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ENABLING PARTIAL UPGRADING IN ALBERTA: A REVIEW OF THE REGULATORY FRAMEWORK AND OPPORTUNITIES FOR IMPROVEMENT*

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EXECUTIVE SUMMARY

One of the ways that Alberta can help alleviate its worsening bottleneck in oil-export pipelines is by partially upgrading oil sands bitumen before shipping it to market. Partial upgrading is the process of upgrading raw bitumen into a higher-value, lower-viscosity crude oil, resulting in an oil that can flow more easily through pipelines but stopping short of a fully upgraded synthetic crude oil product. In-province partial upgrading of bitumen can deliver important benefits to Alberta's economy. Compared to raw bitumen, partially upgraded bitumen is (1) less costly to refine and therefore commands a higher price; (2) transported directly via pipeline with reduced (or no) diluting agents, avoiding the need to purchase costly condensate for blending; and (3) less viscous and thus, per barrel of bitumen, requires less pipeline capacity compared to raw bitumen, which ships with a high volume of blended condensate. Because of these factors, partial upgrading would allow the province to ship more bitumen via existing pipelines and at the lower tolls per barrel of bitumen extracted.

The Alberta government has recognized these potential benefits and the subsequent value of developing partial upgrading capacity in the province. The province's own legislative and regulatory regimes, however, may be barriers to

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that happening. The province features an environment of regulatory uncertainty that may be too much for partial upgrading proponents to tolerate, and if the provincial government wants to see investors back partial upgrading projects in Alberta, it should take steps to clarify and modernize the regulatory framework.

This study reviews the existing regulatory framework governing partial upgrading in Alberta, identifying opportunities to better facilitate implementation of partial upgrading at scale. We find that a partial upgrader would be treated as an oil sands processing plant, but the lack of formal delineation between types of processing plants creates ambiguity and potential inefficiencies. Other gaps and sources of uncertainty are not unique to partial upgrading projects, but are of special importance to these projects due to timing, the newness of the technology, and the shifting environmental regulation context in Alberta and Canada in general. We find the key causes of regulatory uncertainty faced by partial upgrader proponents to be: (1) lack of explicit definition of partial upgrading under law; (2) unpredictable regulatory review and approval timelines; (3) application of regional cumulative effects measurement and management strategies; and (4) competing climate policy and hydrocarbon-resource conservation policy objectives.

If Alberta's government wants to see partial upgrading come forward as a way to bolster the provincial economy and alleviate the oil-pipeline bottleneck, it will need to get its own regulatory roadblocks out of the way.

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INTRODUCTION

Alberta's oil sands resources face market access constraints; investors, industry leaders and policymakers are looking to in-province "value-added"[1] processing as a solution. Partially upgrading bitumen, especially, has the potential to create new markets for Alberta oil while improving pipeline capacity for all producers and offering significant social and economic benefits to Alberta and Canada as a whole (Alberta Energy 2016; Fellows et al. 2017; Energy Diversification Advisory Committee 2018).

As of October 2019, several emerging bitumen partial-upgrading technologies have been field-tested as pilot and demonstration plants in Alberta, but a commercial-scale facility with associated production of marketable volumes of partially upgraded bitumen is not yet operational.[2] Despite large potential public and private benefits from commercial-scale partial upgrading in Alberta (Fellows et al. 2017), proponents face substantial issues in overcoming the "death valley problem," where firms are unwilling or unable to endure the lengthy sustained negative cash flows associated with expensive commercial investments to de-risk and prove-up a new technology and the associated uncertainty and potential delays caused by the regulatory process. To alleviate this problem, in June 2018 the Government of Alberta passed the Energy Diversification Act, which enabled the province to invest $1 billion in partial-upgrading capacity under the Petroleum Marketing Act (2000) (Province of Alberta 2018).[3] In addition to fiscal-support tools like those implemented via the Energy Diversification Act, however, there is the opportunity to de-risk investment by increasing certainty and mitigating uncertainty within Alberta's existing regulatory regime.

Regulatory uncertainty increases costs to a firm, deters investment, and hinders uptake of new and potentially promising technologies.[4] As a new approach to bitumen processing, partial upgrading does not fit neatly into existing regulatory processes and rules. This is compounded by the experimental nature of some of the proposed technologies, where the capital to support a potentially uncertain regulatory process is lacking. We review existing regulatory regimes to answer the question: *how would a commercial-scale partial upgrader be regulated in Alberta and are there gaps or areas of uncertainty in the regulatory framework?* Our work is relevant for policymakers, project proponents and regulators. In addition to its policy relevance, this paper is the first to

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1 We note that the colloquial use of the term "value-added" (turning raw resources into finished goods) does not reflect the true meaning (income generated through economic activity). For more, see Tombe (2015). Our use of the term reflects the policy context and colloquial usage, as it is a term frequently used by the Government of Alberta.

2 As of October 2019, the Value Chain Solutions – Heartland Complex (VCS-H), operated by Value Creation Inc., is the only commercial-scale partial upgrading facility that has received regulatory approval in Alberta. The Heartland Complex is a mixed-purpose facility that includes a bitumen partial upgrading component to produce a medium synthetic crude oil and a refining component to produce an ultra-low-sulphur diesel, defined as a "merchant crude customization and clean oil refinery." Facility construction has begun but operation has not.

3 In October 2019, the Government of Alberta cancelled the Partial Upgrading Program, citing grants and loan guarantees carrying higher financial risk (Government of Alberta 2019c).

4 As articulated by Fellows and Hollis (2013), pre-approval costs carry more risk and therefore investors demand a higher expected return. As approval becomes more uncertain, the cost of pre-approval capital increases, since any approved projects have to pay for pre-approval costs incurred by failed ones.

examine how partial upgrading will be regulated in Alberta, an intellectual contribution to current understanding of Alberta's regulatory processes.

We provide an overview of the current Alberta and federal regulatory regimes governing the construction and operation of a commercial-scale bitumen partial-upgrading facility, identify gaps and areas of uncertainty, and discuss opportunities to better facilitate implementation of partial upgrading at scale (we take as given the policy direction to increase partial upgrading in the province).[5,6] We assume that a partial-upgrading facility would be treated as an oil sands processing plant under existing Alberta and federal law. Our review includes provincial and federal legislative acts, regulations, directives and other legal instruments, and is limited to the rules applicable to non-experimental projects.[7] We also examine decisions on project-approval applications for comparable facilities (for example, upgrading facilities and refineries) to understand how regulatory authorities have applied and interpreted relevant law.

We find there are several gaps and sources of uncertainty in Alberta's regulatory framework that may hinder broader implementation of partial upgrading at scale. First, and most easily addressed, is that partial upgrading is not delineated in current law. This creates inconsistency in how regulators and policymakers assess which laws apply and how the laws are interpreted. Other gaps and sources of uncertainty are not unique to partial upgrading, but these features of Alberta's regulatory system are likely to pose challenges to partial-upgrading project proponents. First, most partial-upgrading methods involve deployment of new technologies or existing technology in novel ways. There is increased regulatory risk on the proponent of any new technology, which decreases in the familiarity of the regulator with the technology. Earlier proponents of partial upgrading in Alberta will bear the burden of "testing" the regulatory process and are likely to face longer application processing timelines and more stringent review until the requisite familiarity is gained.

Second, and related, partial upgrading in Alberta does not have a fit-for-purpose regulatory process. By definition, partial upgrading is a less intensive process than full upgrading. Although the environmental footprints of partial-upgrading projects can vary and are ultimately dependent on the size of facility and the technology applied, many advanced partial-upgrading methods show potential for achieving lower environmental

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5 While the government's Partial Upgrading Program is now cancelled, the government has indicated a continued desire for diversification within the province. Moreover, our analysis is relevant for future government policy affecting partial upgrading.

6 We do not consider the construction and operation of pipelines outside of the facility boundary. Our analysis of pipeline regulations only includes ensuring that the product meets pipeline specifications.

