

Good for the Economy? An Ecological Economics Approach to Analyzing Alberta's Bitumen Industry

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Abstract

Competing claims about the economic, social and environmental impacts of bitumen projects make Alberta's oilsands industry highly contentious. This paper uses a case study of a major bitumen project, Shell Canada's Jackpine mine expansion, to examine the evidence considered by government decision-makers in the project approval process. The project was determined to be "in the public interest" based primarily on its economic benefits, despite significant adverse environmental and social impacts. The paper evaluates the evidence that was presented to support this decision, using three criteria drawn from ecological economics: efficient allocation, just distribution, and sustainable macroeconomic scale. It finds that the evidence presented is, in fact, insufficient to justify the project on any of the three criteria. Furthermore, other studies of the bitumen industry cast doubt on the likelihood that the project would satisfy these criteria if further analysis were conducted. It concludes by recommending several measures that could help to improve decision-making on bitumen projects in the future.

Keywords

bitumen; oilsands; Alberta; resource policy; ecological economics

Highlights

The paper examines the evidence considered by government in approving a major bitumen project.

The project was deemed "in the public interest," based primarily on its economic benefits.

The evidence does not demonstrate efficient allocation, just distribution, or sustainable scale.

Several measures are available that could improve decision-making on such resource projects.

1. Introduction

Alberta's bitumen industry is highly contentious, both within Canada and internationally. The industry produced 2.4 million barrels of oil per day in 2015 from the third largest oil reserve in the world. It is widely considered "the cornerstone of the provincial economy" (Alberta, 2009, p. 3), "a key driver of the Canadian economy" (Alberta, 2012), and "the economic engine for the country for the foreseeable future" (Cooper, 2012). Nevertheless, in 2015, over 100 respected North American scientists issued an open letter calling for a moratorium on new bitumen developments until the environmental and social impacts can be addressed (Homer-Dixon et al., 2015). Proposals for pipelines intended to carry bitumen to other countries have been met with national and international protests. Aboriginal groups have launched multiple court challenges against oilsands projects (Droitsch and Simieritsch, 2010), and their concerns were echoed by the United Nations Special Rapporteur on the Rights of Indigenous Peoples (Anaya, 2014). Debates about whether Alberta's bitumen should be considered "dirty oil" have raged for years as the European Union considers whether it should restrict imports. The Canadian government is reported to have spent millions of dollars on advertising and outreach activities in Canada and internationally, trying to sway public opinion towards the industry (Lukacs, 2015).

Before bitumen mines can be constructed or expanded, companies must receive approval from both the federal and provincial governments.¹ Typically, the Canadian Environmental Assessment Agency and Alberta Energy Regulator strike a Joint Review Panel (JRP) that is tasked with evaluating the project with respect to applicable legislation. Under the federal *Canadian Environmental Assessment Act*, approval may be granted to a project that "is likely to cause significant adverse environmental effects," as long as those effects are "justified in the circumstances" (2012, s. 52). Under the provincial *Oil Sands Conservation Act*, approval is granted to projects that are found to be "in the public interest" (2000, s. 10[3]). The provincial *Responsible Energy Development Act General Regulation* requires the regulator to

¹ In-situ bitumen projects, the fastest growing type of oilsands projects, must also receive provincial approval; however, they do not automatically trigger a federal approval process.

consider the social, economic, and environmental impacts of a project before granting such approval (2013, s. 3).

But how do decision-makers weigh competing claims to discern whether a project's benefits outweigh its negative effects, and whether it is in the public interest? What information do they consider, and what criteria do they use to evaluate this information? What process do they follow in coming to a decision? And, most importantly, can citizens trust that their political representatives are making good decisions, based on the best evidence available?

The answers to some of these questions are opaque. The actual decision-making discussions are not public; specific bitumen projects are not generally debated in government legislatures and project approvals are often not accompanied by explanations. However, available documentation does provide significant clues. The project approval process includes an Environmental Impact Assessment (EIA) conducted by the company, written submissions from affected parties including Aboriginal and environmental groups and government agencies, and public hearings involving all these parties. All this documentation, including full transcripts of the hearings, is publicly available on the website of the Canadian Environmental Assessment Agency. The JRP's final report, which details the information it heard, its assessment of this information, and its recommendation, is also publicly released upon completion. Since the JRP is tasked with gathering evidence on behalf of both the federal and provincial governments, this documentation offers valuable information as to the evidence considered in the final approval decisions. It also offers an opportunity for others to evaluate the validity of these decisions.

