Review of Net Economic Benefits of Telkwa Coal Limited's Tenas Project

July 1, 2022

Chris Joseph, MRM PhD

Swift Creek Consulting

PO Box 1513

Garibaldi Highlands, BC

V0N 1T0

604-848-9804

cjoseph@swiftcreekconsulting.com

Executive Summary

Telkwa Coal Limited (TCL) proposes to develop the Tenas project (the Project) near the town of Telkwa in northwest BC and in the traditional territory of the Wet'suwet'en Nation. The Project is currently being reviewed under the BC environmental assessment process of the 2002 *Environmental Assessment Act* overseen by the BC Environmental Assessment Office. The act is concerned with avoiding what are termed 'significant adverse effects' but also with furthering the public interest. The 45-day comment period on TCL's application under the act will end on July 3rd, 2022.

As part of its application, TCL has undertaken an assessment of the Project's economic and other benefits, an assessment of adverse economic impacts, and other studies. The Northwest Institute is concerned about the economic benefits and impacts of the Project in light of environmental and other impacts of the Project and in the context of the public interest case for the Project. Accordingly, the Northwest Institute commissioned Swift Creek Consulting to prepare an assessment of the Project's net economic benefits and comment on the Project's public interest case. Economic benefits play an out-sized role in public interest evaluations, and therefore it is crucial to closely examine economic net benefits so that the BC government is properly informed.

The objective of the Project is to produce metallurgical coal for export to Asia. The Project would take advantage of existing infrastructure but entail the construction and development of various mine components. TCL proposes an annual production rate of about 800,000 metric tonnes of processed metallurgical coal annually over 21 years of operations after 1.5 years of construction and followed by at least 29 years of decommissioning, reclamation, and post-closure activities.

TCL argues that the Project will have a variety of economic and other benefits, and the application reviews a wide range of environmental and other impacts. Stated economic benefits include employment, tax revenue, and impacts on gross domestic product. TCL concluded that the Project would have only one significant adverse effect in terms of visual quality.

TCL applied the method of economic impact analysis, including the technique of input-output modeling, to estimate the Project's economic benefits, but this method is inconsistent with modern practice and provides results that provide limited useful information on the Project's economic benefits and impacts. TCL's method is incapable of providing a comprehensive assessment of net economic benefits, was never meant to be a method for assessing project benefits, and therefore TCL's assessment of Project benefits has little value in informing the BC government's decision regarding the Project's public interest case.

A proper assessment of Project benefits must assess net benefits, which is the difference between benefits and costs. The best method available for such an assessment is cost-benefit analysis (CBA), which is modern economics' standard method for assessing a project's value to society. CBA and its variants have a long history of use in BC and Canada, and the method's usefulness to major project evaluation was recently recognized by the Joint Review Panel for the proposed Grassy Mountain Coal mine and is recognized also by the Impact Assessment Agency of Canada for its potential in federal environmental assessment.

To support the BC government's decision-making, a CBA was performed on the proposed Tenas project. The CBA examined Project costs, Project revenues, employment, government revenue and costs, impacts on other financial interests, and environmental and other benefits and costs including social costs of carbon associated with the Project's greenhouse gas emissions. Uncertainties in these parameters were considered by examining 24 different sensitivity analysis scenarios, and all impacts were considered in terms of their time-value. Input parameters were based upon TCL data, government information, or information in the academic and professional literature.

The results of the CBA suggest that the Project is not in the public interest. Fourteen (58%) of the scenarios resulted in a negative net present value, suggesting that that Project will not be a net benefit to society. The private investment case is also weak: only under an assumption of an atypically-high coal price is an internal rate of return above typical investor expectations found. The break-even price for the Project is also high relative to historical and expected future coal prices. No incremental employment benefits are expected due to current and anticipated labour market conditions, and the many environmental and other impacts and risks pose further reasons to be skeptical about the Project's public interest case.

Overall, it is hard to see a positive public interest case for the Tenas project. TCL's application provides insufficient information on the Project's economic benefits and public interest case, and the information gathered in the course of the CBA helps fill these gaps, indicating that the future coal market, costs of development, the social cost of carbon, and the risks posed by coal mining to the environment and taxpayers all conspire against the Project's public interest case.

Statement of Limitations

This document was prepared by Swift Creek Consulting for the exclusive use and benefit of the Northwest Institute ("Client"). This document represents the best professional judgment of Swift Creek Consulting based on the information available at the time of its completion and as appropriate for the scope of work. Services were performed according to normal professional standards in a similar context and for a similar scope of work.

Copyright Notice

This document and the materials within it are copyright of Swift Creek Consulting. The Client is permitted to reproduce these materials for archiving and distribution to third parties only as required to conduct business specifically related to the scope of this study. Any other use of these materials without the written permission of Swift Creek Consulting is prohibited.

Acknowledgements

- Dr. Thomas I. Gunton (Professor and Director of Resource and Environmental Planning at Simon Fraser University) provided peer review of this report including methodological suggestions

Contents

Acronyms

2002 EAA	BC *Environmental Assessment Act 2002*
BC EAO	BC Environmental Assessment Office
CBA	cost-benefit analysis
EconIA	economic impact analysis
EA	environmental assessment
GHG	greenhouse gas
IRR	internal rate of return
mtpa	million tonnes per year
NPV	net present value
VC	valued component

1. Introduction

1.1 Project and Context for this Report

Telkwa Coal Limited (TCL), a joint venture of Australian mining company Allegiance Coal and Itochu Corporation of Japan, proposes to develop the Tenas project (the Project) near Telkwa, BC. The Project is currently being reviewed under the BC environmental assessment (EA) process of the 2002 *Environmental Assessment Act* (*2002 EAA*) overseen by the BC Environmental Assessment Office (BC EAO). The *2002 EAA* is concerned with avoiding what are termed 'significant adverse effects', but also with furthering the public interest (see sections (ss.) 6, 17, and 31 of the *2002 EAA*). The 45-day comment period on TCL's application for an EA certificate will end on July 3rd, 2022.

As part of its EA application, as directed by the final Application Information Requirements for the EA (BC EAO 2022), TCL has undertaken an assessment of the Project's economic and other benefits, an assessment of adverse economic impacts, and other studies. The Northwest Institute is concerned about the economic benefits and impacts of the Project in light of environmental and other impacts of the Project and in the context of the public interest case for the Project. Accordingly, the Northwest Institute commissioned me – Dr. Chris Joseph of Swift Creek Consulting – to prepare an assessment of the Project's net economic benefits and comment on the Project's public interest case to the extent possible based upon the analysis I undertook. While the *2002 EAA* does not define the term 'public interest', economic benefits play an out-sized role in public interest evaluations (Goodday et al. 2020) and therefore it is crucial to closely examine economic net benefits so that the BC government is properly informed.

1.2 Project Overview

The Project is a proposed surface coal mine near the town of Telkwa in northwest BC and in the traditional territory of the Wet'suwet'en Nation. The objective of the Project is to produce metallurgical coal, a type of coal used in steelmaking, for export to the Asian market. There is a history of coal mining at the site, though mostly for thermal coal.

The Project would take advantage of existing road, rail, and electrical infrastructure but entail the construction and/or development of: an open pit for mining coal, a coal processing plant, conveyors and other components of coal handling systems, administration and other buildings, surface water management infrastructure including sedimentation ponds, diversion berms, water storage pond, new roads and powerline,

new rail infrastructure to enable coal loading, and a bridge (Telkwa Coal Limited Tenas Project Application (hereafter Application), Section (s.)0.0/s.1.2.2.2).[1]

TCL proposes an annual production rate of about 800,000 metric tonnes of processed metallurgical coal annually over 21 years of operations. TCL proposes 1.5 years of construction, 21 years of operations, 4 years of decommissioning and reclamation, followed by 10 years of active and then 15 years of passive post-closure activities (Application s0.0/s.1.2.2.3), summing to 51.5 years.[2] However, in its reclamation plan (Application s.13/s.15, page (p)83) TCL discusses post-closure activities to year 75 and beyond.

TCL argues that the Project will have a variety of economic and other benefits, and the application reviews a wide range of environmental and other impacts. TCL estimates economic benefits will include 125 person-years of direct employment during construction and between 55 and 145 full-time equivalent employees during operations, the majority of which are anticipated by TCL to come from the local region (Application s.0.0/s.1.2.5; s.1/s.3). TCL also estimates a variety of indirect and induced economic benefits as well as benefits under other value pillars (Application s.0.0/s.1.2.5; s.1/s.3).