7 Our purpose is to identify regulatory gaps and opportunities for accelerated implementation of bitumen partial upgrading at scale, and so our focus is on regulations governing commercial, "non-experimental" projects designed for commercial purposes and using proven methods, as opposed to pilot or demonstration "experimental" projects. We define a commercial-scale partial-upgrading facility as one that meets technology-readiness level (TRL) 8 or higher on the scale used by the Alberta Partial Upgrading Program: "TRL 8: Actual system completed and qualified through tests and demonstration in an operational environment. Operational and mechanical availability better defined; TRL 9: Actual system proven through successful deployment in operational setting. Commercial risks mitigated sufficiently for financing to occur; TRL 10: Wide scale deployment. Capital, operational and market risks understood and defined." (Alberta Energy 2018).

footprints compared to the benchmark of full upgrading using delayed coking, in terms of emissions, energy use, waste and byproducts (Keesom and Gieseman 2018). Within existing technologies, there is a wide range of processing intensity, and all will be subject to the regulatory framework for processing plants. This framework was designed to regulate large-scale and high-environmental-footprint projects. Without adjusting scale provisions, lower-impact methods that show promise may be over-regulated.

Third, the cumulative nature of economic development poses inherent challenges to new projects. Environmental limits and social acceptance define the operating context for project proponents, regulators and policymakers. Likely locations for partial upgrading are areas with specific limits to additional development, such as regional ambient air-quality limits, which are becoming increasingly important in project approvals. The risk to partial upgrading proponents (and Albertans) is that lower-value projects will be approved, while partial upgrading will be crowded out due to delays in proving the methods as viable. A corroborating risk is that the environmental health of the surrounding area will be compromised to achieve the policy objectives of increased oil sands processing.

Finally, proponents of partial upgrading will be subject to greenhouse gas emissions regulations for all oil sands activity. This regulatory and policy space is evolving, which is a source of uncertainty for all project proponents, but an especial source of risk for new technologies.

This paper proceeds as follows. We briefly review the operating context for partial upgrading in Alberta, including expected types of facilities. Second, we exhaustively review guiding legislation, responsible authorities, and the applicable regulatory approval processes. We summarize and illustrate the regulatory approval process for two partial upgrading scenarios: an expansion of an existing in situ field project and development of a new, standalone central facility. Based on our review of the regulatory framework, we describe gaps and sources of uncertainty in the regulation of partial upgrading and identify opportunities to address these concerns. Finally, we conclude with discussing opportunities for regulators and policymakers to support the implementation of partial upgrading at scale.

BACKGROUND AND CONTEXT

Despite strong government support for partial upgrading, this approach to processing bitumen is still nascent and may be unfamiliar to readers. Here, we provide a brief overview of partial upgrading and how it may be implemented in Alberta; readers familiar with bitumen processing and partial upgrading in particular may wish to skip this section and proceed to our review of the current regulatory framework.

DEFINING BITUMEN PARTIAL UPGRADING

Crude bitumen, the unconventional petroleum resource found in Alberta's oil sands, is too viscous and dense to flow through pipelines without processing or dilution. Processing options include full or partial upgrading. Full upgrading transforms bitumen into a product that requires no diluent in order to flow through pipelines (synthetic crude oil or SCO), while partial upgrading results in a product able to meet pipeline specifications with no or reduced diluent addition. In 2017, about 42 per cent or 1.2 million barrels per day (bbl/day) of crude bitumen produced in Alberta was upgraded into a synthetic crude oil before being exported to downstream refineries (Government of Alberta 2018). While there are four full upgraders currently operating in Alberta, there are no plans for additional full upgraders. This is largely a function of high capital costs, significant heavy-oil refining capacity in the United States, and steeply rising light crude oil production in North America (resulting in a highly competitive market for SCO); all these factors severely reduce the economic viability of new upgraders in Alberta.

As an alternative to full upgrading, new technologies for partially upgrading bitumen have emerged, which present alternative opportunities for getting bitumen products to market. Partial upgrading transforms bitumen into a product resembling a medium or heavy crude oil. Accordingly, several partial upgrading technologies allow the upgraded product to flow through a pipeline without added diluent. Partially upgraded bitumen is also a more marketable product, as the heaviest carbon molecules have been broken down and the resulting medium or heavy crude oil is easier for refineries to process.

Bitumen partial upgrading is not explicitly defined in Alberta or federal law. However, the Government of Alberta's 2018 Alberta Partial Upgrading Program provides a definition, which we use:

- Partial upgrading: "a process that reduces the thickness of oil sands bitumen so it can flow through pipelines more easily, without having to be blended with as much diluent, a thinning agent" (Alberta Energy 2018).
- Partial-upgrading facility (partial upgrader): "a facility that consumes feedstock containing bitumen and produces a partially upgraded product that reduces the need for diluent addition; reduces, eliminates or converts vacuum bottoms quantity and/or quality; increases the refining value of the product produced" (Alberta Energy 2018).

TECHNOLOGY APPROACHES AND METHODS

In current partial upgrading methods, four main technology approaches are used to achieve the reduction in viscosity and density required: the addition of diluent (diluting); cracking of large molecules into smaller molecules (cracking); removal of large molecules (deasphalting); and reduction of density through the addition of hydrogen, which occurs only in combination with cracking (hydrogen addition); or the removal of sulphur (sulphur removal) (Keesom and Gieseman 2018). A given method will commonly use a combination of one or more of these approaches.

All current methods require hydrocarbon fuels as energy inputs — usually natural gas and mixed hydrocarbon gases — and produce air pollutants, including greenhouse gas emissions, as a result. The feedstock is crude bitumen and, in addition to the intended partially-upgraded crude oil product, all methods produce some form of byproduct as well. Common byproducts are petroleum coke (from cracking), asphaltenes (from deasphalting) and sulphur (from sulphur removal).

A 2018 white paper prepared by Bill Keesom and John Gieseman at Jacobs Consultancy Canada Inc. explored the market readiness of bitumen partial upgrading technologies and found two main potential pathways for partial upgrading: (1) mild thermal cracking, with or without enhancements such as fluid-mechanical manipulation or addition of other crude oil fractions; and (2) mild thermal cracking in combination with partial asphaltene rejection (Keesom and Gieseman 2018). Thermal conversion (cracking) is common to all promising methods due to its low cost. Mild cracking does not produce coke, which is an additional criterion Keesom and Gieseman use in evaluating technologies. Other criteria are: ability to meet partial upgrading specifications; over-conversion that exceeds partial upgrading specifications; excessive greenhouse gas emissions; production of large amounts of low-value or unwanted byproducts; and degree of current development.

POTENTIAL TYPES OF FACILITIES

There are three likely profiles for a commercial-scale partial-upgrading facility in Alberta:

- **Type 1: Incorporated into an in situ oil sands project in a designated oil sands area.** The partial-upgrading facility would be a field operation and part of a steam-assisted gravity drainage (SAGD) in situ oil sands project. The facility may be an add-on to a SAGD central processing facility or midstream infrastructure ("bolt-on"), or located at the SAGD site and integrated with water treatment and steam generation ("SAGD-integrated").
- **Type 2: A central, standalone facility in an industrially zoned area.** The facility would be a merchant facility (e.g., collect product from multiple SAGD fields), on a new site that does not have any pre-existing facilities. Such a facility would likely be located in an industrially zoned area with established utility and pipeline connectivity and where other developments are already occurring, for example Alberta's Industrial Heartland or the Hardisty hub. In this paper we assume Alberta's Industrial Heartland (AIH) as the most likely location for a Type 2

merchant facility.[8] Type 2 facilities in Hardisty or other townships with similar development profiles would face similar challenges and opportunities.

- **Type 3: A central, standalone facility in a non-industrially zoned area, including the oil sands area.** The facility characteristics would be the same as Type 2, but the facility would not be located in an industrial area. For three reasons, we have determined that this case is not likely and, as such, have excluded this type of facility from our analysis. First, the business case is weak. There are substantial economic benefits to siting a merchant facility in an industrial area such as the AIH or Hardisty, as economies of scale become possible (for example, providing access to infrastructure required for transport of inputs and outputs). Second, there would be significant regulatory hurdles to overcome. As we discuss later, the regulatory approval process favours projects that align with the surrounding area's intended land use as set out in land-use zoning regulations — in this case, the project type (industrial) and land-use zone (non-industrial) would conflict. A central facility would likely have a larger footprint than a SAGD-integrated project, and pose greater potential impacts across a wider area. Third, and related to the second point, more comprehensive stakeholder involvement would be needed, which is an additional barrier to project approval, especially in a non-industrial area where homeowners and residents are directly impacted.