This paper uses a case study of a specific bitumen project, Shell Canada's Jackpine mine expansion, to evaluate the basis for the project's approval. How was the project justified? Did decision-makers use the best possible evidence to reach their conclusions? Does the evidence present a convincing case that the project is indeed "in the public interest?"

This paper focuses on these questions from an economic perspective only, setting aside broader political concerns that have been raised about the role of the bitumen industry in shaping provincial and federal decision-making processes (e.g. Hiemstra, 2013; Nikiforuk, 2010). In defining what "in the public

interest” might mean from an economic perspective, it adopts ecological economics’ three policy goals: efficient allocation, just distribution, and sustainable macroeconomic scale (Costanza and Folke, 1997; Daly, 1992). After describing the case study and the justification offered by the JRP for its approval, the paper evaluates the project on each of these three criteria. It finds that the evidence provided in the approval process and cited by the JRP is, in fact, insufficient to make a convincing case for the project on any of the three grounds. Drawing on studies of other bitumen projects and the industry as a whole, it then shows that there are reasons to doubt that these criteria would be satisfied if additional information were available. It concludes by recommending several measures that could help improve decision-making on such projects in the future.

2. The Case Study: Shell’s Jackpine Mine Expansion

In 2013, Shell Canada Limited, a subsidiary of Royal Dutch Shell, received approval to significantly expand its existing Jackpine bitumen mine. The mine is located north of Fort McMurray, Alberta, within the Athabasca bitumen deposit. The region already contains a number of existing and approved open-pit bitumen mines. The Jackpine expansion will add additional mining, processing and tailings disposal areas affecting about 130 square kilometres of land and requiring the diversion of 22 kilometres of the Muskeg River (Canada, 2013a). It will result in the production of an additional 100,000 barrels of bitumen per day (Canada, 2013b).

Shell initially submitted its project application in 2007. Its EIA was deemed complete in 2010 and the Joint Review Panel was established in 2011. In 2012, the JRP invited public input and held three weeks of public hearings in Fort McMurray and Edmonton. It issued its decision report in July 2013, based on the EIA and supplemental reports submitted by Shell, written submissions from several intervenors (Aboriginal groups and individuals, environmental organizations, provincial and federal government agencies, the local municipality, and other companies), and testimony provided during the public hearings.

In its report, the JRP concluded that despite “significant adverse project effects...the Project is in the public interest” (Canada, 2013a, p. 2). This finding resulted in provincial approval of the application. Federal approval followed in December 2013, with the governor-in-council’s finding that the “significant adverse environmental effects” of the project were “justified in the circumstances” (Canada, 2013b). This federal approval was not accompanied by any further explanation of the government’s decision. The analysis in this paper therefore relies on the evidence presented in the JRP’s report.

In support of its recommendation to approve the project, the JRP cites “significant economic benefits for the region, Alberta, and Canada” (Canada, 2013a, p. 2). These benefits are later spelled out in detail:

The Project is an expansion of an existing project and is in an area where the government of Alberta has identified bitumen extraction as a priority use. Shell stated that the Project will result in the recovery of about 325 million cubic metres of dry bitumen over its approximately 40-year life. The municipal, provincial, and federal governments will all receive significant financial benefits as a result of the Project. The Project will provide major and long-term economic opportunities to individuals in Alberta and throughout Canada, and will generate a large number of construction and operational jobs. (Canada, 2013a, p. 4)

The JRP’s discussion of the social and economic effects of the project is based on Shell’s own analysis of the economic benefits, described in the socio-economic assessment that Shell completed as part of the EIA. According to the EIA, Shell used project-specific data and input-output modelling to calculate the impacts on employment, government revenue, and GDP, and to determine the geographical impacts of project expenditures. The JRP cites Shell’s projections of the economic benefits: \$7-10 billion increase in provincial GDP, 12410 work years of employment during construction, 750 ongoing jobs, \$23-24 million in annual property taxes, and a total of \$17 billion in federal and provincial royalties and taxes (Canada, 2013a).