TCL examined the potential for the Project to have effects on nine environmental valued components (VCs), two economic VCs, five social VCs, one heritage VC, and one health VC, and considered the potential for accidents and malfunctions, as well as effects of the environment on the Project (Application ss.3-10). TCL concluded (Application s.0.0/s.7, p87) that the Project

> *is likely to result in no significant adverse effects on all VCs except one of the VCs [Visual Quality] with the application of proven, accepted mitigation measures.*

1.3 Scope of Swift Creek Consulting's Analysis

I was hired to conduct a third-party, independent assessment of the Project's net economic benefits, i.e., benefits (positive impacts) minus costs (negative impacts, also known as adverse effects). To do so, I employed the methodology of cost-benefit analysis (CBA). The objective of my report is to provide insight – to the BC EAO, other government entities, and the public – into the Project's net economic benefits and the

[1] TCL's EA application is structured into the Application Summary (s.0.0), front matter (ss.0.1-0.7), Part A Introduction (ss.1 and 2), Part B Assessment of Environmental, Economic, Social, Heritage and Health Effects (ss.3-10), Part C Wet'suwet'en Rights and Interests (s.11), Part D Public Consultation (s.12), Part E Management Plans and Management Strategies (ss.13-14), Part F Conclusions (ss.15-16), and Appendices, but within these sections are sections and chapters. For example, s.1.2.2.1 Existing Infrastructure and Information is in s.0.0 Application Summary, and I refer to it as "s.0.0/s.1.2.2.1".

[2] TCL refers to the initial 26.5 years as the 'life-of-mine' or LOM (Application s0.0/s.1).

Project's public interest case, for use in the BC government's decision-making regarding the EA application.

1.4 Qualifications

My qualifications are as follows:

- I have undergraduate, masters, and doctorate degrees in resource and environmental management;
- my doctorate was focused on the environmental assessment process, including an examination of appropriate methods of economic impact assessment for evaluating major energy projects, and a CBA of the Kearl bitumen mine;
- I have written and co-written articles for peer-reviewed academic journals on aspects of the environmental assessment process, economic impact assessment, cumulative effects assessment, greenhouse gas impact assessment, and other aspects to environmental and natural resource management, and I have provided peer review for a variety of academic journals;
- I have 18 years of experience consulting on the impacts of major projects, including coal mines, oil and gas pipelines, bitumen extraction projects, LNG projects, refineries, and port and shipping projects;
- I work as a private consultant, though from 2016 through 2018 I was also the socio-economic impact assessment lead at SNC Lavalin for the BC and Yukon region;
- I have provided expert testimony to:
    - the BC Utilities Commission for the Fortis Okanagan Upgrade Project;
    - the Joint Review Panel for the Grassy Mountain Coal Mine;
    - the Alberta Energy Regulator for the Syncrude Mildred Lake Extension project;
    - the Joint Review Panel for the Teck Frontier Oil Sands Mine;
    - the Supreme Court of British Columbia for the Site C Clean Energy Project;
    - the Minnesota Public Utilities Commission for the Enbridge Line 3 Replacement;
    - the National Energy Board for the Kinder Morgan Trans Mountain Expansion Project;
    - the National Energy Board for the Enbridge Northern Gateway Project; and
    - the Stk'emlupsemc te Secwepemc First Nation's Review Panel for the proposed Ajax copper/gold mine;
- I have written guidance and advised the BC, Alberta, and federal governments on aspects of economic impact assessment and cumulative effects assessment; and
- I have instructed university-level and professional courses in economics, resource and environmental management, and environmental assessment.

A current copy of my CV is available at www.swiftcreekconsulting.com.

2. Methodological Alternatives for Assessing Project Economic Impacts

TCL applied an economic impact assessment methodology inconsistent with modern practice, with results that unsurprisingly provide limited useful information on the Project's economic benefits and impacts. TCL used the method of economic impact analysis, including the technique of input-output modeling, to estimate what TCL refers to as the Project's economic benefits, namely: capital and operating expenditures, direct construction and operations employment and labour income, indirect and induced employment and labour income, gross domestic product impacts, and government tax and royalty revenue. As detailed in articles I and colleagues have authored in the international journal *Impact Assessment and Project Appraisal* (Joseph et al. 2020a; Joseph et al. 2020b), consistent with decades of literature and research on the subject, EconIA presents only a limited assessment of a project's gross economic impacts. EconIA is incapable of providing a comprehensive assessment of net economic benefits, was never meant to be a method for assessing project benefits, and therefore TCL's assessment of Project benefits has little value in informing the BC EAO's decision regarding the Project's public interest case. As well, standard practice in EA is to present the limitations of any methodology used, but TCL did not do this – no information was provided in the application regarding the limitations of EconIA – leading readers to potentially misunderstand the information provided. Lastly, TCL assessed various potential adverse economic effects in s.5 and assessed various non-economic adverse effects in ss.4, 6, 7, 8, and 9, but did not bring this information all together as is possible with available methodology to assess net benefits.

A proper assessment of Project benefits must assess net benefits, which is the difference between benefits and costs. Consistent with standard Canadian and international methodology, EA is concerned with the *incremental* effects of projects, defined as the difference between two futures: one with, and one without, a project. The best method available for such an assessment is CBA.

CBA is the standard method in modern economics for assessing a project's value to society. CBA entails identifying a project's benefits and costs, and then summing these impacts to arrive at an estimate of a project's net benefits (Boardman et al. 2018). While the method of CBA is not required under the Project's final Application Information Requirements, CBA can be used and is a standard method for project evaluation in many jurisdictions around the world, including Canada (see below), Australia and New Zealand, EU countries, the US, by international development banks, as well as for

economic analysis of proposed regulatory change in Canada, the US, and other countries.

CBA can be used narrowly or broadly in an EA. The narrow approach is to use CBA to assess financial impacts of the Project (e.g., project costs, revenues, employment) as well as those economic impacts that are commonly thought of in economic and/or financial terms and can thus be labelled 'market impacts', such as impacts on other employers who must compete for labour by paying higher wages. The broader approach is to use CBA to assess the whole array of a project's impacts – both market and 'non-market' impacts – thereby quantifying and monetizing all of a project's impacts to arrive at a statement of the project's so-called 'total economic value' associated with a project (Pearce et al. 2006). Due to technical but also philosophical obstacles to implementing the latter, analysts often apply a modified form of CBA, such as multiple account CBA, to assess a project's net benefits (Gunton et al. 2020; Shaffer 2010).

CBA and its variants have a long history in BC and Canada. CBA has often been employed both in and outside of government (BC MAL 2007; BC MoTI 2014; Boardman et al. 2006; Crown Corporations Secretariat 1993), and in the EA context, CBA is increasingly being used to inform EA application decisions while EconIA is increasingly being recognized for its substantial limitations. For example, in 2020 I employed CBA as part of my assessment of a proposed coal mine in Alberta (Joseph 2020), and the Joint Review Panel for EA acknowledged the limitations of EconIA and the usefulness of CBA (JRP Grassy Mountain Coal Project 2021), stating:

> *[p]roponents should be required by the terms of reference to provide both an economic impact analysis and a cost-benefit analysis that allows decision makers to make informed decisions based on both types of economic information. We also suggest that governments develop guidelines on the methodologies and assumptions that should be followed by proponents in producing these future analyses (588).*

The Impact Assessment Agency of Canada (IAAC) now recognizes CBA for its potential in federal EAs (see IAAC Undated).

For this report, I relied upon CBA methodology to help inform the BC EAO, the Northwest Institute, and other interested parties of the net economic benefits of the proposed Tenas project. I conducted this analysis by building a spreadsheet-based model of costs and benefits.

3. Net Economic Benefits of Tenas Project

3.1 Overview of Swift Creek Consulting Analysis

Consistent with standard CBA methodology applied to assessment of major projects, in the sub-sections below I examine the following costs and benefits of the proposed Tenas project, including relevant key uncertainties:

- project costs;
- project revenue, including coal production and coal price;
- employment;
- government revenue and costs;
- other financial interests; and
- environmental and other benefits and costs.

Some of the impacts are examined in quantitative and monetary terms, while others only in qualitative terms. I conduct my analysis in 2021 CAD, though I at times present monetary figures in other currencies and dollar-years (I convert currencies and dollar-years using Bank of Canada data and calculators). I follow my discussion of impacts with a discussion of the time-value of impacts (i.e., discounting), and then I provide interpretation of the results.