REVIEW OF THE REGULATORY FRAMEWORK

- In order to understand the regulatory opportunities and challenges a project proponent of a partial upgrader faces, it is useful to review Alberta's current regulatory framework. This includes the relevant legislation and its purpose; the responsible federal, provincial and local government authorities; and regulatory approval processes. Specifically, a bitumen partial-upgrading facility would be considered an oil sands processing plant under Alberta law, and its regulatory playing field defined by the rules and regulations applicable to oil sands processing plants.[9],[10] With an understanding of Alberta's regulatory framework

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8 Alberta's Industrial Heartland is a joint land-use planning and development initiative between the City of Fort Saskatchewan, Lamont County, Strathcona County, Sturgeon County and the City of Edmonton. It is an area of over 530 square kilometres dedicated to industrial activity with a focus on petrochemical, chemical and oil and gas industrial facilities.

9 Under the Oil Sands Conservation Act (2000), a partial-upgrading facility would be considered a "processing plant," which is defined as including "a facility for obtaining oil sands products from oil sands, crude bitumen, de-asphalted bitumen or synthetic crude oil" (Province of Alberta 2000c). Under the Environmental Protection and Enhancement Act (2003), as per the Activities Designation Regulation, a partial-upgrading facility would be an "oil sands processing plant," defined as "a plant for (ii) the extraction from crude bitumen of crude oil, natural gas and other substances" (Province of Alberta 2003a). We discuss how partial upgrading may be classified under existing law below.

10 Under the Environmental Protection and Enhancement Act Activities Designation Regulation (2003), a bitumen partial-upgrading facility that uses in situ technology would be classified as an "enhanced recovery in-situ oil sands or heavy oil processing plant," and not an oil sands processing plant (Province of Alberta 2003a). In situ partial-upgrading approaches are not included in the scope of this study for the following reasons: the technology is not sufficiently mature at the time of publication, the increase in API value is modest and not well quantified, and the applicable regulatory regime would likely differ significantly from surface technologies.

for oil sands processing plants, detailed below, we can then discuss gaps and areas of regulatory uncertainty in the subsequent section.

GUIDING LEGISLATION

The rules governing oil sands projects are largely derived from three pillars of overarching legislation: guiding energy resource development enactments, especially the Oil Sands Conservation Act (2000) (OSCA) and the Oil and Gas Conservation Act (2000) (OGCA); the Environmental Protection and Enhancement Act (2000) (EPEA); and the Climate Change and Emissions Management Act (2003) (CCEMA).

Both OSCA and OGCA exist to support the same general purposes:

- resource conservation and waste prevention (where "resources" are oil sands or oil and gas resources);
- economical development in the public interest of the resource;
- pollution control;
- safe and efficient resource development practices; and
- monitoring and reporting.

Each act provides provisions pursuant to these purposes and is accompanied by a set of regulations: the Oil Sands Conservation Rules (2000) (OSCR) and the Oil and Gas Conservation Rules (2000). The OGCA regime applies to all oil and gas activities in Alberta, whereas OSCA applies to only those involving the exploration or development of bitumen oil sands. Approval under OSCA is required for the construction and operation of an oil sands processing plant, e.g., a partial-upgrading facility.

EPEA equally applies, and a partial-upgrader proponent would require a separate approval under the EPEA regime, administered by the Alberta Energy Regulator (AER) (AER 2019b). EPEA lays out a wide range of provisions intended to support and promote the protection, enhancement and wise use of the environment, while recognizing a variety of factors, including the need for Alberta's economic growth and prosperity in an environmentally responsible manner and the need to integrate environmental protection and economic decisions in the earliest stages of planning (Province of Alberta 2000a, Section 2). Key principles incorporated into EPEA include sustainable development, cumulative effects measurement and the polluter-pays principle. Approval under EPEA is required for any activity that involves the release of substances that causes or may cause an adverse effect, where "activity" includes the construction, operation or reclamation of a plant, structure or thing for the manufacture or processing of petroleum products, and the processing of coal, heavy oil, oil sands or minerals (Province of Alberta 2000a, Schedule of Activities (a) and (k)).

The third pillar of the legal framework governing partial upgrading and oil sands development in general is the Climate Change and Emissions Management Act (2003) (CCEMA). The Act, along with the 2007 Climate Change and Emissions Management Amendment Act, is based on the general principles of sustainable economic development, environmental protection and stewardship, and life-cycle greenhouse gas emissions management. CCEMA legislates an intensity-based greenhouse gas

emissions-reduction target, requires facilities with emissions above certain limits to report their emissions, and grants the provincial cabinet authority to regulate emissions and offsets (Province of Alberta 2003b). The Act is supported by a set of regulations; most important for partial upgrading is the Carbon Competitiveness Incentive Regulation 2017 (CCIR).[11] The CCEMA regime impacts the regulation of a partial-upgrading facility as it relates to greenhouse gas ("specified gas") emissions.

RESPONSIBLE AUTHORITIES

Here, we briefly discuss the most relevant authorities related to the regulation of partial upgrading in Alberta.

Federal

Federal agencies such as the Impact Assessment Agency of Canada, Environment and Climate Change Canada, the Canadian Energy Regulator and Fisheries and Oceans Canada may have jurisdiction over oil sands activities. The Impact Assessment Act (2019) (IAA) established the Impact Assessment Agency of Canada (IAAC) as the body responsible for co-ordinating the federal environmental-assessment process and determining what other federal bodies may need to be involved (House of Commons of Canada 2019). The involvement of federal regulatory agencies in a review of a project is required if (1) the project is listed as a "designated activity" in the Physical Activities Regulations (2019); or (2) the responsible Minister designates the project as a physical activity requiring federal review, based on its potential to cause adverse effects within federal jurisdiction — the definition of which we discuss later in this paper (House of Commons of Canada 2019).

Otherwise, the AER (or other provincial regulatory agency or responsible provincial Minister, depending on the type of activity proposed) may at any time request a federal government review of a project (Province of Alberta 2000a, Section 10; Province of Alberta 2012, Section 18). If federal jurisdiction applies, the responsible Minister may decide that project assessment should be undertaken by a review panel jointly established between two jurisdictions or two federal agencies, if he or she believes it is in the public interest to do so (House of Commons of Canada 2019).

Provincial

Alberta Energy Regulator

The Alberta Energy Regulator (AER) is the regulatory agency responsible for petroleum-based energy resource development activities in Alberta, including oil and gas processing plants and upgrading facilities, as delegated through the Responsible Energy Development Act (2012) (REDA) (Province of Alberta 2012). The AER is responsible for applying and enforcing all legislation specific to petroleum-based energy resource development (OSCA, OGCA), as well as related provisions under other

[11] As of October 2019, this regulation is under review by the Government of Alberta.

applicable legislation ("specified enactments") to these activities. Specified enactments include EPEA, the Public Lands Act, the Water Act, and Part 8 of the Mine and Minerals Act (Province of Alberta 2012).

As set out in REDA Section 2(1), the AER's mandate is twofold:

> (a) to provide for the efficient, safe, orderly, and environmentally responsible development of energy resources in Alberta; and
>
> (b) in respect of energy resource activities, to regulate the disposition and management of public lands, the protection of the environment, and the conservation and management of water, including the wise allocation and use of water, in accordance with energy resource enactments and in accordance with specified enactments.

The AER is the primary authority responsible for regulating a partial-upgrading facility over its full life-cycle — e.g., it grants approvals and monitors and enforces applicable rules, from application to reclamation.

Provincial Ministries

Alberta Environment and Parks (AEP) is the ministry responsible for setting policy relating to land use and the impact of energy resource development on the environment. AEP is also the authority responsible for regulating some energy-related activities that fall outside of the AER's purview, including oil refineries, power plants and alternative-energy plants (AER 2019b). Depending on facility characteristics, some partial-upgrader proponents may need to get approval from AEP directly for project activities; for example, activities falling under the CCEMA regime (AER 2014).

Alberta Energy is the government ministry responsible for setting policy relating to the stewardship and responsible development of energy and mineral resources (Alberta Government 2018). Alberta Energy is ultimately responsible for the management of energy and mineral resources in the province, and has the authority to grant approvals for access to energy resources and minerals rights. As such, the ministry is involved in the regulatory process for upstream oil sands recovery schemes, but not midstream or downstream operations such as processing plants.

As policy development and implementation bodies, both AEP and Alberta Energy, along with other relevant ministries, are involved in determining the regulatory environment within which oil sands projects operate. The AER may work directly with AEP and Alberta Energy for policy direction and interpretation guidance.