However, the JRP report also states that “the Project would likely have significant adverse environmental effects on wetlands, traditional plant potential areas, wetland-reliant species at risk, migratory birds that are wetland-reliant or species at risk, and biodiversity” (Canada, 2013a, p. 2). In combination with other projects in the region, there would be additional significant adverse effects on old-growth forests and related species, caribou, and “Aboriginal traditional land use (TLU), rights, and culture” (p. 2-3). The JRP further finds that many of these impacts cannot be mitigated, despite Shell’s commitment (as required by law) to reclaim the disturbed areas. In addition, the report notes uncertainties regarding “groundwater modelling, bitumen recovery, tailings management, and reclamation” (p. 4). The report cites a variety of additional negative impacts, but accepts that mitigation measures and adaptive management efforts on the part of Shell and other parties will be sufficient to address them.

In the end, it appears that the economic arguments in favour of the project carried the day. While the JRP’s report, and the federal government’s subsequent approval, were accompanied by a number of requirements aimed at mitigating the adverse impacts of the project as much as possible, they acknowledged that there is no way to mitigate several of the impacts and that these impacts will be significant. Nevertheless, these impacts were deemed to be “justified” and the project was found to be “in the public interest” based, presumably, on the economic benefits cited: bitumen extraction, economic growth, employment, and government revenues.

3. Evaluating the Evidence: Is the Project in the Public Interest?

Is the analysis conducted by the JRP really adequate to conclude that the project is in the public interest? The first step in answering this question is to define what “in the public interest” might mean from an economic perspective. Economic theory typically offers efficiency as the primary criterion for making such a determination. Many economists and policy-makers would also include distributional impacts in their considerations. Ecological economists, however, point out that a third criterion is often missing from policy deliberations: the economy must operate within the limits of the biosphere’s capacity to provide resources and process wastes.

This paper therefore operationalizes “in the public interest” using the three economic policy goals defined by ecological economists (Costanza and Folke, 1997; Daly, 1992): efficient allocation of resources towards their highest-priority uses, as determined by individual preferences; just distribution of the benefits of economic activity between different people and generations; and sustainable macroeconomic scale, meaning that the extraction of natural resources and production of wastes does not erode the capacity of the biosphere to support life over the long term. This approach aligns with provincial legislation that requires regulators to consider the social, economic, and environmental impacts of a project before granting approval (*Responsible Energy Development Act General Regulation*, 2013, s. 3).

The following sections examine the JRP’s analysis of the Jackpine mine expansion with respect to each of these three criteria and show that the evidence presented is inadequate to demonstrate that the project will satisfy any of three. Furthermore, studies of other projects and of the industry as a whole cast doubt on the likelihood that fuller analysis would conclude that the project could satisfy these criteria.

3.1 *Efficient allocation*

On first glance, the Jackpine project easily satisfies the efficient allocation criterion. No one else is clamouring to extract the bitumen; at present, given current technologies and consumer demand, the resource appears to be primarily useful as an energy source. Furthermore, since oilsands extraction is carried out by private companies operating in a competitive market, market mechanisms should be sufficient to ensure that this scarce resource is directed towards its highest-value use.

However, on closer analysis, it is clear that the market for bitumen is subject to serious market failures which mean that market mechanisms are not capable of ensuring allocative efficiency in this case. In particular, bitumen extraction results in many negative externalities, such as the adverse impacts identified by the Shell JRP on wetlands, old-growth forest, animal and bird species, and traditional land use. While there are certainly economic benefits from extraction, it is possible that the total social costs of extraction exceed the benefits. In this case, it would be more efficient to leave the bitumen in the ground.

Cost-benefit analysis (CBA) is the method typically used to determine whether the benefits of a project exceed the costs. This method involves quantifying and totalling all the costs and benefits of a project, including social and environmental costs, discounting them over time, and determining the final net benefit. There is no discussion whatsoever of CBA in the documents submitted by Shell, the hearing transcripts, or the JRP report, and no evidence that a CBA was ever conducted. The Socio-Economic Impact Assessment (SEIA) conducted by Shell as part of its EIA gives some quantitative analysis of the project's impact on certain indicators, including population, housing, and pressure on infrastructure, as well as monetary values for construction and operating expenditures, impacts on provincial GDP, and government revenues (Shell Canada Limited, 2007). There is, however, no attempt to provide monetary values for any of the negative social or environmental impacts described in the SEIA or EIA.