3.2 Project Costs

Coal mines have a variety of costs, including: exploration, study costs (to do EAs, for example), construction, operating, and reclamation. TCL (s.1/s.3; s.13.15/s.8) says that the Project will have the following costs:

- initial and sustaining capital costs over the Project's lifespan of $242 million (2019CAD);
- operational costs over the Project's operational phase of $983 million (2019CAD);
- reclamation costs by end of year 21 of the Project of $44 million; and
- post-closure monitoring costs of a total of $4.1 million.[3]

I accept the proponent's statement (Allegiance Coal 2016) that there is little in the way of new exploration costs because of the history of past exploration and activity at the site and little need for further work of this nature.

There are three important issues with TCL's project cost information from a CBA perspective.

First, TCL presents these materials in the 'project benefits' section of their application. This presentation of costs as benefits is erroneous. These costs are costs, or in technical

[3] Application is unclear on dollar year for reclamation and post-closure costs, and so I assumed these figures were 2019 CAD.

terms, these costs are *opportunity costs*, which means that spending this money prevents it from being spent on other things. In my analysis these costs are appropriately categorized as costs instead of benefits.

Second, it is important to compare TCL's estimate with other coal mine cost estimates to ensure that the estimates are reasonable. A comparison with the recent Grassy Mountain mine proposal (Riversdale Resources 2019) suggests that TCL may be underestimating their costs. On a cost/tonne of production basis, it appears that TCL's estimates are low (Table 1), though site-specific, scale, or other factors may be at play. I do note that TCL investment materials argue that the coal is relatively low in cost to extract, in part because the resource is already well-defined (Allegiance Coal 2016).

Table 1. Cost comparison: Tenas Project vs. Grassy Mountain

	Tenas	Grassy Mountain	Difference
Average annual production (mtpa)	0.8	4.25	431%
Construction costs (million $2019CAD)	123.5	738	498%
Construction costs / tonne of production ($2019CAD)	154	174	12%

Sources: Application s.0.0/s.1.2.2, s.1, Executive Summary, s.1/s.3; Riversdale Resources (2019).

Comparing projects requires 'apples-to-apples' comparisons, but major projects do have a longstanding history of cost escalation (e.g., Deloitte 2017; Flyvbjerg et al. 2003; Gunton 2017; Hendricks et al. 2017; Lewis and Fife 2018; Olaniran et al. 2015). Regardless of the TCL project's characteristics, common practice in project cost forecasting is to conduct sensitivity analysis and consider cost escalation of 25% or more, thus bringing the Tenas project's capital costs and operational costs to $302 million and $1.1 billion under an assumption of 25% escalation, respectively.

It is also important to consider cost escalation with mine site reclamation. Reclamation of polluted industrial sites, such as mines, is notoriously challenging, and TCL's plan to address its potentially acid generating materials, tailings pond, and other physical and ecological disturbances associated with the Project may or may not be adequate. The experience in Alberta with bitumen mine reclamation is demonstrative of the costly challenges of reclamation (De Souza et al. 2018), and the potential for cost escalation in coal mine reclamation was noted by the Alberta-Canada Joint Review Panel for the proposed Grassy Mountain mine (JRP Grassy Mountain Coal Project 2021).

Reclamation, but also operational and even capital costs, may escalate due to the environmental impacts and risks posed by coal mining. In BC's Elk Valley, much money has been spent to date trying to address legacy and ongoing selenium and other

pollution (Teck 2022), yet the problem remains. The Grassy Mountain review panel noted substantial uncertainty with respect to managing coal mine water pollution, and how it poses a risk to taxpayers, water users, and ecosystems (JRP Grassy Mountain Coal Project 2021). In reference to disconnects between the costs of complete reclamation and the financial security held by government to enforce reclamation, the Alberta Auditor General has expressed serious concern about coal mine reclamation liability (AGA 2019). The BC government recently introduced an interim policy (BC MEMLCI 2022) to address potential taxpayer liability of coal mine reclamation by requiring higher financial security from developers, but it is not clear if TCL's application is consistent with this new policy.

As well, near-term costs – particular construction – may escalate more than typical in the current, post-COVID-19 inflationary and supply-constrained economic environment. Statistics Canada (2022a), for example, recently noted supply chain-related cost inflation in things such as structural metal, electrical and telecommunications equipment, fuel, and labour – all things that would be necessary to build a coal mine. Therefore, depending on when construction starts, the Project may face much higher costs beyond the factors that commonly cause cost escalation.

For the purposes of my CBA, I used the proponent's estimated capital, operational, and reclamation costs but in alternative sensitivity analysis scenarios I escalated each 25% (I see no reason to test scenarios with lower costs). For reclamation, I note that TCL plans progressive reclamation, and lacking any further information I averaged TCL's reclamation costs over the construction and operations phases to get annual averages.

3.3 Project Revenue

The main benefit of a resource extraction project is its revenue from the sale of the commodity extracted, and this revenue is a function of production volume and commodity price.

3.3.1 Production Volume

TCL says that the Project will produce between 775,000 and 825,000 metric tonnes of processed coal per year (Application s.0.0/s.1), or an average of 0.8 million tonnes per year (mtpa). This number could vary upwards or downwards, due to uncertainty in such things as the quantity and quality of the realized coal resource and final mine configuration and efficiency. However, for the purposes of my analysis, I did not vary production rates and instead assumed 0.8 mtpa of production.

3.3.2 Price of Tenas Coal

A critical parameter in estimating the Project's net economic benefits is the future coal price, and not just a global price, but the specific price that this project will obtain. The price obtained by TCL determines its revenue but is also important in forecasting the Project's benefit stream to government (as mineral and corporate income taxes are a function of a project's profitability) as well as the Project's abilities to finance mitigation measures and final reclamation. TCL explains in its Application that the Project's purpose is to sell steelmaking coal to the Asian market, and TCL provides estimates of government royalties and taxes in s.1/s.3.8, but nowhere does TCL disclose its assumed coal price over the life of the Project. Therefore, it is not possible to verify and validate TCL's estimates of government benefits. In order to undertake my own assessment of the Project's benefits, I have reviewed information on current and future coal markets, as well as information available on the physical and chemical characteristics of Tenas coal and information on any location differential that may affect the price that TCL will obtain.

At present, post-pandemic and while Russia continues to invade Ukraine, steelmaking coal commands a high price, though there is uncertainty with respect to the effect of inflation, other global economic and geopolitical factors, and potential recession on demand (Kolijn 2020; World Steel Association 2022). Prices for steelmaking coal, like thermal coal of which its price is well-correlated, have risen markedly over the last year, but for a project like Tenas what matters is the market over its operational lifespan, which would be roughly 2025 to 2045.

Over the Project's lifespan, the demand – and thus price – for steelmaking coal is expected to decline; the question is how much and how fast. International energy giant BP produces an annual energy outlook, and its 2022 outlook (BP 2022) notes in stark terms that the global carbon budget is "running out" and that

> *government ambitions globally [with respect to reducing GHG [greenhouse gas] emissions have grown markedly… increased momentum in tackling climate change… movement to a lower carbon energy system leads to a fundamental restructuring of global energy markets (6).*

BP examined three scenarios in its 2022 outlook, and all of them anticipate a substantial reduction in use of coal for industrial processes including steelmaking, and increased uptake of alternative technologies including use of low-carbon hydrogen. BP states that

> *within hydrocarbons, the largest falls occur in the share of coal as the world increasingly shifts towards lower-carbon fuels in industry and buildings (39).*

BP anticipates a 1.4% to 6.9% reduction in coal as a primary energy source per year between 2019 and 2050.

Another international energy authority is the International Energy Agency – Canada is a member – and its most recent global energy outlook (IEA 2021) is also pessimistic with respect to the long-term outlook for coal in steelmaking. The IEA anticipates modest growth in demand for steelmaking coal in two scenarios to 2030, under assumptions of continued growth in economic activity in China and emerging and developing nations with little to no climate policy, in contrast to a third scenario of decline straight away from today. Beyond 2030, though, the IEA anticipates decline in industrial coal demand across scenarios, the rapidity of which is a function of climate policy. Speaking more pointedly towards the world's climate and renewable energy goals, the IEA's executive director Fatih Birol stated that "we do not need any more investments in new oil, gas and coal projects" (Chestney 2021).

These two international energy authorities' forecasts suggest that there may be a shorter-term market for TCL's coal but a diminishing market over the longer-term. The consequent effects on the price of coal will translate to diminished benefits over the Project's lifespan (e.g., in terms of operational employment, mineral and corporate income tax revenue) but also potential risk to the funding of mitigation programs and mine reclamation. I discuss potential liabilities from diminished Project revenues and benefits further in s.3.5 below.

