and the proper use of key terminology with respect to British Columbia's oil and gas endowment.

Although this Quick Reference Guide has been put together for internal use, the non-confidential nature of the data makes this document suitable for public consumption.

IV DISCUSSION:

- The “British Columbia's Oil and Gas Reserves and Resources – A Quick Reference” guide is a synopsis of BC's current resource and reserve numbers.
- This work was done in collaboration with the BC Oil and Gas Commission.
- It is an attempt to synchronize often quoted oil and natural gas resource and reserve numbers for BC by combining the most recent and relevant resource estimate studies with the annual OGC Hydrocarbon Reserves Report.
- Reserve and resource numbers are subject to change and are, at best, only snapshots in time; however, they report volumes with very different implications. Reserve numbers are updated annually by the OGC and represent discovered/proven volumes whereas resource estimates are updated only sporadically and are an attempt to quantify ultimate potential across areas with little or no data. As such, resource estimates have far less certainty than reserve calculations.
- In the past, quoted resource production and reserve numbers have varied in official presentations or official publications between the OGC and MNGD. While some

instances were the result of using different date cutoffs for data compilation, others were the result of utilizing different or outdated source material.

- On occasion, the terms reserves and resources have been incorrectly used as synonyms. In addition, raw gas-in-place resource numbers have been perceived as proven reserves available for gas supply. The misuse of these terms can result in confusion or lead to inaccurate conclusions. The glossary section of the Quick Reference guide provides definitions and background regarding the correct use of certain terms.
- Often, it is desirable to quote conventional versus unconventional figures for resource/reserves/production. The Quick Reference guide provides data for doing this.
- The “British Columbia’s Oil and Gas Reserves and Resources – A Quick Reference” will be updated on an as needed basis whenever substantive changes are recorded in recognized resource or reserve figures.
- If used and managed by both the OGC and MNGD, the “British Columbia’s Oil and Gas Reserves and Resources – A Quick Reference” should ensure that staff from the OGC and MNGD present or quote the same resource or reserve figures.
- The “British Columbia’s Oil and Gas Reserves and Resources – A Quick Reference” will be updated on an annual basis.

APPROVED BY:

Filippo Ferri, Dir. ✓

Garth Thoroughgood, ED ✓

BRITISH COLUMBIA'S OIL & GAS RESERVES AND RESOURCES – A QUICK REFERENCE

Established Natural Gas Reserves in British Columbia (to year-end 2012)

	Raw Gas		Marketable Gas		
	Tcf	10 ⁹ m ³	Tcf	10 ⁹ m ³	
Original Gas-In-Place	230	6,506	–	–	raw gas from OGC Hydrocarbon and By-Product Reserves 2012 (changes annually)
Initial Reserves Estimate	71.1	2,014	58.0	1,643	from OGC Hydrocarbon and By-Product Reserves 2012 (changes annually)
Cumulative Production	30.9	875.6	24.5	694	from OGC Hydrocarbon and By-Product Reserves 2012 (changes annually)
Remaining Reserves	40.2	1,138.5	33.5	948.7	from OGC Hydrocarbon and By-Product Reserves 2012 (changes annually)
Production in 2012	1.43	40.5	1.13*	32.0*	raw gas from OGC Hydrocarbon and By-Product Reserves 2012 (changes annually)
Discovered Resources			58.0	1,643	using above initial marketable reserves estimate from OGC 2012 (changes annually)
Undiscovered Resources			403	11,402	difference between ult. marketable potential and discovered resources (461 – 58 Tcf)
Ultimate Potential**			461	13,045	total of ultimate marketable gas from table below
Remaining Ultimate Potential			437	12,351	ultimate marketable potential minus cumulative production to year-end 2012

* calculated estimate of marketable production in 2012

** Ultimate Potential is from most recent resource assessment studies such as NEBC conventional gas (2006), Horn River Basin (2011), Montney Formation (2013) and other recent OGC estimates of marketable ultimate potential from the Liard Basin, Cordova Embayment, Jean Marie, and Deep Basin Cadomin-Nikanassin

Northeast BC's Gas Resource Potential, Discovered Reserves and Cumulative Production to end of 2012 (Imperial units)