This approach is typical of economic analysis of the bitumen industry. The Alberta Energy Regulator is not required to conduct CBAs on oilsands projects, nor has CBA been a part of other joint review processes. McLeod-Kilmurray and Smith examine the 2007 JRP decision for the Kearl oilsands mine and find that while the project seems to have been approved on the basis of an "implicit" CBA, in which the "benefits are presumed" (2010, p. 92), the costs are incomplete and mostly unmeasured, and while approval of the project implies that "benefits outweigh costs... this analysis was never done" (p. 94). Instead, economic analysis of the bitumen industry usually takes the form of Economic Impact Assessment (Joseph, 2013), which uses input-output modelling to quantify the industry's impacts on GDP, investment, employment, and government revenues (see, for example, Bonakdarpour et al., 2014; Burt et al., 2012; Gibbons and Roach, 2010; Honarvar et al., 2011). Such studies are commonly cited by the provincial government (Alberta, 2014) and in the news media (e.g. CBC News, 2012, 2014). However, Economic Impact Assessment is completely unsuitable for determining allocative efficiency. It looks only at the gross benefits of development and does not include consideration of the costs, net benefits, or uncertainties (Joseph, 2013). In addition, because it reports total impacts to GDP and employment, it essentially treats the opportunity costs of resources as benefits rather than costs (Joseph, 2013).

Since a CBA was not conducted for the Jackpine expansion project, we do not know whether the project satisfies the criteria of efficient allocation. The fact that Shell proposed the project implies that they expect private construction and operating costs to be smaller than private benefits; however, a CBA would also need to consider the external social and environmental costs and benefits. These would include both the direct impacts of the project and the project's contribution to the cumulative impacts of bitumen development in the region. Other studies of the impacts of the bitumen industry suggest that a CBA would need to consider:

- Environmental damages including land disturbances², impacts on water quantity and quality from water withdrawals and release of chemicals, emissions of air pollutants³, adverse impacts on habitats and animal populations, production of wastes (tailings), and greenhouse gas emissions resulting in climate change (Foote, 2012; Gosselin et al., 2010; Grant et al., 2013; Homer-Dixon et al., 2015; Pasqualetti, 2009). Many of these impacts have not been assigned monetary values, though a handful of studies have examined the costs of greenhouse gas emissions from the oilsands (Sharpe et al., 2008; Shiell and Loney, 2007).
- Impacts on the abilities of Aboriginal people to pursue their traditional ways of life (Candler et al., 2010; Droitsch and Simieritsch, 2010; Vaux, 2010).
- Health impacts, such as possible increases in the rates of cancer and other illnesses in communities near the oilsands because of air and water contamination (McLachlan, 2014).
- Socio-economic impacts in local “boom-town” communities, including housing shortages and a rise in homelessness, pressure on transportation and other municipal infrastructure, gaps and

² Although land reclamation requirements are in place for all projects, the risk that reclamation will not be completed or that it will be insufficient to restore viable ecosystems, as well as the loss of ecological services and use value while the land remains disturbed, represent environmental costs. The JRP report states that some types of ecosystems affected, such as peatlands, cannot be reclaimed using current technology (Canada, 2013a).

³ Note that even if air and water emissions fall within regulatory guidelines, this does not necessarily mean that they cause no damage. Recent studies have shown, for example, that contaminants in the oilsands region are having measurable effects on both fish and birds (Hebert et al., 2013; Schwalb et al., 2015).

shortages in health care services, social services and child care, and issues of drug and alcohol abuse (Alberta, 2006).

- Government direct spending on the bitumen industry, including research and development, including research into carbon capture and storage, subsidies in the form of royalty and tax breaks, the costs of advertising campaigns in Alberta and elsewhere, and the costs of regulation and monitoring (McLeod-Kilmurray and Smith, 2010)
- The cost of the public infrastructure investments necessary to support both bitumen projects themselves and rapid residential growth in nearby communities such as Fort McMurray. For example, these have included costs for twinning the highway from Edmonton to the oilsands, expanding the Fort McMurray airport, and expanding health and social services.