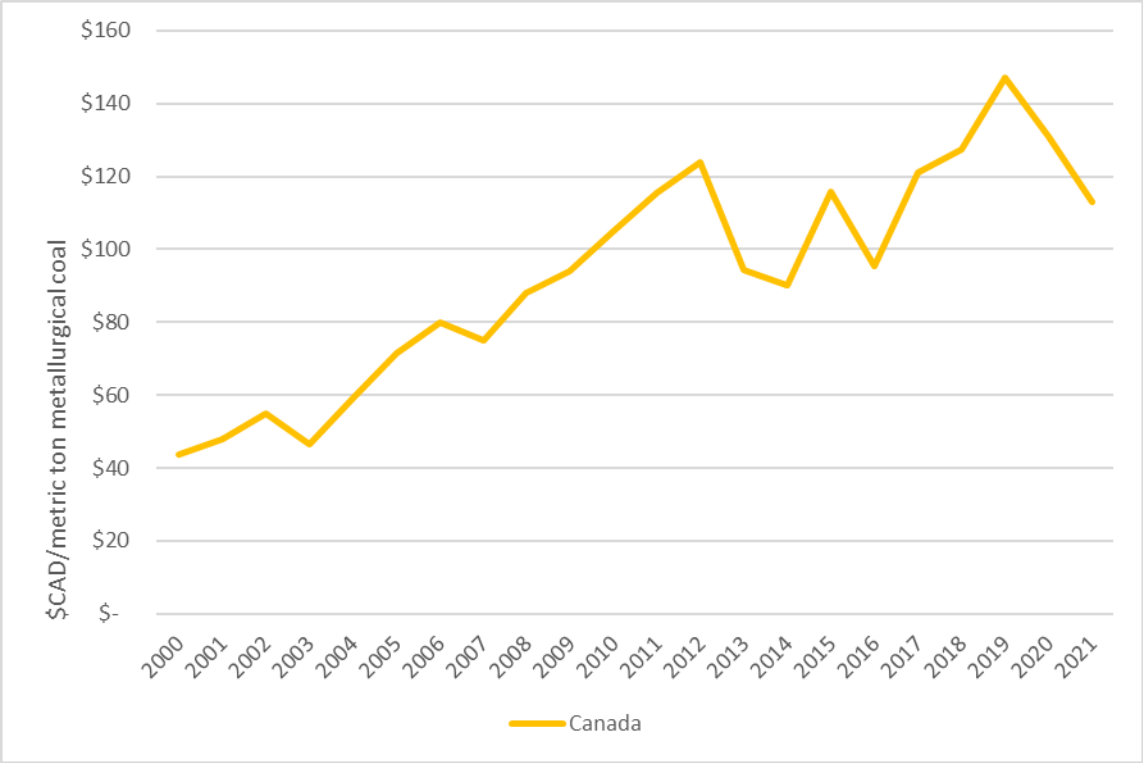
A key parameter in coal price is the quality, or rank, of the coal that would come from the Tenas project. A presentation of different coal ranks is provided by ScienceDirect (Undated). TCL states that the coal is suitable for use as a semi-soft coking coal and/or a pulverized coal injection (PCI) coal (Application s.1/s.1.8.2.4), but I note that the Tenas property has a history of thermal coal extraction due to its predominantly bituminous coal consistency (BC Undated) and the proponent itself has characterized the coal resource as a mix of PCI and thermal coal (Allegiance Coal 2016). It would therefore seem that the Tenas coal is not of the highest quality, and the price that the Tenas coal will command in the marketplace will reflect this.

On the other hand, as pointed out by TCL, the Project is located adjacent to the CN rail line and is very close to the Prince Rupert coal export terminal, which translates into a relatively lower cost to ship to market compared to product from coal mines further east in Canada. The low cost to market translates to a higher minehead price for Tenas coal, all else equal.

One source of data for BC coal export prices is from the BC government (BC MEMLCI 2021). Over 2020, BC PCI prices averaged "between $75 and $80" (2020USD), or about $108 (2021CAD), respectively.

Another source of price data is the US Energy Information Administration (US EIA Undated). According to this source, Canada's export price for metallurgical coal was $113 (CAD) in 2021 and averaged $93 (CAD) over the 2000 to 2021 time period (Figure 1).

Figure 1. Prices for metallurgical coal exports from US and Canada, 2000 to 2021



Source: US EIA (Undated). Original data in USD and short tons; converted to metric tons and CAD using Bank of Canada historical exchange rate data (Bank of Canada 2017; Undated).

Considering all of the above, for the purposes of my CBA I assume a base case long-term average price of $100 (2021CAD) per metric ton consistent with BC government and US EIA data, reflective of the BP and IEA long-term forecasts which anticipate a decline in the market for steelmaking coal, and reflective of the location benefit of the TCL project. In sensitivity analysis, I examine two alternative price scenarios: a high price case with a long-term average price 25% higher, or $125 (2021CAD), and a low price case 25% lower, or $75 (2021CAD).

3.4 Employment

TCL states that the Project will "generate" 125 person-years of direct employment during construction, and will "require" 55 to 145 full-time equivalents for operations, or approximately 3,125 person-years over the life of the Project excluding construction and post-closure activities (s.0/s.1.2.5). Elsewhere in the application (s.1/s.3.4) TCL provides slightly different numbers for Project direct employment, and argues in another section

(Application s.1/s.3.5) that the Project will also provide indirect and induced employment, i.e., employment at firms supplying goods and services to the Project and at firms supplying goods and services to Project direct employees spending their wages. TCL also provides quantitative figures indicating the proportion of workers who will be sourced from the local region, elsewhere in the province, and other geographic locales. For example, in s.0/s.1.2.5 TCL contends that it expects that approximately 58% of direct construction jobs, 90% of operations workers, and 50% of decommissioning workers will be from the local region. Lastly, TCL also provides information on the wages and salaries associated with this employment.

It is critical to observe the fact that labour is a cost of the Project, and that there is only an incremental benefit of the Project's employment if workers would not otherwise be paid as much or would not be working. In other words, if the workers on the Tenas project would otherwise be working for the same wages and salaries there is no net employment benefit of the Project. This is standard economic logic. To address this question, one needs to examine the current and anticipated labour market.

Mine construction requires construction skillsets, and the most recent BC construction labour market data indicates that the unemployment rate for the construction labour force was about 4.6% in 2021 and is expected to average 5.6% for the 2022 to 2027 period (BuildForce Canada 2022). Unemployment rates between 5% and 7% generally indicate a balanced labour market – the 5% to 7% range reflects the fact that there are always people in between jobs or unwilling to work at the time – with rates above 7% indicating an excess of labour relative to job opportunities, and rates below 5% indicating a shortage of labour. As such, there is little if any excess in the BC construction labour force, meaning that little if any Project employment will be incremental. In other words, the direct employment impacts – numbers of jobs, as well as labour income – are costs of the Project and there is no benefit to employing these workers on the Project because they would be employed elsewhere if the Project was not built.

The current state of the Canadian labour market is in a similar state, strongly suggesting that TCL's estimates of indirect and induced employment do not represent incremental gains in Canadian employment. The most recent data, from April of this year (2022), indicate a 5.2% unemployment rate, which in historical terms is very low (Statistics Canada 2022b). Therefore, it can reasonably be assumed that employment at firms supplying goods and services to the Project and its workers will also not be incremental, and thus the information provided by TCL in s.1/s.3.5 of their application on indirect and induced employment 'benefits' should be ignored.

3.5 Government Revenues and Costs

TCL presents estimates of the revenues that governments will receive from the Project in s.1/s.3.8 of its application. TCL estimates that over the first 50 years of the Project all governments combined will receive about $368 million in revenues.[4] TCL's information on government revenue benefits has several important shortcomings.

First, TCL provides no information explaining how they arrived at their estimates. Considering that, in practical terms, the Project's public interest case rests substantially on its economic benefits, this lack of transparency impeding one's ability to verify and validate TCL's estimates is a major shortcoming of TCL's application. Revenues to government, but also other benefit streams (e.g., employment), will be affected by coal prices and any escalation in costs. As explained in KPMG's guide to mining taxation (2016), the '2% net current proceeds tax' and '13% net revenue tax' that BC charges coal mine operators are based upon mine revenues and costs. If revenues are lower and/or if costs are higher, government revenues will be lower. Such a situation was recognized by the Alberta-Canada Joint Review Panel for the proposed Grassy Mountain coal mine in its 2021 decision statement and contributed to the review panel's conclusion that the proponent had likely overstated the positive economic impacts of the project (JRP Grassy Mountain Coal Project 2021, s.23).