Basin/Play	Resource Potential		Discovered Resources			Cumulative Production	
	OGIP Raw	Ultimate Marketable	Discovered Marketable (Initial Reserves OGC 2012)	Undiscovered Marketable (Ultimate - Discovered)	Percent Undiscovered (%)	Cumulative Production (Marketable to end of 2012 OGC 2012)	Remaining Discovered Marketable (Remaining Reserves OGC 2012)
Tcf							
Conventional	71.9*	41.3*	30.6	10.7	25.9	20.6	10
Horn River Basin	448**	78**	9.1	68.9	88.3	0.31	8.7
Montney	1965***	271***	13.2	257.8	95.1	1.4	11.8
Liard Basin	210****	40****	0.09	39.9	99.8	0.006	0.08
Cordova Embayment	200****	20****	0.03	19.97	99.9	0.008	0.02
Jean Marie	10.1*	6.5*	3.2	3.3	50.8	1.8	1.4
Deep Basin Cadomin Nikanassin	9*	4.1*	1.8	2.3	56.1	0.4	1.4
TOTAL	2,914	460.9	58.0	402.9		24.5	33.5

Northeast BC's Gas Resource Potential, Discovered Reserves and Cumulative Production to end of 2012 (SI units)

Basin/Play	Resource Potential		Discovered Resources			Cumulative Production	
	OGIP Raw	Ultimate Marketable	Discovered Marketable (Initial Reserves OGC 2012)	Undiscovered Marketable (Ultimate - Discovered)	Percent Undiscovered (%)	Cumulative Production (Marketable to end of 2012 OGC 2012)	Remaining Discovered Marketable (Remaining Reserves OGC 2012)
10⁹ m³							
Conventional	2,036*	1,170*	866	304	25.9	583	283
Horn River Basin	12,629**	2,198**	258	1,940	88.3	8.8	249
Montney	55,664***	7,677***	374	7,303	95.1	40	334
Liard Basin	5,949****	1,134****	2.5	1,131	99.8	0.173	2.38
Cordova Embayment	5,666****	567****	0.8	566	99.9	0.234	0.62
Jean Marie	286*	184*	91	93	50.8	51	40
Deep Basin Cadomin Nikanassin	255*	116*	51	65	56.1	11	40
TOTAL	82,485	13,045	1,643	11,402		694	948

* from MEMPR/NEB Report 2006-A, NEBC's Ult. Potential for Conventional Natural Gas - Jean Marie and Deep Basin Cadomin-Nikanassin tight gas are subtracted

** from NEB/MEM Oil and Gas Reports 2011-1, Ultimate Potential for Unconventional Natural Gas in Northeastern BC's Horn River Basin (May 2011)

***from NEB/OGC/AER/MNGD Energy Briefing Note - The Ultimate Potential for Unconventional Petroleum from the Montney Formation of BC and Alberta (Nov. 2013)

**** current best estimate from OGC

Other Conventional and Unconventional Gas Resources in British Columbia

	Tcf	10 ⁹ m ³	
Interior Basins (conventional) *	17.8	504	MNGD gas-In-place estimate
Offshore (conventional) **	41.8	1,184	MNGD gas-In-place estimate
Coalbed Gas (unconventional)	100	2,832	MNGD gas-in-place estimate
Tight Gas – Other (unconventional) ***	140	3,964	low range estimates from Tight Gas Potential in NEBC, Open File 2003-3

* includes Whitehorse Trough, Bowser/Sustut Basins, Nechacko Basin, Quesnel Trough, Tyaughton Basin and Methow Basin