The question of whether these costs exceed the economic benefits of the Jackpine project remains unanswered, since no CBA was conducted. However, a cautionary note is sounded by the one CBA that has been conducted for a bitumen project: an assessment of the Kearl bitumen mine, conducted as part of a doctoral thesis (Joseph, 2013). The Kearl mine was approved in 2008. Despite data gaps that mean the costs are probably underestimated, Joseph finds that the project results in a net *cost* to society of more than \$10 billion over its lifespan. Revenues of \$59.1 billion are more than offset by the total of project construction and operating costs (\$33.8 billion), government regulatory and infrastructure costs (\$350 million), user costs from the depletion of natural capital (\$300 million), and environmental costs (\$35 billion, of which \$34.2 billion is due to global climate change costs, valued at \$87.48/ton). The environmental costs included in this calculation include costs associated with air pollution, climate change, and the loss of ecosystem services from landscape disturbance. Costs associated with water consumption and water pollution are omitted due to lack of data (Joseph, 2013).

It is also worth noting that several studies have raised concerns about negative macroeconomic consequences of the bitumen industry, including the possibility that Canada may be suffering from Dutch disease, the risks of building an economy dependent on fossil fuel exports when global action on climate

change may reduce the demand for such fuels, the difficulty of conducting macroeconomic policy when inflation rates vary between Alberta and other regions of Canada, and volatility in government revenue streams resulting in fluctuations in the price of oil (Dobson et al., 2013; Clarke et al., 2013; Lemphers and Woynillowicz, 2012; Medas et al., 2013; Ryan, 2013). While these concerns would be very difficult to include in the CBA of a particular project, they serve as an additional reminder that the economic impacts of the industry are not all positive.

3.2 *Just distribution*

The criterion of just distribution suggests that decision-makers should consider how the benefits and costs of a bitumen project will be distributed among different people and generations. Equity can be defined in a number of ways, including access to economic opportunities, economic outcomes such as income or wealth, or the achievement of basic human rights.

There are only minimal attempts in the Jackpine documents to discuss the distributional impacts of the project. These are primarily focused on geography. Shell's SEIA breaks down construction and operating expenditures into the categories of region/Alberta/other Canada/outside Canada. The SEIA states that the company's policy is to provide employment and contracting opportunities to local workers and businesspeople, wherever possible (Shell Canada Limited, 2007, p. 8-233), and acknowledges local issues of housing affordability resulting from the influx of workers for the construction of this and other projects (p. 8-248).

However, neither Shell's documents nor the JRP report discuss the potential impacts of the Jackpine project on income distribution. This could, potentially, go either way. The project will provide both direct and induced employment, as well as government revenues that help to fund programs such as income assistance. However, one report suggests that the industry has had an overall negative impact on income distribution in Alberta because, even though oilpatch jobs tend to be well-paid, they account for a relatively low portion of the industry's output, while capital income accounts for a relatively large portion; capital income, in turn, tends to be highly unequally distributed (Clarke et al., 2013). An earlier

report written during Alberta's oilsands boom found that Alberta's strong per capita GDP growth did not raise average family incomes, again implying that the benefits disproportionately went into corporate profits. The report also found that the boom worsened the situation of the poor in Alberta, with a drastic increase in homelessness and falling real incomes for those working for minimum wage or on social assistance, neither of which kept up with high inflation rates caused by the boom (Gibson, 2007).

An additional distributional concern is that the negative impacts of Shell's Jackpine project may fall disproportionately on Aboriginal peoples. The Athabasca oilsands are located in a region with a high Aboriginal population, including several distinct First Nations and Metis groups. These groups have legal rights to pursue activities such as hunting, fishing and trapping on their traditional lands, which overlap with the Jackpine mine and other oilsands projects (Candler et al., 2010, Vaux, 2010). Some Aboriginal individuals and communities have certainly benefitted from economic opportunities associated with the oilsands, through job opportunities and contracts held by Aboriginal-owned companies. However, the JRP report states that the Jackpine project, combined with other projects in the area, will have "significant adverse cumulative effects on Aboriginal TLU [traditional land use], rights, and culture" due to its impact on land, resources, habitats and animals (Canada, 2013a, p. 7). It also finds that "the long-term and possibly irreversible nature of these effects has significant implications for the sustainability of traditional ecological knowledge, TLU practices, Aboriginal and treaty rights, and culture" (p. 8). In addition, a study found that Aboriginal people are at higher risk than others to contract illnesses resulting from contamination of the air, soil and water because they continue to eat country foods harvested in this region (McLachlan, 2014). The fact that several Aboriginal groups have filed legal challenges against various oilsands projects, including the Jackpine project (Athabasca Chipewyan First Nation, 2014; Droitsch and Simieritsch, 2010) suggests that they may not believe that the economic benefits are sufficient to justify the negative effects.