The second problem with TCL's presentation of government revenue benefits is that it is an incomplete accounting of economic impacts on government. TCL does not present any information on incremental government costs of the Project. New major projects can create incremental costs for government due to such things as:

- an increase in road use and increased needs for road maintenance;
- increased need for policing and other emergency services associated with road accidents, industrial accidents, worker interactions in host communities (e.g., Ruddell 2011);
- increased use of health care services and facilities (Aalhus 2018); and
- environmental impacts to water, air, and land.

TCL recognizes some of these adverse effects in the Application, such as potential effects on roadways in their Infrastructure and Services VC, but TCL did not connect the dots between government revenue benefits and these adverse effects, leaving the impression that the revenue benefit estimates were accurate. In reality, the net benefit stream flowing to government is lower than what TCL presents. Certainly, tax revenue is intended in part to help address costs of development and activity on government, but BC's mineral taxes also exist to compensate the owners of the natural resource – BC

[4] TCL's reclamation plan at s.13 Chapter 15 notes that the post-reclamation activities are expected to continue at least 75 years into the future.

citizens – for its extraction and consumption. There will be revenues to government with the Project, but also costs, and sound analysis demands clarity on the net effect.

Compounding these analytical gaps is the real possibility that there are additional and sizeable costs to government stemming from mitigation and/or reclamation failure due to technical and scientific gaps but also threats to the Project's financial viability, as discussed in ss.3.2 and 3.3. Technical and scientific gaps to coal mine reclamation were recognized by the Alberta-Canada Joint Review Panel for the proposed Grassy Mountain coal mine and contributed substantially to the review panel's rejection of that project (JRP Grassy Mountain Coal Project 2021). Beyond this, it is important to recognize the risk to government posed by coal price decline over the lifespan of the Project. Many of the environmental impacts in need of eventual reclamation will be created early in the Project's lifespan, but the threat of coal price decline is more of a longer-term issue (s.3.3.2). A risk, therefore, emerges that the Project's financial viability may be threatened at a time in its lifespan when it needs funds to pay for reclamation. While the BC government has recently introduced new rules with respect to the amount that mine developers must put forward as financial security to protect taxpayers from mine reclamation liability (BC MEMLCI 2022), it remains to be seen whether these new rules will in practice address this longstanding problem (OAGBC 2016). Therefore, financial parameters are not only material with respect to the magnitude of government revenue benefits already mentioned, but also with respect to future government costs.

For the purposes of my analysis, and given the limited information provided by TCL as well as the complexity of estimating tax revenues, I rely on TCL's estimates of government revenues provided in the application at s.1/s.3.8. I averaged TCL's tax payment estimate (totalling $368 million) for the period of construction through Project year 51 and ignored any potential payments to government after year 51. Given the time and budget constraints of my study, I have not attempted to quantitatively or estimate the potential incremental costs of the Project on government, but suffice it to say that the net benefit to government is less than the $368 million in revenues presented by TCL.

Lastly, note that from a CBA perspective, government revenue benefits are *transfers* between parties; the government tax revenues stem from revenues earned by TCL through coal production and thus are counted only once in the CBA net benefit calculation. The taxes do matter, though, for the calculation of the private investment case for the Project, and in discussions of government net revenues and risks to government and taxpayers.

3.6 Other Financial Interests

TCL acknowledges that there are a variety of other impacts on other commercial, industrial, and financial interests that may, or in some cases will with certainty, be affected by the Project. In its application (s.0/s.6, ss.5, 6) TCL acknowledges potential and in some cases certain effects on such things as:

- other employers, by way of competition for labour;
- tourism;
- housing and child care; and
- land and natural resource tenure-holders.

With the exception of the Visual Quality VC, TCL concluded in their application that the Project would have no significant effects, but from a CBA perspective the issue is not one of an EA determination of significance or no significance based upon subjective interpretations of effects characterization criteria (such as geographic extent, frequency, and context), but the magnitude of benefits and costs to other financial interests in a ratio numerical sense. Across their application and the VCs that covered the above-listed issues TCL observed potential adverse effects (i.e., costs from a CBA perspective) and identified mitigation measures that would be implemented to dull these adverse effects, but there is uncertainty as to the effectiveness of mitigation measures. It is beyond the scope of my study to quantitatively estimate these various effects of the Project on other financial interests, but it can be said that there will be costs.

3.7 Environmental and Other Benefits and Costs

TCL's application examines a range of other impacts of their proposed project to the environment and other values.

For benefits, TCL explains at s.1/s.3.9 that it expects the Project to have a variety of social and health benefits:

- sponsorship and scholarship program;
- community support such as food bank drives;
- education and training initiatives;
- mine site tours;
- sponsorship of sports teams;
- a staff health program;
- funds for employees to participate in health lifestyle activities; and
- programs for dealing with substance abuse issues.

On a general level, it is questionable if these items can all be counted as benefits of the Project, when they are largely mitigation measures intended to reduce adverse effects. Are mine site tours a meaningful benefit of the Project? Is providing funds for

employees to participate in health lifestyle activities simply another way of saying that employees will be paid? Are the programs that TCL says it will provide for dealing with substance abuse issues the mitigation measures listed in s.6/s.5 (Community Well-Being VC)? No other detail on the above list of 'benefits' is provided by TCL, and these questions are suggestive of the need for more information. However, from a CBA perspective, in principle the above 'benefits' are such if there is a willingness to pay among Project employees and the public for these things. One could argue that there is a willingness to pay for some or all of these things, albeit presumably small in magnitude. In my CBA I therefore acknowledge these benefits in unquantified terms.

Much of the EA application (Application, ss.4-11) covers potential costs of the Project – on the environment but also on social, heritage, and health values. Other than that covered by their economic VCs, TCL examined potential adverse effects of the Project on the following VCs:

- the atmospheric environment, including GHG pollution;
- terrain and soils;
- surface water quantity and quality, including selenium pollution;
- ground water;
- aquatic resources;
- fish and fish habitat;
- vegetation;
- wildlife;
- avian species;
- (community) demographics;
- visual resources, i.e., visual quality;
- infrastructure and services;
- land and resource use;
- community well-being;
- heritage resources; and
- human health

Adverse impacts on Wet'suwet'en rights and interests are also anticipated by TCL, but I do not bring these impacts into my CBA due to the incompatibility of the CBA lens of benefits and costs with rights and legal issues.

TCL predicted adverse impacts on all of the VCs examined, even though TCL concluded that a significant adverse effect would only occur on the Visual Quality VC – a significant adverse effect on visual resources during Project construction and operations (s.0/s.6.3.2). These adverse effects (significant and non-significant) are costs from a CBA point of view that each detract from the Project's net benefits. It is outside the scope of

my study to quantitatively estimate all of these adverse effects, though I do explore two of them further next.

First, it is common in CBA to monetize major projects' GHG emissions, and this can be done by multiplying the Project's GHG emission volumes by what is known as the social cost of carbon. TCL provides estimates of direct GHG emissions in s.4/Chapter 1 of its application. TCL estimates that its GHG emissions for year 5 of operations will be about 69 kt of CO_2e (s.4/ch1/p49). TCL did not estimate GHG emissions for other years of operations, nor for other phases of the Project. TCL then applies the minimization argument (also known as the 'scale trick'; Joseph 2019; Ohsawa and Duinker 2014) by arguing that the Project's emissions are quantitatively small relative to BC's and Canada's emissions and therefore they can be ignored. This argumentation fails to recognize global significance thresholds for GHG emissions, of which Canada and BC have signed on to – safe atmospheric concentrations of CO_2 in the atmosphere that limits climate change – and that BC and Canada have yet to bring GHG emissions in line with Canada's Paris and COP 26 commitments. New GHGs contribute to the cumulative effect of climate change, and it is noteworthy that the Tenas project is being proposed not only at a time when BC and Canada have commitments to sharply reduce GHG emissions but the Secretary General of the United Nations has said that "[n]ew funding for fossil fuels is delusional" (UN 2022).

The finding of non-significance by TCL with respect to its GHG emissions is therefore unjustified. TCL's GHG accounting is also problematic in that it doesn't provide a full accounting of emissions over the Project life, counter to typical assessments which provide estimates of emissions in each phase on a yearly or average annual basis. As well, TCL's assessment of GHG emissions ignores indirect emissions, i.e., emissions caused by the Project's demand for project inputs (e.g., diesel), as well as downstream emissions (e.g., by rail and marine shipping, and most significantly at point of coal combustion), the latter of which can be expected to be disproportionately large compared to the direct emissions at the mine site. Given the state of the global climate today and as expected over the Project's lifespan, the Project's mine site emissions over its lifespan and the Project's downstream emissions are non-negligible costs.