Executive Council of Alberta

The Executive Council of Alberta (the provincial cabinet; referred to as the "Lieutenant Governor in Council" in law) has the authority to set rules and regulations governing the AER and oil sands operations in general, as specifically provided for in enactments. The cabinet may also be directly involved in authorizing approvals for oil sands projects, depending on project characteristics (discussed below). In any case, the AER or AEP

may invite the cabinet into the process to review the suitability of the project under EPEA (Province of Alberta 2000a, Section 54.2). For non-experimental oil sands processing plants where the total quantity of energy in the oil sands, crude bitumen, or derivatives of crude bitumen recovered in any year is over 5 petajoules (roughly 816,993 barrels of oil equivalent (BOE) or 2,238 BOE/day), cabinet authorization is required (Province of Alberta 2000c, Section 11.5(b)). Importantly, the cabinet ultimately has the authority to overturn an approval decision.

Other Provincial Regulatory Bodies of Note

The Alberta Land Use Secretariat (LUS) regulates activities prescribed by the Alberta Land Stewardship Act (2009), which governs regional-plan development and implementation (Province of Alberta 2009). The LUS operates independently of a government department and its role is to support effective regional land use and development in Alberta, including to ensure the use of regional plans and cumulative effects assessments as tools for land-use management in Alberta (Province of Alberta 2009). If a proposed development, including a partial upgrader, falls within the boundaries of an approved regional plan, the activity must align with the objectives of the plan and comply with its regulatory instruments. In the case of a proposed oil sands project, the AER first determines whether the project meets these criteria. The involvement of the LUS only becomes necessary if the AER determines that the project does not meet the regional-plan requirements and the project proponent chooses to apply directly to Alberta's Land Use Secretariat for relief or adjustment of the plan (Province of Alberta 2009; AER 2013).

The Government of Alberta's Aboriginal Consultation Office (ACO) also plays a role in approval of oil sands projects. The ACO is administered by the Ministry of Aboriginal Relations and its role is to provide consultation-management services to meet the needs of government ministries, First Nations, the AER and project proponents (Government of Alberta 2014).[12] The AER has no jurisdiction with respect to assessing the adequacy of Crown consultations associated with the rights of Indigenous Peoples (Province of Alberta 2012, Section 21). Instead, the ACO provides this function in proceedings before the AER and has the authority to determine whether the "duty to consult" common-law obligation is triggered. Under provincial ministerial order, the AER is required to request advice from the ACO prior to making a decision on a project application for which Indigenous consultation is required, and the two agencies must work together to produce joint operating procedures related to consultation (Alberta Government 2014; 2016). Likewise, the AER is not able to issue approvals under specified enactments unless the ACO has deemed consultation to be adequate.

[12] The ACO has a broader mandate than consultation-management services for the AER; however, we restrict ourselves to its relevance to oil sands processing plants in this section, which are regulated by the AER.

Local

The Municipal Government Act (2000) governs planning on private land; municipal government agencies are responsible for local land-use planning and development of private lands within their boundaries. The project area of an oil sands project determines which municipality or other local authorities have jurisdiction over the project. For an oil sands processing plant, the project area is defined as the boundaries within which surface development may occur over the life of the project (AER 2013). In general, permits and approvals relating to land-use development are handled at the municipal level. Local authorities set bylaws and determine land-use zoning regulations including the municipal tax rate, fees and permits to be applied to projects. They also play a role in developing local and regional plans that determine land-use priorities and requirements. A project's degree of alignment with local zoning and land-use priorities is considered in the application review process (Province of Alberta 2000a).

REGULATORY APPROVAL PROCESS

Overview

In general, a proponent of any type of commercial oil sands project is required to obtain AER approval under energy resource enactments and specified enactments, as well as local authority approval under the Municipal Government Act (e.g., building and development permits). For construction and operation of an oil sands processing plant, AER approval is required under OSCA Section 11 and EPEA Section 60 (Province of Alberta 2000a; 2000c; 2003a).

The AER is responsible for administering the approval-application process for all energy resource development activities (Province of Alberta 2012, Section 2.2). The agency is responsible for assessing project applications against enactment provisions, and may subsequently refuse or grant approval, or defer to a later time consideration of the application based on any terms and conditions it sets.[13] The AER also has the authority to make any inquiries and hold any hearings it considers necessary or desirable to assess an application (Province of Alberta 2000c, Section 11).

The AER provides commercial-scheme approval for which terms and duration are determined on a case-by-case basis, as well as approvals under four relevant legislative acts: OSCA, EPEA, the Public Lands Act and the Water Act. We focus on AER commercial-scheme approval and OSCA and EPEA approvals in this section, as they have especially interesting implications for partial upgrading. The application process for commercial-scheme approval is described in AER Directive 023; for OSCA approval, in OSCA Sections 10, 11 and 13; and for EPEA approval, in EPEA Division 2 and the EPEA

13 As discussed earlier, provincial cabinet approval is required for a commercial processing plant that obtains more than 5 petajoules of oil sands products in one year, which is about 820,000 BOE or 2,200 BOE/day (Province of Alberta 2000c, Section 11.5(b)). Regardless of scheme size, however, cabinet approval is never required for an amendment to an existing project approval, although the regulator may invite cabinet review. These terms are laid out in Section 13 of the OSCA, "Amendment of Approvals," and their implications are discussed further, below.

Approvals and Registration Procedure Regulation (Province of Alberta 1993a).

Simplified, the regulatory approval application and review process is as follows:

1. **Application**: Application to the AER for relevant approvals under energy resource enactments and specified enactments.
2. **Initial application review by the AER**
3. **Public notice of application**: Once the AER determines the application requirements have been met, the agency may issue a "Notice of Application" to publicly announce that the application is before it.
4. **Statement of concern intake, review and participation decisions**:[14] Once the Notice of Application is posted, the application is opened up to objections from the public, known as "statements of concern" (SOCs). The AER considers or rejects these SOCs based on the criteria laid out in the Alberta Energy Regulator Rules of Practice (2013) (discussed in detail, below).
5. **Detailed AER application review**
6. **Interrogatories:** Supplemental information requests (SIRs, or "interrogatories") made by the AER, if necessary.
7. **Public hearing (if necessary):** If the AER determines that one or more SOCs have standing and they are not able to be resolved, the application may be set down for a public hearing by the AER, in which case a Notice of Hearing is issued.
8. **Decision by the AER**
9. **Request to appeal decision:** Decisions are only appealable if they were made without involvement of a public hearing (Province of Alberta 2012, Section 36).

The process described above is not linear. There may be multiple back-and-forths between the proponent and the AER; for example, where the AER requests subsequent interrogatories. These are known as "time-outs," as the clock on the application review process is paused when an interrogatory is in the proponent's hands. Similarly, objectors may submit a request to appeal an AER participation decision, requiring iterations of Step 4 (AER 2013).

As of July 2019, multiple applications are required for project activities falling under different regulations. Applications for potable-water use and treatment are submitted to AEP; applications for licences or approvals under the Water Act must be submitted separately to the AER through the OneStop portal; and approvals for activities falling under the CCEMA must go through AEP (AER 2014). The AER is currently piloting a

14 The statement of concern intake is not required for specific types of applications as described under the AER's Rules of Practice (2013) Section 5.2(2) (Province of Alberta 2013a). These include applications that the AER decides have minimal or no adverse effect on the environment; routine applications under Directive 56; and certain kinds of licences and licence amendments under the Water Act. We do not expect a project approval for a partial-upgrading facility to be categorized under these exceptions.

new integrated-decision approach that would provide one application process for all of the approvals needed for an oil sands project under all applicable provincial-level enactments (AER 2019b). AER-led efforts to streamline the process, such as through its integrated-decision approach and OneStop online tool, only apply to decisions under the AER's jurisdiction and regulatory purview, however, and therefore may not address all applications and project reviews that a proposed new partial upgrader is subject to. AER-co-ordinated reviews of environmental-impact assessments (EIAs), for example, may require external reviewers to address non-AER concerns and add additional time to the application cycle.

Guiding Principles for Project Approvals

The REDA General Regulation outlines the broad factors the AER must take in to account when determining whether to grant approval for a project (Province of Alberta 2013b, Section 3). These factors are:

- the social and economic effects of the energy resource activity;
- the effects of the energy resource activity on the environment; and
- the impacts on a landowner as a result of the use of the land on which the energy resource activity is or will be located.