A third concern, not mentioned in the Jackpine JRP report, has to do with intergenerational equity. The citizens of Alberta are the owners of the bitumen that is mined. Royalties are meant to ensure that the owners of this resource receive a fair return from its extraction, and intergenerational equity

demands that future Albertans should also receive a share of this wealth.⁴ Norway, another major oil producer, collects over 80% of net oil revenues and places them into a public fund which ensures social programs will be maintained into the future (Campbell, 2013). Alberta, on the other hand, has collected only 9% of economic rent from the oilsands, on average, since 1997 (Campanella, 2012). Although Alberta has a fund similar to Norway's in place, it makes minimal contributions to this fund and has instead used petroleum revenues to replace other taxes, meaning future Albertans will see little benefit from the extraction of this non-renewable resource (Campbell, 2013).

3.3 *Sustainable macroeconomic scale*

A third policy goal is that of sustainable macroeconomic scale. This involves the recognition that the human economy fundamentally depends on the biosphere for both resource inputs and waste absorption, and that human activities must therefore not diminish the biosphere's capacity to support life over the long term (Costanza and Folke, 1997; Daly, 1992). The JRP report never explicitly mentions this concept; indeed, it is difficult to evaluate scale on the level of a specific project such as the Jackpine mine, since it is inherently an economy- and biosphere-wide goal. Any economic activity will have some impact on the biosphere; the question is whether the sum of impacts is within ecological limits. However, information from the report and other studies offer several reasons to be concerned about the project from this perspective, especially when considered together with other projects in the region.

First, the JRP report finds that the Jackpine project will result in the permanent loss of some types of ecosystems. While Shell is required to reclaim all land disturbed over the course of the project to "equivalent land capacity," some types of ecosystems cannot be restored to their original functions using current technology. In particular, there will be a permanent loss of wetlands, including peatlands and a unique lenticular fen, and the project will contribute to long-term and possibly irreversible loss of old-

⁴ One might also argue that future Albertans should have access to the bitumen itself, not only a pool of money, since future technologies could make the resource useful for purposes as yet unknown.

growth forest in the region (Canada, 2013a). As a result of this, there will be long-term, possibly irreversible losses of biodiversity in the region. The JRP recommended that the government consider requiring conservation offsets as one of its conditions for project approval, but the federal government did not include such a requirement in its decision statement (Canada, 2013b).⁵ Thus, the project will result in a permanent loss of the ecosystem services that would have come from these particular ecosystems.

Second, the report finds - based on Shell's own estimates - that the project will result in emissions of approximately 1.2 Mt of carbon dioxide equivalent per year. While the panel is satisfied that this level of emissions would be compliant with current regulatory standards, the report notes that it will "make it more difficult for Alberta and Canada to meet their GHG reduction targets" (Canada, 2013a, p. 51). This finding echoes broader concerns about the implications of the oilsands industry for climate change. A number of studies have found that if the international goal of limiting warming to two degrees above pre-industrial levels is to be met, the majority of Canada's bitumen deposits will need to stay in the ground (Lee and Ellis, 2013; Lemphers and Woynilowicz, 2012; McGlade and Ekins, 2015).

Third, the Jackpine project, like any other bitumen project, is based on the extraction of a non-renewable resource. Once upgraded and refined, the bitumen is used primarily for fuel and therefore cannot be recycled. Continuing to extract it for such consumptive uses is inherently unsustainable. This concern might be partially allayed if bitumen revenues were being used to fund the development of renewable energy sources, but there is little evidence to show that this is happening to any great extent. The 2014 Annual Report of Royal Dutch Shell, Shell Canada's parent company, reports that the company has investments in biofuel, but does not report any figures for the amounts invested. According to Statistics Canada, Canadian companies spent \$1.45 billion on research and development of fossil fuel energy sources in 2013, and only \$120 million on renewable energy sources.

⁵ A news report did note that Shell "has purchased about 730 hectares of former cattle pasture in northwestern Alberta to help compensate for 8,500 hectares of wetland that would be lost" (Sterritt, 2013).