For my CBA, I assumed TCL's year 5 operations GHGs would be the same for all other operations years (i.e., years 1 to 4, and 6 to 21), and I multiplied these emission estimates by social cost of carbon estimates provided by Environment and Climate Change Canada (ECCC 2016). ECCC provides two sets of social cost of carbon estimates: (1) the 'updated central' series representing a moderate view of climate change damages, and (2) the '95^{th} percentile' series which represents a more catastrophic view of climate change. The latter series may even underestimate climate change damages given that climate change is progressing more rapidly and severely than previously

thought (Le Page 2018). Given the constraints of my study I did not try to estimate construction-related GHGs, GHGs associated with post-reclamation activities, nor downstream emissions, but these costs are real.

The second impact that I do consider further pertains to risks of failure with respect to mitigation and reclamation. Reiterating points I made above in ss.3.2, 3.3, and 3.5, there is a risk (i.e., potential cost) that TCL is unable to fulfil its various impact mitigation and reclamation measures, rendering its conclusions of 'non-significance' contingent upon mitigation and reclamation false, due to cost escalation and/or revenue decline, resulting in one or more of:

- TCL baulking at implementing its promised mitigation, or doing so in a reduced form, or
- TCL abandoning the Project, or selling the property to another entity, compromising mitigation and/or reclamation.

As a consequence, the environmental costs of the Project may fall on the public, government, and/or taxpayers. Reclamation liabilities in Alberta have led the auditor general there to warn of risks to the taxpayer (AGA 2015).

3.8 Time-Value of Impacts

An important part of CBA methodology is accounting for the time-value of impacts, commonly referred to as discounting. For several reasons, people tend to value benefits in the near-future higher than the same benefits occurring later in time, and people tend to prefer to defer costs to the future (Shaffer 2010). This fact is as applicable to financial (i.e., monetary) impacts as it is to others.

To address the time-value of impacts in CBA, a mathematical factor – called a discount rate – is applied to the benefits and costs of a project, with impacts occurring further into the future being more influenced by this factor than impacts closer to the present. Various technical and philosophical issues are relevant in setting the discount rate and discounting approach, and despite substantial effort over many decades these issues have not been resolved. Given the fact that people do discount, the best way to overcome uncertainty as to the appropriate discount rate and approach is to undertake sensitivity analysis.

For my CBA I undertook two alternative discounting approaches:

1. a dual discounting approach using a rate reflective of investor expectations for a return on capital invested (10.7%) and used in a recent CBA of the Grassy Mountain coal mine proposal (Joseph 2020) for all financial (i.e., market) impacts covered in the analysis, and a 3% rate for the social cost of carbon consistent with Environment and Climate Change Canada (ECCC 2016); and

2. a uniform discounting approach using an 8% rate for all impacts.

In neither approach were non-monetized impacts discounted numerically.

3.9 Tenas CBA Input Summary

My CBA was conducted by building a spreadsheet-based model of quantified costs and benefits of the Tenas project. The inputs to the CBA model are presented in Table 2.

Table 2. Tenas CBA inputs

Parameter	Input	Source
Capital, operational, reclamation costs[1]	Sensitivity analysis scenarios: • Proponent estimate • 25% higher	Application s.1/s.3; s.13.15/s.8 See s.3.2 of the present report
Mine production	800,000 tonnes per year	Application s.0.0/s.1
Coal price	Sensitivity analysis scenarios: • base case of $100 (2021CAD) over the life of the Project • high price case of 25% higher, or $125 (2021CAD) • low price case of 25% lower, or $75 (2021CAD)	BC MEMLCI (2021) US EIA (Undated) Also see other materials in s.3.3.2 of the present report
Employment	No impact; cost of labour part of capital, operational, and reclamation costs	See s.3.4 of the present report
Government revenues and costs	Proponent estimate of government revenues averaged over 53-year period, covering project years -0.5 to 51 Unquantified government costs	See s.3.5 of the present report

Parameter	Input	Source
Other financial interests	Unquantified benefits Unquantified costs	See s.3.6 of the present report
Environmental and other benefits and costs	Proponent estimate of operational emissions assumed for all operational years of Project Sensitivity analysis scenarios for the social cost of carbon: • 'updated central' estimates • '95th percentile' estimates Other unquantified costs	ECCC (2016) See s.3.7 of the present report
Time-value of impacts	Sensitivity analysis scenarios: • dual discounting approach using 10.7% for market impacts and 3% for GHG impacts • uniform discounting approach using 8% for all impacts	ECCC (2016) Sources in Joseph (2020) See s.3.8 of the present report

Notes: 1. While the CBA model disaggregates capital, operations, and reclamation costs, varying each of these cost items in isolation was found to be immaterial to the results, and so all are lumped together for discussion and presentation purposes.

3.10 Tenas CBA Results

Table 3 presents a summary of results for my limited-in-scope Tenas CBA, exclusive of unquantified benefits and costs. The results are presented in terms of the net present value (NPV) of quantified costs and benefits of the Project under alternative scenarios. NPV is a monetary figure that captures the net of quantified Project costs and benefits over the Project's lifespan but in discounted terms. Each row in Table 3 represents a different scenario composed of a unique combination of coal price, cost, social cost of carbon, and discounting approach. As my CBA considered three different coal prices,

two different cost cases, two different sets of social costs of carbon, and two discounting approaches, there were 24 scenarios examined. Ten of the 24 combinations (42%) result in a positive NPV, and 14 (58%) result in a negative NPV, though none of the results in Table 3 reflect unquantified costs and benefits. Generally, from the perspective of CBA, a positive NPV suggests the Project is worthwhile from a societal point of view, and a negative NPV suggests not.

Table 3. Summary of results for limited-in-scope Tenas CBA (excluding unquantified costs and benefits)

Project costs[1]	Coal price	Social cost of carbon	Discounting approach	NPV (million 2021CAD)
Proponent estimates	25% higher ($125/t)	updated central	Uniform	280.7
25% higher	25% higher ($125/t)	updated central	Uniform	263.2
Proponent estimates	25% higher ($125/t)	updated central	Dual	189
25% higher	25% higher ($125/t)	updated central	Dual	174
Proponent estimates	25% higher ($125/t)	95th percentile	Uniform	127.8
25% higher	25% higher ($125/t)	95th percentile	Uniform	110.3
Proponent estimates	base case ($100/t)	updated central	Uniform	81.7
25% higher	base case ($100/t)	updated central	Uniform	64.3
Proponent estimates	base case ($100/t)	updated central	Dual	24.6
25% higher	base case ($100/t)	updated central	Dual	9.6
Proponent estimates	25% higher ($125/t)	95th percentile	Dual	-53.1
25% higher	25% higher ($125/t)	95th percentile	Dual	-68.1
Proponent estimates	base case ($100/t)	95th percentile	Uniform	-71.2
25% higher	base case ($100/t)	95th percentile	Uniform	-88.6

Project costs[1]	Coal price	Social cost of carbon	Discounting approach	NPV (million 2021CAD)
Proponent estimates	25% lower ($75/t)	updated central	Uniform	-117.2
25% higher	25% lower ($75/t)	updated central	Uniform	-134.7
Proponent estimates	25% lower ($75/t)	updated central	Dual	-139.9
25% higher	25% lower ($75/t)	updated central	Dual	-154.9
Proponent estimates	base case ($100/t)	95th percentile	Dual	-217.6
25% higher	base case ($100/t)	95th percentile	Dual	-232.6
Proponent estimates	25% lower ($75/t)	95th percentile	Uniform	-270.1
25% higher	25% lower ($75/t)	95th percentile	Uniform	-287.6
Proponent estimates	25% lower ($75/t)	95th percentile	Dual	-382.1
25% higher	25% lower ($75/t)	95th percentile	Dual	-397.1

Notes: 1. For the sensitivity analysis scenarios presented, project costs refer to all of capital, operations, and reclamation costs.

Another typical output of CBA is a project's internal rate of return (IRR), which is the discount rate at which a project is worthwhile from an investor's point of view. Generally, the IRR needs to be greater than investors' cost of capital, which is generally 10% or higher, to support a positive investment decision. In this case, taxes paid to government matter, as the mathematical test looks at the Project from the investor's point of view, but the social cost of carbon and other externalities do not matter as these costs are not (directly) paid by investors. Under the scenario using TCL's cost estimates and the base case coal price, the IRR for project years -0.5 to 21 is 7%, and with the same parameters but 25% higher costs, the IRR is 5.5%. In scenarios where the coal price is 25% higher, then the IRR is over 20%, but in scenarios where the coal price is 25% lower, the IRR is worse than 0%. Generally, the IRR results suggest the Project is not a worthwhile private investment, and if the investment is made, that there are risks with respect to government benefits and government and taxpayer costs.