** includes Queen Charlotte, Winona, Tofino and Georgia Basins

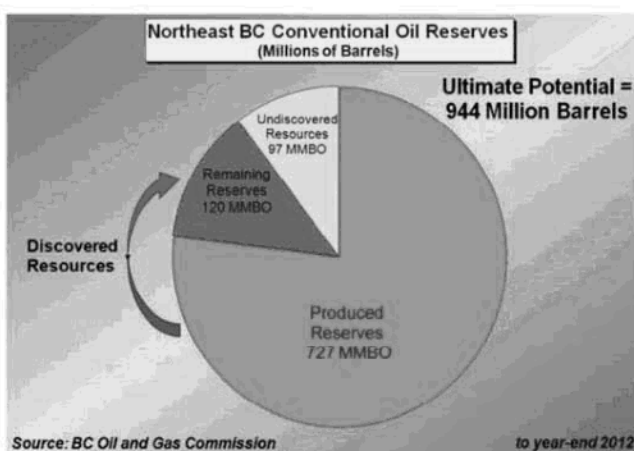
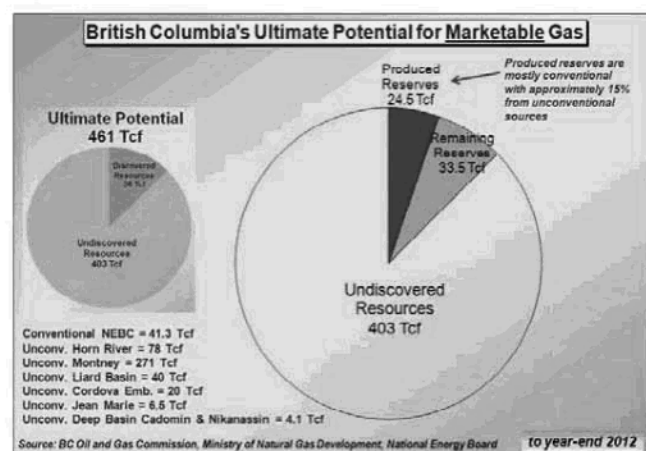
*** excludes low range estimates of Cadomin/Gething (south), Nikanassin (south) and Jean Marie listed in Tight Gas Potential in NEBC, Open File 2003-3

Conventional Oil Reserves and Resources in British Columbia (to year-end 2012)

	Millions of Barrels	10 ⁶ m ³	
Original Oil-In-Place	3,038	483	from OGC Hydrocarbon and By-Product Reserves 2012 (estimate changes annually)
Initial Reserves Estimate	847	134.6	from OGC Hydrocarbon and By-Product Reserves 2012 (estimate changes annually)
Cumulative Production	727	115.5	from OGC Hydrocarbon and By-Product Reserves 2012 (estimate changes annually)
Remaining Reserves	120	19.1	from OGC Hydrocarbon and By-Product Reserves 2012 (estimate changes annually)
Production in 2012	7.7	1.22	from OGC Hydrocarbon and By-Product Reserves 2012 (estimate changes annually)
Discovered Resources	847	134.6	using initial reserves estimate from OGC Hydrocarbon and By-Product Reserves 2012
Undiscovered Resources	97	15.4	ultimate potential minus discovered resources
Ultimate Potential	944	150	from previous oil potential study (Geological Survey of Canada)
Oil Resource Potential of Other Basins			
Interior Basins *	7,614	1,210	MNGD Original Oil-In-Place estimate
Offshore **	9,817	1,560	MNGD Original Oil-In-Place estimate
Fernie Basin	88.1	14	MNGD Original Oil-In-Place estimate

* Includes Whitehorse Trough, Bowser/Sustut Basins, Nechacko Basin, Quesnel Trough, Tyaughton Basin and Methow Basin

** Queen Charlotte Basin



Relationship between Resources and Reserves

The total theoretical volume of hydrocarbons in a basin or system is termed a “**Resource**” whereas the volume of a basin’s known and producible hydrocarbons is termed a “**Reserve**”. When reserve volumes are compared to resource volumes, they represent only a relatively small proportion of its total ultimate in-place hydrocarbon potential. **Resource potential** studies are highly dependent on the data source, methods and assumptions utilized in their development. An important point to consider is that **resource** estimates represent a snapshot in time and they continually evolve as new geological concepts, economic and technological developments occur.

Definitions

Resources or Resource Estimates are estimated volumes of hydrocarbon that may or may not be economically or technically recoverable. There is an inherent amount of uncertainty in these estimates. Resources are typically measured as volumes that are “in-place”, that is before any production has occurred and without regard for the extent to which such volumes will be recovered. The term “resources” can be used interchangeably with the term “potential”.