Finally, researchers have identified serious gaps in our knowledge about the threshold and cumulative effects of the bitumen industry as a whole. Thresholds, according to ecologist Lee Foote, are “points in a continuum that represent irreversible or noteworthy changes in the human-resource relationship that manifest in ecological, social, or economic regime changes” (2012, p. 35). Establishing thresholds through advance planning could potentially offer one way to limit oilsands development to a level that is ecologically sustainable. However, Foote finds that, with respect to the oilsands, “scientific knowledge and operational techniques are weak or lacking for addressing a suite of impending resource constraints and ecological thresholds” and that usable standards are missing entirely, weak, or inconsistently applied (p. 35).

Similarly, the consideration of cumulative effects offers a way to look at the environmental impacts of the industry as a whole. This approach, according to a report by the federal Commissioner of the Environment and Sustainable Development (2011), considers not only the particular project under review, but the combined impacts of all past, present and future projects in a geographic area, taking into account the carrying capacity of the local ecosystems. The report found that there were significant gaps in the information necessary to assess the cumulative effects of oilsands projects. There has been some movement on this issue since that time. Shell’s Jackpine mine was the first project review that was required to include consideration of cumulative effects as part of its EIA (Chandler, 2014). In addition, the provincial government approved the Lower Athabasca Regional Plan, a framework which includes regional thresholds for air and water quality, in 2012. The plan, however, faced criticism on several environmental grounds (Pembina, 2012) and its associated Biodiversity Framework, promised for 2013, had not yet been released as of early 2017.

4. Conclusion and Recommendations

Given the gaps in the JRP’s analysis detailed above, it remains entirely possible that, rather than being in the public interest, Shell’s Jackpine project is instead an example of what Herman Daly calls “uneconomic growth.” This is growth where the negative results outweigh the positive, such that the end

result is a net loss of well-being (Daly, 2005). While the JRP tasked with reviewing Shell's project did establish that there will be economic benefits from the project, it also established that there will be significant adverse social and environmental impacts that cannot be mitigated. In weighing the evidence, the panel failed to consider the full range of the project's economic costs, leaving open the question of whether the project will be efficient, largely ignored the potential impacts on distribution, and omitted significant concerns about macroeconomic scale. Thus, from an economic perspective, the JRP's analysis – which presumably formed the basis for the provincial and federal approvals of the project – is simply inadequate to demonstrate that the Jackpine mine is in the public interest.

The Jackpine project is not an isolated example of a poorly-designed project or shoddy decision-making process. In its documentation and testimony, Shell repeatedly emphasized its use of the most up-to-date technology and its commitment to adaptive management. The project is expected to comply with all regulatory requirements, and its impacts are typical of this type of bitumen mine. The approval process, which took years to complete, was done in accordance with applicable legislation, invited public input and drew on expert testimony. The most notable change from previous project approvals, the requirement that the project include cumulative effects in its EIA, was a significant improvement. The unpalatable implication is that, supposing the Jackpine project to be a typical case, the federal and provincial governments may be regularly approving bitumen projects which have not been shown to be in the public interest.

Fortunately, there are several things that can be done to improve such analysis. One is relatively straightforward: requiring that a cost-benefit analysis be completed as part of every bitumen project application, alongside the EIA. CBA is by no means a perfect tool (Nyborg, 2014; van den Bergh, 2004; Wegner and Pascual, 2011). Besides the broader theoretical issues surrounding CBA and non-market valuation in general, analyses of bitumen projects will face several practical issues, including a lack of data, uncertainty about ecological impacts, and difficulties around attributing cumulative impacts to a particular project. Nevertheless, despite its limitations, CBA could improve decision-making by

increasing transparency and ensuring that decision-makers systematically consider both the benefits and costs of each project (Sunstein, 2014).

Distributional concerns highlight the need to ensure full consultation with Aboriginal groups during the approval process. Under the Canadian Constitution, the government has a duty to consult and accommodate First Nations when there is a possibility that their treaty or Aboriginal rights may be affected (Passelac-Ross and Potes, 2007). While consultation procedures are in place and Aboriginal groups also participate in public hearings on bitumen projects, many concerns have been raised about the adequacy of such consultation, and a number of legal challenges have been launched (Anaya, 2014; Droitsch and Siemeritsch, 2010; Passelac-Ross and Potes, 2007). The Jackpine mine expansion itself faced such a legal challenge (Athabasca Chipewyan First Nation, 2014). Ensuring that the adverse impacts of oilsands projects do not fall disproportionately on Aboriginal groups will require concentrated, good-faith efforts on the part of both government and industry to listen to and take Aboriginal concerns seriously. Impact Benefit Agreements, which are privately negotiated between companies and Aboriginal groups and typically involve monetary payments, may also help to address these concerns.