A third output of CBA is the break-even price – the average coal price over the Project's operational lifespan needed to make the Project net positive. The 'social break-even price' is the price from a societal point of view, and in the case of my Tenas CBA, which

includes not just financial impacts but also monetizes the social cost of carbon, any calculation of a break-even price assumes substitutability of natural and human capital, which is a 'weak sustainability' point of view (e.g., Ayres et al. 2001). With these caveats, under the scenario of proponent cost estimates, the 'updated central' estimates of the social cost of carbon, and the dual discounting approach, the social break-even price is $96.27, but under the '95th percentile' estimates of the social cost of carbon, the price is $133.08. Under the same conditions but the uniform discounting approach, the break-even prices are $89.73 and $108.94. The break-even prices are higher if Project cost escalation is assumed.

3.11 Interpretation of CBA Results

The underlying decision criterion of the 2002 *EAA* is whether or not a project is in the public interest (see ss.6, 17, and 31). TCL makes no direct analysis of the public interest case for the Tenas project in its EA application, and in some respects TCL confuses matters through the erroneous application of EconIA. In this report I present my own analysis of the public interest case for the Project using the standard method in economics designed for this purpose: CBA. While my CBA is limited in its scope due to time and budget constraints, the results are nonetheless informative.

The results of my CBA suggest strong caution with this Project. More than half (58%) of the scenarios tested result in a negative NPV, suggesting that the Project is not in the public interest. Of the smaller proportion of scenarios (42%) that resulted in a positive NPV, a result suggestive of a positive public interest case, most of these (60%) rely on an assumption of a 25% higher coal price, which is doubtful given international energy forecasts, industry trends, and climate policy expectations. Furthermore, all of the scenarios actually over-estimate NPV because none incorporate a variety of known but unquantified costs of the Project acknowledged by TCL as covered in ss.3.5 to 3.7 of my report.[5] Compounding this, the social cost of carbon estimates used likely underestimate climate damages given the global observation that climate change is worsening.

In non-technical terms, the Project's public interest case is in doubt because:

- Project costs are likely to be higher than what TCL estimates,
- Project revenues are at risk because of a poor outlook for the coal market over the Project's lifespan,
- there will be no incremental employment benefits from the Project,
- government benefits have not been validated, and incremental costs to government have not been tallied,

[5] Unquantified benefits are also excluded, but they are expected to be small – see s.3.7 of my report.

- other financial interests will be affected, increasing the costs of the Project on society, and
- a variety of environmental and other costs will be incurred, and the various benefits that TCL lists (e.g., minesite tours) appear minor,

all contributing to a disproportionate number of scenarios resulting in negative NPVs, low IRRs, and high break-even prices.

A serious concern of coal mining is mitigation of environmental impacts like potentially acid generating materials and selenium pollution, and eventual reclamation of the mine site upon mine closure to deal with these and other environmental impacts, and these concerns are at the heart of a key economic impact issue. Coal mine mitigation and reclamation are costly, and there is ample uncertainty about success, translating to risk of high cleanup costs and/or reclamation failure (ultimately resulting in legacy costs on society). While new BC policy regarding the financial security that new mines must provide may lessen this risk, the fact remains that there is substantial risk of ongoing and lasting environmental and associated economic costs. In a context of a declining market for coal over the Project's lifespan, there is a real risk that the revenues that mitigation and reclamation depend upon may not be available.

The two key parameters of the CBA were found to be coal price and the social cost of carbon associated with the Project's GHG emissions. Both of these parameters have at least a moderate relationship to climate change and climate policy. The future coal price that would be obtained by TCL will be shaped substantially by climate policy. TCL argues that there will be a strong market for steelmaking coal throughout the Project's life, but two of the most prominent international energy forecasts anticipate moderate to rapid decline in market demand. With climate change worsening, both energy forecasts note that climate policy must strengthen, and if it does, then the market demand for coal in all industries will diminish. Worsening climate also translates to greater a social cost of carbon for each new volume of GHG released, diminishing the value to society of a coal mine.

4. Conclusions

TCL proposes to develop the Tenas project near Telkwa, BC. The Project is currently being reviewed under EA legislation overseen by the BC EAO. The underlying decision criterion is whether or not the Project is in the public interest. The 45-day comment period on TCL's application will end on July 3rd, 2022.

TCL hasn't demonstrated that the Project is in the public interest, explicitly or implicitly. TCL's analysis of economic benefits relies upon flawed methodology, the limitations of this methodology are not transparent in TCL's application, and TCL has not been

transparent about a key parameter foundational to the Project's economic benefits and public interest case – the future price of its coal.

The Northwest Institute is concerned about the economic benefits and impacts of the Project in light of environmental and other impacts of the Project and in the context of the public interest case for the Project. In this context, the Northwest Institute hired me – Dr. Chris Joseph of Swift Creek Consulting – to prepare an assessment of the Project's net economic benefits and comment on the Project's public interest case.

The evidence that I have gathered through the use of CBA casts serious doubt on whether the Project is in the public interest. CBA is the standard method in modern economics for assessing a project's net economic benefits and for evaluating a project's public interest case. While CBA was not required under the 2002 BC environmental assessment law that TCL chose to conduct its assessment under in 2022, modern environmental assessment in Canada recognizes the limitations of TCL's methods of assessment and the analytical value of CBA to major project evaluation.

To fill this information gap, I examined: Project costs, Project revenues, employment, government revenue and costs, impacts on other financial interests, and environmental and other benefits and costs. Uncertainties in these parameters were considered, and all were considered in terms of their time-value.

The results of my analysis suggest that the Project is not in the public interest. Fourteen (58%) of the scenarios resulted in a negative NPV, suggesting that that Project will not be a net benefit to society. The private investment case is also weak: under the scenario that uses TCL's cost estimates and the base case coal price, the IRR is 7%, and with the same parameters but 25% higher costs, the IRR is 5.5%, both substantially lower than typical investor expectations. In scenarios where the coal price is 25% higher, then the IRR is over 20%, but given international expectations that the future coal market will weaken over the life of the Project, such scenarios are unlikely. The break-even price for the Project is also high relative to historical and expected future coal prices. No incremental employment benefits are expected due to current and anticipated labour market conditions, and the many environmental and other impacts and risks pose further reasons to be skeptical about the Project's public interest case.

Overall, it is hard to see a positive public interest case for the Tenas project. TCL's application provides insufficient information on the Project's economic benefits and public interest case, and the information that I have gathered through my analysis helps fill these gaps, indicating that the future coal market, costs of development, the social cost of carbon, and the risks posed by coal mining to the environment and taxpayers all conspire against the Project's public interest case.

References

Aalhus, M. (2018). The social determinants of health impacts of resource extraction and development in rural and northern communities: A summary of impacts and promising practices for assessment and monitoring. Northern Health. 76 pp.

AGA (Auditor General of Alberta) (2015). Environment and Parks and the Alberta Energy Regulator—Systems to Ensure Sufficient Financial Security for Land Disturbances from Mining. Report of the Auditor General of Alberta. 12pp.

AGA (Auditor General of Alberta) (2019). Alberta Energy Regulator—Systems to Ensure Sufficient Financial Security for Land Disturbances from Mining. Report of the Auditor General of Alberta. 9pp.

Allegiance Coal (2016). Investor Presentation Acquisition of Telkwa Coal Limited. 21 pp. https://www.allegiancecoal.com.au/site/PDF/985_0/InvestorPresentation.

Ayres, R. U., J. C. J. M. van den Bergh and J. M. Gowdy (2001). Strong versus weak sustainability: Economics, natural sciences, and "consilience". Environmental Ethics 23(2): 155-168.

Bank of Canada (2017). Historical Noon and Closing Rates. https://www.bankofcanada.ca/rates/exchange/legacy-noon-and-closing-rates/, Accessed on March 1, 2018.

_____. Annual Exchange Rates. https://www.bankofcanada.ca/rates/exchange/annual-average-exchange-rates/, Accessed on June 14, 2022.

BC (Government of BC) (Undated). The Telkwa Coalfield. https://www2.gov.bc.ca/gov/content/industry/mineral-exploration-mining/british-columbia-geological-survey/geology/coalfields/telkwa, Accessed on June 14, 2022.