In northeast BC, estimates of conventional undiscovered potential are derived from statistical analysis of known reserves and pool sizes. In unconventional plays, resource estimates are performed by mapping key geological characteristics using a probabilistic analysis of relevant parameters. Where discovery history and reserve data is absent (e.g. offshore, Bowser or Nechako), resource potential is estimated on the basis of available geological and geophysical evidence.

Resource estimates are undertaken only periodically and are often performed, in collaboration, by various agencies including: the National Energy Board, the Geological Survey of Canada, the BC Oil and Gas Commission and the Ministry of Natural Gas Development and relevant agencies in adjoining provinces and territories (e.g. Alberta, Yukon, Northwest Territories). Estimates for some basins such as the Liard and Cordova are approximations, as formal scientific evaluations have yet to be performed. As such, they have a lower associated probability and are more susceptible to error. Similarly, the quoted resource numbers for the Interior

Basins, coalbed methane and the offshore are based on attempts at quantifying potential that are quite dated, have very little certainty, and contain severe geologic/economic/environmental challenges.

Undiscovered Resources/Potential: Resource estimates of unproven hydrocarbon volumes thought to exist within a basin but which have not yet been proven to exist by drilling, testing or production.

Discovered Resources are confirmed volumes in known, drilled reservoirs that can be recovered using current technology. Some of these volumes are too remote from existing infrastructure to be readily connected to markets.

Ultimate Resources: The total volume of discovered in-place reserves (produced and remaining) hydrocarbons plus estimated undiscovered volumes. Often referred to as endowment.

Conventional Resources: The spectrum of geological play concepts that have been traditionally exploited in the Western Canadian Sedimentary Basin. These play types produce discreet pools and are considered proven and developable with today's technology. They are low risk and thus have a high probability of, or are proven to be commercially productive.

Unconventional Resources: These play concepts comprise widespread proven resources that are economic and accessible by today's technology. These may also include unproven or uneconomic conceptual geological plays. Examples include CBM or coalbed gas, tight gas, and shale gas. BC now realizes a significant proportion of oil and gas production from established unconventional plays. Identified unconventional plays in BC have associated Regional Fields and are identified in the Drilling and Production Regulation under Schedule 2. In addition, the Jean Marie and Cadomin formations in northeast BC are considered to be gas charged, regionally extensive unconventional systems.

Original gas/oil in place (OGIP/OOIP) is the initial volume of discovered gas/oil in the reservoir whereas recoverable gas is the volume of OGIP that can be produced. Marketable gas is the volume that remains after the recoverable volume is processed and is available for sales.

OGIP = Original Gas in Place OOIP = Original Oil in Place

Marketable Resources: The recoverable volume of resource under foreseeable market conditions without the benefits of rigorous economic analysis. This volume is derived from the in-place resource estimate by applying an empirically derived recovery factor together with a shrinkage factor due to removal of impurities.

Reserves are proven (high probability) volumes of hydrocarbons as determined by drilling (i.e. discovered) and that are deemed to be technically and economically recoverable. Gas reserves are often measured in terms of marketable gas (or sales gas). Marketable gas is the measure of saleable product in the raw gas stream. BC reserve estimates are performed and published annually by the BC Oil and Gas Commission in the Hydrocarbon and By-Product Reserves in British Columbia Report.

Initial Reserves are the established reserves prior to any production (same as "Discovered Resources" above)

Cumulative Production is the volume of oil or raw gas produced to date.

Remaining Reserves are the initial established reserves less cumulative production.

Recoverable oil/Raw gas: The measure of in-place resources that are estimated to be recoverable. For oil, initial recoverable volumes may range from 5 percent to 35 percent of original in-place volumes. For natural gas, recoverable raw gas reserves generally are about 75 percent to 85 percent of original in-place volumes. The percentage volume reduction realized in converting from in-place to raw recoverable is referred to as the recovery factor.

Marketable (Sales) gas: Methane concentration within natural gas accumulations can vary due to impurities such as hydrogen sulphide (H₂S) and carbon dioxide (CO₂). Marketable gas (or sales gas) is the measure of saleable methane in the raw gas stream. This percentage volume reduction from raw to marketable is referred to as the shrinkage factor. On average northeast BC marketable gas reserves run about 80 percent of raw gas volumes.