Efforts should also be made to analyze the impacts of the bitumen industry – and ideally of specific projects – on income distribution. Social Accounting Matrices (SAM) may offer a means to do this. SAMs are similar to the input-output modelling typically used to predict the economic impacts of the industry, but allow these impacts to be differentiated by socio-economic groupings of households (Round, 2003). A SAM has been constructed for Canada, using data from the year 2000 (Siddiqi and Salem, 2012), and it may be possible to use this tool to analyze the impacts of the bitumen industry if the necessary data can be obtained.

A handful of options are available to improve analysis of the bitumen industry with respect to macroeconomic scale. Input-output models can be expanded to account for environmental impacts, including both resource flows and wastes. This technique is called environmentally-extended input-output analysis (Kitzes, 2013). Natural capital accounting offers another way to record changes in resources and ecosystems over time. Since neither of these tools compare ecological impacts with carrying capacity,

they are not direct measures of scale, but they do provide fuller information than do current analyses. Another approach, ecological footprint analysis, offers a direct measure of macroeconomic scale. This method calculates the area of biologically productive land and water necessary to support economic activity and compares it with the area available (Wackernagel and Rees, 1997). Ecological footprints can be calculated for specific industries and projects. It should be possible to calculate the ecological footprint for a bitumen project and to compare this footprint with that of other projects, alternative energy sources, and/or alternative job- and revenue-generating industries. The difficulty with all these techniques, of course, is access to data. There is still a great deal of uncertainty regarding the magnitude and significance of the bitumen industry's ecological impacts, and this is compounded by the difficulty of attributing cumulative effects to a particular project. This issue calls for continued efforts on the part of government, industry and academic researchers to monitor and understand these impacts.

Carbon accounting can be used to analyze bitumen projects with respect to one particular scale impact, greenhouse gas emissions. Such analysis has already been conducted, in fact, and the authors concluded that 85% of current reserves of Canadian bitumen will have to remain in the ground in order to limit average global temperature increases to 2°C above pre-industrial temperatures (McGlade and Ekins, 2015). This study projected a complete end to open-pit bitumen mining after 2020, and only limited in-situ extraction in conjunction with greatly expanded carbon capture and storage. Canadian decision-makers will need to seriously consider the implications of these findings for new project approvals.

Since oil prices began dropping in 2014, bitumen investment in Alberta has slowed down significantly. Because bitumen production costs are relatively high, compared to conventional oil sources, bitumen projects are unprofitable when oil prices are low. While most existing operations have continued production, and construction has continued on projects that were already begun, new applications have slowed to a trickle. However, in its most recent World Energy Outlook, the International Energy Agency (2016) forecasts that oil prices will rise above \$120/barrel by 2035, as oil demand continues to increase, OPEC continues to restrict production, and declines in conventional oil sources cause producers to shift to more expensive sources. Anticipating that the oilsands will remain economically viable well into the

future, the Canadian government recently approved two new pipelines intended to transport oil from the oilsands to global markets. In sum, it is far too soon to assume that the bitumen industry is coming to an end; concerns about bitumen project approvals thus remain relevant. It is worth noting that the current low oil prices make it less likely that a project would be found to be efficient on the basis of a CBA, even if it remains privately profitable.

Given the lack of evidence regarding whether the benefits of a project exceed its costs, how those benefits and costs are distributed, and the effects with respect to macroeconomic scale, it is irresponsible for decision-makers to continue approving bitumen projects on the basis of their economic benefits. It is especially irresponsible given that at least some of this information could be obtained relatively easily, through well-established techniques such as cost-benefit analysis. Evidence alone is not sufficient to ensure that good policy decisions will be made, of course, but it is nevertheless necessary. For the public to trust that their elected representatives are making good decisions on their behalf, they need to be assured that decision-makers are drawing on solid and comprehensive evidence regarding the pros and cons of the choice. We have seen that with respect to decisions regarding bitumen developments in Alberta at present, this is not the case. The steps that have been outlined here would go a long way toward improving such decision-making.

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