When assessing these effects and impacts, the AER evaluates proposed projects on (1) their ability to meet provisions under the relevant enactments[15] and (2) the spatial and temporal context (Province of Alberta 2012, Section 15; AER 2014).[16] Proponents of projects with a larger potential footprint, for example, are required to do a more comprehensive analysis of the spatial context compared to what smaller-footprint project proponents must do, due to their potential to result in broader impacts. Applicants provide the rationale used to define the spatial and temporal scales evaluated for the application.

The degree of alignment between a proposed project and local land-use priorities is also a key factor in regulatory decisions. In a number of regulatory review board decisions on bitumen upgrading facilities in Alberta over the past 12 years, for example, the board has assessed the appropriateness and compatibility of the facility location with the intended land use of the project site (EUB 2007; ERCB 2009; ERCB 2010; AER 2018a). Common criteria included: the type of site zoning (with zoning for heavy industrial use preferred); the degree to which regional municipalities have accommodated this zoning and expressed support for the proposed land use; and the degree to which that type of land use is already common in the area.

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15 The rules and regulations projects must comply with are outlined in the regulatory instruments that make up the three pillars of legal regimes governing oil sands activities: energy resource enactments, EPEA and CCEMA.

16 As stated in the EPEA Guide to Content for Energy Project Applications, "the location, setting or duration of an activity provides its context, and therefore may inform some obligations and requirements in a resulting approval" (AER 2014).

Economic Effects and the Public Interest

As noted above, a purpose of the OSCA regime is to support economical development of oil sands resources in the public interest (Province of Alberta 2000c). As such, a major factor considered by the AER when making decisions on project applications is the economic effects of the activity (Province of Alberta 2013b).

One case suggests that this requirement to consider economic effects will work in favour of partial-upgrading projects. In the May 2018 public hearing on its application for amendments to the Heartland Upgrader project, Value Creation Inc. (VCI) argued that the project would add value to oil sands resources by "producing more refined products that can be moved to markets more easily" (AER 2018a). The review panel accepted this argument and stated that "(g)iven the current pipeline transportation constraints for Alberta resources, we find the potential that these applications will produce more refined products and diversify resource marketing will help with continued development of Alberta's oil sands resources" (AER 2018a). The Government of Alberta's policy direction to promote more "value-added" activities associated with hydrocarbon resource development and processing in the province was noted in the panel's finding that the project was in the public interest.

The consideration of the public interest underpins the federal regime as well, and comes in to play where a partial upgrader falls under federal jurisdiction and is subject to federal review. Compared to its predecessor, the Canadian Environmental Assessment Act (2012), the IAA requires broader assessment of project impacts, including evaluation of a broader range of social, economic and environmental components, and supports assessment from regional and strategic perspectives (House of Commons of Canada 2019). The IAA shifts the basis for project-approval decisions to focus on public-interest determination, and away from the previous determination of significance. This wide-frame perspective may support the consideration of partial upgrading as important to meeting broader strategic objectives, such as market diversification and access.

Alignment with Regional Plans

Alberta's Land-Use Framework regional plans, created under the Alberta Land Stewardship Act (2009), have the potential to affect project approval and project design. The goal of these cabinet-approved plans is to integrate provincial policies at the regional level, set out regional land-use objectives and provide the context for land-use decision-making within the region (AEP 2018). The plans include management and decision priority frameworks for a variety of issues including land use, water use and quality, air quality, and socioeconomic linkages. The "regulatory details plan" section of a regional plan is legally binding on all, including the Crown. The regulatory plan includes binding air-quality and water-quality frameworks that set thresholds for contaminants of concern.

If exceeded, the levels act as a warning and trigger to initiate management responses.[17]

Any project located within the boundaries of an approved plan must align with the land-use objectives and environmental limits in order to receive regulatory approval from the AER or AEP (Province of Alberta 2000a, Section 3.1; Province of Alberta 2012, Section 20). If a project is in conflict with a regional plan, the proponent has the option to apply directly to Alberta's Land Use Secretariat for relief or adjustment of the plan (Province of Alberta 2009; AER 2013). There are rules for how relief can be provided or amendments made, outlined in the Alberta Land Stewardship Regulation (2011). The party applying for relief or amendment must be able to show that it is directly and adversely impacted by a provision in a regional plan; review and decision of an application is conducted by an advisory panel established by the Land Use Secretariat stewardship minister (Province of Alberta 2011). The regulation mainly provides process and does not speak to substantive factors to consider in making the decision. The result, therefore, is determined by the perspectives of the individual panel members.

As of July 2019, Alberta has two approved regional land-use plans: the Lower Athabasca Regional Plan and the South Saskatchewan Regional Plan. Figure 1 shows the relevant land-use regions: the oil sands area and Alberta's Industrial Heartland. The Lower Athabasca Regional Plan includes Fort McMurray and the oil sands area and, as such, is of most relevance to partial-upgrading project proponents and to the AER as the responsible regulatory agency (Alberta Government 2012). Importantly, however, the frameworks outlined in sub-regional plans of not-yet-approved draft regional plans are increasingly used in regulatory approval decisions. In projects located in AIH, which falls within the boundaries of the proposed North Saskatchewan Regional Plan, for example, the AER has requested that proponents participate in regional air- and water-quality monitoring initiatives prescribed by these sub-regional plans and has required proponents to comply with regional-plan frameworks once the plans are approved (EUB 2006; ERCB 2009; ERCB 2010; AER 2018a). In these cases, proponents voluntarily proposed taking these steps both in good faith and based on the business case to be in compliance once the plans come in to effect. A proponent of a partial-upgrading facility located outside of the two currently approved plan boundaries should still aim to align the project with relevant plan requirements. Table 1 outlines the relevant requirements of the two regional plans that are most likely to impact partial upgrading, assuming the AIH and the oil sands area are the most likely locations for such a facility.

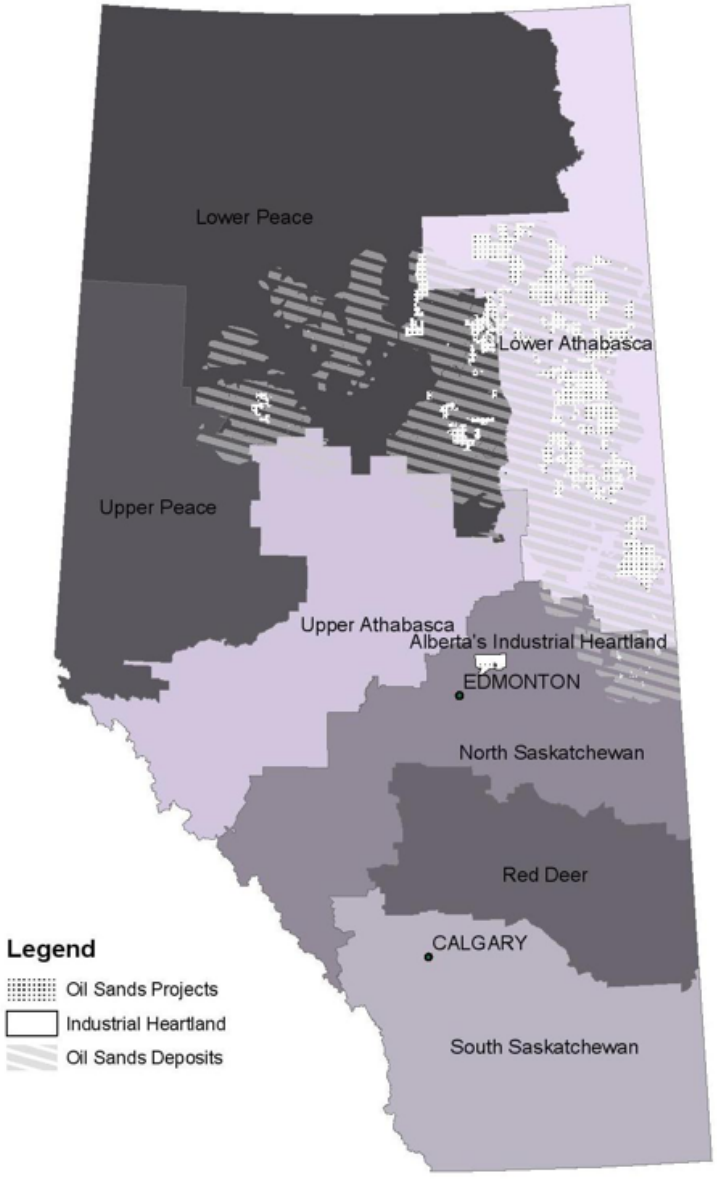
17 The regulatory details plan may not state exactly what kind of management response must be taken. In the Lower Athabasca Regional Plan, for example, the management response required for both air and surface-water quality limit exceedances is up to the discretion of an appropriate official or officials in the designated minister's government department and the only criterion is that the response be "consistent with the framework" (Alberta Government 2012).