BC EAO (BC Environmental Assessment Office) (2022). Application Information Requirements: Tenas Project. 179pp.

BC MAL (BC Ministry of Agriculture and Lands) (2007). Guidelines for Socio-Economic and Environmental Assessment (SEEA) - Land Use Planning and Resource Management Planning. 98pp.

BC MEMLCI (BC Ministry of Energy, Mines and Low Carbon Innovation) (2021). British Columbia Coal Industry Overview 2020. Information Circular 2021-02. 13pp.

_____ (2022). Major Mines Reclamation Security Policy (Interim) https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/mineral-exploration-mining/documents/reclamation-and-closure/major_mines_reclamation_security_policy_interim_v1_05apr2022.pdf.

BC MoTI (BC Ministry of Transportation and Infrastructure) (2014). Benefit Cost Analysis Guidebook: Guidelines for the Benefit Cost Analysis Of Highway Improvement Projects In British Columbia. 44pp.

Boardman, A. E., D. H. Greenberg, A. R. Vining and D. L. Weimer (2006). Cost-Benefit Analysis: Concepts and Practice. Upper Saddle River, New Jersey, Pearson Prentice Hall. 560 pp.

Boardman, A. E., D. H. Greenberg, A. R. Vining and D. L. Weimer (2018). Cost-Benefit Analysis: Concepts and Practice, Cambridge University Press.

BP (2022). Energy Outlook: 2022 Edition. 109 pp. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2022.pdf.

BuildForce Canada (2022). British Columbia Highlights 2022-2027. Ottawa. 24 pp. https://www.buildforce.ca/system/files/forecast_summary_reports/2022%20BC%20Constr%20Maint%20Looking%20Forward.pdf?language=en.

Chestney, N. (2021) End new oil, gas and coal funding to reach net zero, says IEA. Reuters, https://www.reuters.com/business/environment/radical-change-needed-reach-net-zero-emissions-iea-2021-05-18/.

Crown Corporations Secretariat (1993). Multiple Account Evaluation Guidelines. 23pp.

De Souza, M., C. Jarvis, E. McIntosh and D. Bruser (2018) Cleaning up Alberta's oilpatch could cost $260 billion, internal documents warn. Global News, https://globalnews.ca/news/4617664/cleaning-up-albertas-oilpatch-could-cost-260-billion-regulatory-documents-warn/.

Deloitte (2017). British Columbia Utilities Commission Site C Construction Review. 111 pp.

ECCC (Environment and Climate Change Canada) (2016). Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates. 27 pp. http://publications.gc.ca/collections/collection_2016/eccc/En14-202-2016-eng.pdf.

Flyvbjerg, B., N. Bruzelius and W. Rothengatter (2003). Megaprojects and Risk: An Anatomy of Ambition. New York, Cambridge University Press. 207 pp.

Goodday, V., J. Winter and A. Westwood (2020). Public-Interest Determination for Infrastructure Development: A Review of Guidance and Practice in Canada. University of Calgary. 44 pp.

Gunton, T. (2017). Re-evaluating the Need for the Trans Mountain Expansion Project: the Impacts of Weaker Oil Markets and Keystone XL. Burnaby, BC, Simon Fraser University. 28 pp.

Gunton, T., C. Gunton, C. Joseph and M. Pope (2020). Evaluating Methods for Analyzing Economic Impacts in Environmental Assessment. Research report to the Social

Science and Humanities Research Council of Canada and the Impact Assessment Agency of Canada. 34 pp.

Hendricks, R., P. Raphals and K. Bakker (2017). Reassessing the Need for Site C. Vancouver, UBC Program on Water Governance. 151 pp.

IAAC (Impact Assessment Agency of Canada) (Undated). Practitioner's Guide to Federal Impact Assessments under the Impact Assessment Act. https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/practitioners-guide-impact-assessment-act.html.

IEA (2021). World Energy Outlook 2021. International Energy Agency. https://iea.blob.core.windows.net/assets/4ed140c1-c3f3-4fd9-acae-789a4e14a23c/WorldEnergyOutlook2021.pdf.

Joseph, C. (2019). Problems and resolutions in GHG impact assessment. Impact Assessment and Project Appraisal 38(1): 83-86.

Joseph, C. (2020). Review of Grassy Mountain Coal Mine Economic Impact Assessment. Report submitted to the Alberta-Canada Joint Review Panel on behalf of the Livingstone Landowners Group. Swift Creek Consulting. 16 pp.

Joseph, C., T. Gunton, D. Knowler and S. Broadbent (2020a). The Role of Cost-benefit Analysis and Economic Impact Analysis in Environmental Assessment: The Case for Reform. Impact Assessment and Project Appraisal 38(6): 491-501.

Joseph, C., T. I. Gunton and J. Hoffele (2020b). Assessing the public interest in environmental assessment: lessons from cost-benefit analysis of an energy megaproject. Impact Assessment and Project Appraisal 38(5): 1-15.

JRP Grassy Mountain Coal Project (2021). Report of the Joint Review Panel - Benga Mining Limited, Grassy Mountain Coal Project, Crowsnest Pass. 664 pp.

Kolijn, C. (2020). Expert Report Coal Quality and Value Assessment Grassy Mountain Project. Prepared for the Canadian Parks and Wilderness Society Southern Alberta Chapter. 26 pp.

KPMG (2016). A Guide to Canadian Mining Taxation. 123 pp. https://assets.kpmg/content/dam/kpmg/pdf/2016/04/KPMG-Mining-Taxation-Guide-2016.pdf.

Le Page, M. (2018) Worst-case climate change scenario is even worse than we thought. New Scientist, , https://www.newscientist.com/article/2168847-worst-case-climate-change-scenario-is-even-worse-than-we-thought/.

Lewis, J. and R. Fife (2018). Kinder Morgan faces cost overruns on pipeline project. Globe and Mail. May 25, 2018.

OAGBC (Office of the Auditor General of British Columbia) (2016). An Audit of Compliance and Enforcement in the Mining Sector. Victoria, BC. 108 pp.

Ohsawa, T. and P. Duinker (2014). Climate-change mitigation in Canadian environmental impact assessments. Impact Assessment and Project Appraisal 32(3): 222-233.

Olaniran, O. J., P. E. D. Love, D. Edwards, O. A. Olatunji and J. Matthews (2015). Cost overruns in hydrocarbon megaprojects: a critical review and implications for research. Project Management Journal 46(6): 126-138.

Pearce, D. W., G. Atkinson and S. Mourato (2006). Cost-benefit Analysis and the Environment: Recent Developments. Paris, France, Organization for Economic Co-operation and Development. 315 pp.

Riversdale Resources (2019). Target's Statement. 212 pp. http://www.rivresources.com/site/PDF/64aaf8c8-e338-4acc-95ad-db71ddcf66c7/RiversdaleResourcesTargetsStatement28March2019.

Ruddell, R. (2011). Boomtown Policing: Responding to the Dark Side of Resource Development. Policing 5(4): 328-342.

ScienceDirect (Undated). Coal Rank. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/coal-rank, Accessed on June 14, 2022.

Shaffer, M. (2010). Multiple Account Benefit-Cost Analysis: A Practical Guide for the Systematic Evaluation of Project and Policy Alternatives. Toronto, University of Toronto Press. 152 pp.

Statistics Canada (2022a). Building construction price indexes, first quarter 2022. https://www150.statcan.gc.ca/n1/daily-quotidien/220505/dq220505b-eng.htm. Accessed on June 7, 2022.

_____ (2022b). Labour Force Survey, April 2022. https://www150.statcan.gc.ca/n1/daily-quotidien/220506/dq220506a-eng.pdf, Accessed on June 9, 2022.

Teck (2022). Teck's Third Elk Valley Water Treatment Facility Now Complete and Improving Water Quality. 3 pp. https://www.teck.com/media/Teck-Third-Elk-Valley-Water-Treatment-Facility-Now-Complete-and-Improving-Water-Quality.pdf.

UN (United Nations) (2022). Climate change: More fossil fuel investment, just 'delusional', warns Guterres. https://news.un.org/en/story/2022/06/1120372, Accessed on June 20, 2022.

US EIA (US Energy Information Administration) (Undated). Coal Data Browser. https://www.eia.gov/coal/data/browser/, Accessed on June 10, 2022.

World Steel Association (2022) worldsteel Short Range Outlook April 2022. https://worldsteel.org/media-centre/press-releases/2022/worldsteel-short-range-outlook-april-2022/.