TABLE 1: OVERVIEW OF THE ALBERTA LAND-USE FRAMEWORK REGIONAL PLANS RELEVANT TO CONSTRUCTION AND OPERATION OF A PARTIAL-UPGRADING FACILITY

Regional plan	Relevant content (Non-binding)	Provisions (Binding)
Lower Athabasca Regional Plan 2012–2022 Status: Approved Relevant areas covered: Oil sands area	**Strategic plan:** • Strong focus on the economical development of oil sands resources with a focus on technological innovation and continuous improvement. • Specifically mentioned as an opportunity for reducing the carbon footprint of the oil sands industry is the utilization of off-gas from upgraders as petrochemical feedstocks. Management frameworks for air quality, surface-water quality and groundwater quantity and quality: • Set regional limits not to be exceeded and triggers as warning signals for evaluation, adjustment and innovation on an ongoing basis. • Used by decision-makers when determining land-use applications. Management responses may include restricting future development.	**Regulatory details plan:** • Allows the Minister to require management responses by firms (e.g., certain activities) in response to exceedances of limits for air quality and surface-water quality (parts 5 and 6 respectively). • Hard limits on nitrogen oxides (NO_x) are especially relevant to partial-upgrading proponents. • No management responses required for groundwater quality or quantity or surface-water quantity.
North Saskatchewan Regional Plan Status: Pending Relevant areas covered: Alberta's Industrial Heartland including the Capital Region (Edmonton and surrounding areas)	**Capital Region sub-regional plan — The Cumulative Effects Management System within the Industrial Heartland and Capital Region:** • The Capital Region Air Quality Management Framework and the Water Management Framework for the Industrial Heartland and Capital Region set limits and guidelines for air emissions and water use, including mandatory participation in regional monitoring initiatives. • May be considered by regulators when reviewing project applications and drafting approvals.	None currently

Sources: Alberta Government (2012, 2013).

FIGURE 1: ALBERTA LAND-USE REGIONS, OIL SANDS AREA AND ALBERTA'S INDUSTRIAL HEARTLAND



Approval Type

The type of approval required for a project will determine the application process. Every oil sands project will require AER approval under OSCA, EPEA, the Water Act, and the Public Lands Act. If a proponent is planning an expansion of an existing project (for example a SAGD-integrated partial upgrader), then it may be possible to apply for an amendment to an existing project approval rather than require new project approval altogether. The major differences between an application for amendment or new approval are the processing timelines and application requirements. Table 2 summarizes key characteristics of each approval type.

For OSCA approvals, there are three categories of project modifications eligible for an amendment to an existing approval. Proposed project modifications are categorized based on: (a) change to resource conservation; (b) change to environmental and socioeconomic impacts as already predicted and assessed; and (c) effects to stakeholders rights, including mineral-rights owners (AER 2013). Project modifications eligible for a Category 1 amendment must expect no adverse or material change to resource conservation, no change to impacts as predicted, and no direct adverse effects to stakeholder rights. Category 2 modifications could affect resource conservation or involve significant process modifications, although they must show no change to impacts as predicted in the existing application and no direct adverse effects to stakeholder rights. Category 3 modifications, in contrast, are where there may be a change in resource conservation and direct adverse effects to mineral-rights owners and/or an adverse and material change to the impacts assessed and, therefore, potential direct adverse effects to other stakeholders (AER 2013).

The AER provides the following examples of eligible Category 3 amendments: expanding the project area; significantly increasing the approved bitumen production or processing capacity; adding a major process unit to the plant or facility; and modifying tailings technology that will result in significant changes to material balances or reclamation plans (AER 2013, Section 10.4). A major process unit in this case is defined as "a combination of process equipment designed to support the recovery or conversion of, oil sands or oil sands products (e.g., oil treatment, water treatment, gas treatment, steam generation, distillation, coking, cracking, sulphur recovery)" (AER 2013, Appendix A). Based on current technologies, a partial upgrader of any sort would likely constitute "a major process unit," and most methods would result in significant changes to the material balances of an existing project. We assume that expansion of an existing SAGD project to include a partial upgrader would qualify as a Category 3 OSCA modification.[18]

TABLE 2: COMPARING DIFFERENT TYPES OF COMMERCIAL-SCHEME PROJECT APPROVALS

Approval type	Relevance to partial upgrading	Cabinet approval required?	Estimated processing time*	Stakeholder-involvement program required?	Public hearing potentially required?	Guidance document(s)
New project approval	Central, standalone facility	Yes, for a commercial project	375 business days	Yes	Yes	AER Draft Directive 023: Sections 3-6, 9
Category 3 project-amendment approval	Expansion of an existing SAGD project (SAGD-integrated or bolt-on)	No	250 business days	Yes	Yes	AER Draft Directive 023: Section 10 and AER Directive 078

18 Where a proponent applies for construction and operation of a new SAGD-integrated facility, the proponent would require new approvals under both OSCA and EPEA and the same application requirements as a new standalone facility would apply (AER 2013).

*As of Oct. 31, 2018 (AER 2018c). As per Draft Direction 023, the timeline for processing a Category 3 project-amendment application is influenced by a number of factors, including the nature and complexity of the modifications, whether any objections are received, and whether a public hearing is required. Estimates include only the days when the application is in the hands of the AER, and as such do not include pauses for interrogatories or management of statement of concerns. One of the goals of the new integrated-decision approach proposed by the AER is to expedite the application review process and decrease regulatory risk to proponents. In economic modelling conducted by the Canadian Association of Petroleum Producers, initial piloting of the integrated-decision approach for a SAGD project resulted in a three per cent reduction in capital expenditure and reduction of approval timelines from five years to 15 months (CAPP 2018).

For EPEA approvals, the existing approval may or may not need to be amended when expanding a SAGD project to include a partial upgrader. An amendment is only required if an adverse effect that was not reasonably foreseeable at the time the approval was issued may occur (Province of Alberta 2000a, Section 70). We expect that the addition of a partial upgrader would result in new adverse effects, such as increased emissions, and would therefore require an amendment.

Application Requirements

A significant share of a project's lifetime regulatory burden is borne during the regulatory approval process. At this stage, the onus is on the proponent to show if and how the project will meet all of the relevant rules and regulations and contribute to the province's social, economic and environmental goals. Under current processes, project proponents in Alberta are required to conduct certain activities prior to submitting an application and submit a detailed application (and sometimes multiple applications depending on the project proposed). They may also be required to participate in a public hearing, post-submission. Pre- and post-application requirements are outlined in Table 3, and detailed application content requirements are reported in Table 4.

TABLE 3: APPLICATION REQUIREMENTS: SUMMARY OF PRE- AND POST-APPLICATION REQUIREMENTS FOR APPROVAL OF AN OIL SANDS SCHEME

Stage	Requirement	Trigger and requirements of note	Guidance document(s)
Pre-application	Aboriginal Consultation Office (ACO) pre-consultation assessment	Prior to filing an application, a pre-consultation assessment must be completed by the proponent. At that time, the ACO will determine if consultation is required and, if required, the ACO will identify the Indigenous communities that the proponent must consult with.	Government of Alberta's Proponent Guide to First Nations and Metis Settlements Consultation Procedures (2016)
	Stakeholder-involvement program	Required for all new or Category 3 amendment applications. The extent of stakeholder-involvement efforts required depends on the nature, size and scope of the project and may range from the publication of a notice in a local newspaper to meeting directly with persons who raise concerns about and file objections to the proposed activities (AER 2013).	AER Draft Directive 023; AER Directive 056; EPEA Guide to Content for Energy Project Applications
	Environmental assessment (provincial)	Development of an environmental impact assessment (EIA) report is required for both new and Category 3 amendments if the partial upgrader will produce more than 2,000 m3 of crude bitumen or its derivatives per day (Province of Alberta 1993b). Otherwise, upon initial early review of the application, the AER will determine if the preparation of an EIA report is required as per Section 44 of EPEA (2000). Main criteria are: context and scale; presence of similar activities in the area; complexity of the activity and the technology approach; public concerns expressed; any other factors the Director deems to be relevant. If required to complete an EIA report, the proponent must prepare a terms-of-reference submission for its EIA and open this up for public consultation.	EPEA Section 49; EPEA Guide to Content for Energy Project Applications; EPEA Environmental Assessment (Mandatory and Exempted Activities) Regulation
	Environmental assessment (federal)	A federal impact assessment is required if (1) the project is listed as a "designated activity" in the Physical Activities Regulations (2019); or (2) the responsible Minister designates the project as a physical activity requiring federal review, based on its potential to cause adverse effects within federal jurisdiction (House of Commons of Canada 2019). Effects within federal jurisdiction mean changes to environmental components within the legislative authority of Parliament (fish and fish habitat, at-risk aquatic species, migratory birds); changes to the environment on federal lands, in a province other than where the project is carried out, or outside of Canada; certain impacts on Indigenous Peoples (related to their physical and cultural heritage or the use of lands and resources for traditional purposes or historic sites); any change to the health, social or economic conditions of Indigenous Peoples of Canada; and any change to a health, social or economic matter that is within the legislative authority of Parliament (House of Commons of Canada 2019). Relevant to partial upgrading, the Physical Activities Regulation lists the following as designated activities requiring federal review: a heavy-oil upgrader with an input capacity of 10,000 m3 per day or more; an in situ oil sands facility with a bitumen production capacity of 2,000 m3 per day or more, unless it is within a legislated hard cap on greenhouse gas emissions.	IAA 2019; Physical Activities Regulations 2019
	Noise-impact assessment	Required for a new project application. In the case of a project expansion (Category 3 amendment), only required if a valid acoustical evaluation indicates that the addition of the partial upgrader will cause more than a 0.4-decibel increase in sound level.	AER Directive 038

Stage	Requirement	Trigger and requirements of note	Guidance document(s)
	Corporate-level emergency-response plan	Required for all new or Category 3 applications. Public consultation is required in the development the plan.	AER Directive 071
Post-application	Public hearing	The AER may decide a hearing is required based on any factor it deems to be relevant (Province of Alberta 2013a). The AER Rules of Practice (2013) Section 7 describes the factors the AER must consider when determining whether to hold a public hearing. In general, a hearing would be required where the AER determines that the SOCs were not resolved to its satisfaction through being addressed by the proponent or through a dispute-resolution meeting or otherwise; or where the Crown has requested a hearing for the purpose of addressing impacts to Indigenous Peoples.	Alberta Energy Regulation Rules of Practice (2013)
	Joint-review panel	If the responsible federal Minister determines that the project falls within the jurisdiction of the federal government, or if the AER requests that the IAAC participate in the decision.	REDA 2012; IAA 2019

Note: The output capacity of commercial-scale partial upgraders proposed in Alberta ranges from approximately 10,000 BOE/day to 100,000 BOE/day.

TABLE 4: APPLICATION REQUIREMENTS: APPLICATION CONTENT BY TYPE OF APPROVAL

Type of approval	General application requirement	Description and requirements of note	Guidance document(s)
New project approval	Project description	Location, technology used, energy sources used, transport of products and byproducts to market, water sources and use volume; map (project and regional); timeline; other relevant licences; proof of mineral-rights and surface-rights access and ownership.	AER Draft Directive 023 - Section 3
	Stakeholder involvement	The Stakeholder Involvement (SI) program involves the development and implementation of a plan for notification and consultation of affected stakeholders. The SI program must begin prior to filing an application; specifically, an information package prepared and distributed to all SI stakeholders and parties that request it. Proponents must make bona fide efforts to address and resolve concerns and objections raised in connection with the proposed activities. At a minimum, SI activities must include landowners in the project area and offsetting sections, oil sands lease-holders in offsetting quarter sections, and petroleum and natural gas lease-holders and freehold mineral owners of unleased lands in the project area and the offsetting sections. (Note that “offsetting” is not defined in guidance.)	AER Draft Directive 023 - Section 4; AER Directive 056* *Note that AER Directive 056, though it does not explicitly apply to oil sands processing plants, has been found by the regulator to be the minimum requirement for public-consultation requirements expected of all energy project proponents, including oil sands upgrader proponents (EUB 2007). Specifically, upgrader proponents were mandated to comply with the consultation and notification requirements specified for gas-processing plants and sulphur-recovery plants in general.

Type of approval	General application requirement	Description and requirements of note	Guidance document(s)
	Socioeconomic requirements	Review of existing socioeconomic conditions in the area and potential impact to population, housing, employment and training, economic activity, transportation, infrastructure and services; other social effects within the assessment area; related mitigation measures; overall economic effects of the project. Includes discussion of "overall economic effects of the project" — expected direct, indirect and induced revenues.	AER Draft Directive 023 - Section 5
	Environmental requirements	Describing environmental impacts in the assessment area; must include a project-wide evaluation of effects and the measures planned to mitigate them; areas of focus include land use, soils, vegetation and wetlands, wildlife, hydrology, surface-water quality, fisheries, hydrogeology and water source, with a large focus on groundwater, air quality and emissions, noise, reclamation. Air quality: Air-dispersion modelling must be conducted in accordance with the Alberta Air Quality Model Guideline; modelling results not in compliance with the Alberta Ambient Air Quality Objectives must be discussed.	AER Draft Directive 023 - Section 6
	Processing-plant specific requirements	Description of processing technology and each major process unit; material balances of solids, water, sulphur and hydrocarbons (i.e., process gas, bitumen and diluent); energy balance; storage, handling, use and disposal of water, waste and byproducts. Describe the storage, handling, and disposal of byproducts. Include a) the mass of byproducts to be stored on site, either temporarily as running inventory or as a result of emergency situations; b) the transportation of byproducts off-site; and c) any environmental controls.	AER Draft Directive 023 - Section 9
Category 3 project-amendment approval	.	Submissions must contain a detailed description of the modifications, provide reasons for the modifications, and include enough technical information to understand and assess: the effect on resource conservation; impacts on other mineral-rights owners; and environmental and socioeconomic impacts. Category 3 project amendments require applicants to develop and conduct an effective stakeholder-involvement program that complies with Section 4 of AER Draft Directive 023	AER Draft Directive 023 - Section 10.4 for standalone facilities; AER Directive 078 for SAGD-integrated

ILLUSTRATION USING TWO PROJECT SCENARIOS

We assume two viable scenarios for the siting of a commercial-scale partial-upgrading facility in Alberta. Scenario A is an expansion of an existing in situ field project and Scenario B entails development of a new, standalone central facility. In Table 5 we present two prototype project applications, each based on one of these scenarios. We then highlight where application of regulations may differ between the two projects in Table 6. The purpose of this exercise is to illustrate key elements of the regulatory regime governing partial upgrading and demonstrate how facility attributes may influence how a project application is treated with regard to each of these elements.

TABLE 5: PROTOTYPE PROJECT SCENARIOS

	Type of facility	Location	Technology approach	Production capacity	Greenhouse gas emissions profile (coking baseline)
Scenario A	SAGD-integrated *(expansion of existing project)*	A field operation in the oil sands area, outside of Fort McMurray	Mild thermal cracking with partial asphaltene rejection	10,000 BOE/day	Below baseline
Scenario B	Central, standalone merchant facility *(new project)*	Alberta's Industrial Heartland	Mild thermal cracking	100,000 BOE/day	Below baseline

TABLE 6: NOTABLE DIFFERENCES IN REGULATORY REQUIREMENTS BETWEEN TWO HYPOTHETICAL PARTIAL-UPGRADING PROJECTS

Regulatory framework component	Scenario A: SAGD-integrated project expansion in the oil sands area (10,000 BOE/day)	Scenario B: Standalone merchant facility in AIH (100,000 BOE/day)	Implications of differences
Responsible regulatory authorities	The AER is responsible agency	The AER is responsible agency	N/A
	Cabinet approval not required	Cabinet approval required under OSCA Section 11.5(b) due to new commercial-project classification	Scenario B: Potentially more scrutiny; longer approval process likely
	Federal agency involvement possible but not required	Unclear whether federal agency involvement is required.	N/A
Types of approval required	OSCA: Amendment required (likely Category 3 — 250 business days estimated processing time)	OSCA: New approval required (375 business days estimated processing time)	Scenario B: Longer approval process likely
	EPEA: Amendment possibly requirement or no change to existing approval	EPEA: New approval required	Scenario B: More comprehensive application process; longer approval process likely
	Water Act: Amendment possibly required or no change to existing licence	Water Act: New approval (licence) required	Scenario B: More comprehensive application process; longer approval process likely
	Public Lands Act: No new or amended approval required	Public Lands Act: New approval required	Scenario B: More comprehensive application process

Regulatory framework component	Scenario A: SAGD-integrated project expansion in the oil sands area (10,000 BOE/day)	Scenario B: Standalone merchant facility in AIH (100,000 BOE/day)	Implications of differences
Environmental assessment	Provincial: Possibly required – only if the AER determines as such based on factors outlined in EPEA Section 44	Provincial: Required by the Mandatory and Exempted Activities regulation as production (approx. 15,898 m3/day) is over 2,000 m3/day	Scenario B: More comprehensive application process; longer approval process likely
	Federal: Not required. Production (approximately 1,590 m3/day) is lower than the 2,000 m3/day threshold for in situ oil sands facilities not covered by an emissions cap	Federal: It is uncertain whether federal review is required based on current Physical Activities Regulations, although it likely is (discussed below)	N/A
Stakeholder-involvement program	Assuming Category 3 amendment, AER Draft Directive 023 Section 4 requirements apply	AER Draft Directive 023 Section 4 requirements apply	N/A
	Spatial context: Higher prevalence of Indigenous communities in the surrounding area	Spatial context: Highly populated urban centres in surrounding area	Scenario A: Greater emphasis on involvement and consultation of Indigenous Peoples and related impact to federal lands Scenario B: Greater emphasis on involvement and consultation of homeowners and landowners
Public hearing	Possible	Possible	N/A
Air quality	Approved regional plan under the Alberta Land Stewardship Act (Lower Athabasca Regional Plan) means project must comply with the plan's binding NO_x and SO_x air-emissions limits.	Not-yet-approved regional plan under the Alberta Land Stewardship Act (North Saskatchewan Regional Plan) means no binding requirement to comply with the plan's air-quality framework; regulator may prescribe compliance with Capital Region sub-regional plan air-quality requirements, however Spatial context: AIH region is nearing airshed limits under new Canadian Ambient Air Quality Standards coming in to force in 2020	Scenario A: Clear air-quality requirements and performance standards Scenario B: Less clear air-quality requirements and performance standards; cumulative airshed-effects considerations may be more important
Water use and wastewater management	Approved regional plan (Lower Athabasca Regional Plan) means binding surface-water quality limits under the Alberta Land Stewardship Act	Not-yet-approved regional plan (North Saskatchewan Regional Plan) means no binding water-related commitments under the Alberta Land Stewardship Act; implementation of requirements under the Capital Region sub-regional plan, however, may occur	Scenario A: Clear water-quality requirements and performance standards Scenario B: Less-clear water-quality requirements and performance standards
	Groundwater is the likely water source and discharge of treated wastewater into sub-surface aquifers	Surface water is likely water source and discharge of treated wastewater into the North Saskatchewan River	Scenario A: Potentially more technically complicated and onerous water-management requirements

GAPS AND AREAS OF REGULATORY UNCERTAINTY

In this section, we build on our review of the regulatory framework for oil sands processing plants to identify specific aspects of the framework that pose challenges unique to commercial-scale partial upgrading. We also identify issues that are not unique to partial upgrading, but are especially relevant to the implementation of partial upgrading at scale. We classify these gaps and uncertainties, describing their form and consequences for effective regulation, below.

TREATMENT UNDER LAW

Partial upgrading is not explicitly defined under Alberta or federal law. Although bitumen upgrading in general is discussed specifically in many instances (explored below), how regulators will treat partial upgrading differently from full upgrading, if at all, is unknown. Likewise, in some of the applicable legislation, the line between processing plant and refinery is fuzzy. This lack of clarity creates uncertainty for proponents and regulators as to how a partial-upgrading project would be treated under law and which rules and requirements would apply. To increase certainty (and thereby facilitate a more predictable, efficient regulatory process), partial upgrading should be clearly delimited under the IAA, OSCA, EPEA and CCEMA, and related legal guidance produced and distributed. Here, we explain in detail the problems that need to be addressed.

Federal

The federal regime explicitly discusses upgraders, though it doesn't provide a description of this type of facility. "Heavy oil upgrader" is listed in the Physical Activities Regulations (2019) as a type of oil refinery (Canada 2019, Sections 37 and 38). Assuming business as usual, partial upgrading would likely be considered as a heavy oil upgrader and the same limit for federal assessment (input capacity of 10,000 m3/day or more) would apply. To eliminate this uncertainty, we recommend the federal government amend the IAA regulations to clarify the definition of heavy oil upgrader, particularly as it relates to partial versus full upgrading. Further, considering the difference in process intensity between full upgrading and partial upgrading, we suggest the government delineate the environmental-assessment threshold by type of facility, with partial upgraders allowed a higher input capacity than full upgraders before triggering an assessment.

Alberta

Like the Government of Canada, Alberta does not have a fit-for-purpose regulatory regime devoted to management of the approval, construction and life-cycle operations of partial-upgrading facilities. The May 2018 approval of VCI's Heartland Complex set a precedent for how the AER will treat a partial upgrader. It confirmed that the AER views a facility of that nature — a standalone, merchant facility using technology based on deasphalting and thermal cracking — as a processing plant, and will apply the same rules and regulatory processes to it. This adds clarity to how future partial-upgrading projects will be treated under energy resource development enactments and EPEA. However, uncertainty still remains as to how partial upgrading will be treated under the third pillar of oil sands development, CCEMA, which is regulated by AEP, as discussed in detail

below. Similarly, we cannot be certain that partial upgraders with significantly different characteristics than the Heartland Complex — for example those applying less-traditional technology approaches, such as molten-sodium technology, or project expansions versus new facilities — will fall as squarely within the "processing plant" box. We explore the issue by legislative pillar, below.

Oil Sands Conservation Act Regime

In Alberta, OSCA defines "oil sands processing plant" but the category is not further divided into processing plant types (Province of Alberta 2000c). Given this lack of specificity, both a full-upgrading and partial-upgrading facility are treated as an oil sands processing plant, and the same rules apply indiscriminately.

Notably, however, in early 2019, the AER expressly stated that partial upgrading is different from full upgrading:

> "The Government of Alberta defines partial upgrading as a process that reduces the thickness of oil sands bitumen so it can flow through pipelines more easily, without it having to be blended with diluent or as much diluent (a thinning agent). Partial upgrading is different from full upgrading. Full upgrading is a process by which bitumen is converted into synthetic crude oil and other higher quality hydrocarbons. Full upgrading results in the removal of impurities such as heavy metals and sulphur." (AER 2019a).

This statement is problematic for two reasons. First, the AER acknowledges that partial upgrading is different from full upgrading, but fails to provide guidance on how the applicable rules differ. In absence of this guidance, we assume the same rules apply. This suggests regulatory inefficiency, as two facilities with substantially different products and processes are treated equally by law: the relevance and appropriateness of rules are sure to differ, as is the regulatory burden borne by each type of facility's operator. The trade-off is simplicity from the very neutrality of treatment under law against a more complex environment that acknowledges differences in scale and impacts.

Second, the AER uses a process-based definition for partial upgrading, but a product-based definition in defining full upgrading. This makes it difficult to clearly delimit the two types of facilities. Some partial-upgrading approaches may remove heavy metals and sulphur to create a higher-quality hydrocarbon product (for example using molten-sodium technology (Keesom and Gieseman 2018)), rendering the AER's distinction between the two processes disputable. We interpret the AER's basis for differentiation as being based on the intensity of the process, with no clear threshold or scale provisions in place. The lack of clear-cut definitions creates ambiguity, which is detrimental to clear and transparent regulation. We expect this issue to become increasingly important as less-traditional technology approaches enter the regulatory process for project approval. We recommend the AER produce a specified enactment direction in follow-up to its 2019 bulletin on partial upgrading, to explain exactly what rules apply and how the applicable rules differ between full and partial upgrading. This will enable a more fluid regulatory process and decrease risk to proponents.

Environmental Protection and Enhancement Act Regime

We have identified potential problems in the treatment of partial upgraders under the EPEA regime, the environmental legislation governing oil sands activities. Under this regime, there is some ambiguity in the definition of processing plant versus refinery. It appears that both feedstock and product determine plant classification. EPEA considers an oil sands processing plant (regulated by the AER) as a plant for "(i) the recovery from oil sands of crude bitumen, sand and other substances, or (ii) the extraction from crude bitumen of crude oil, natural gas and other substances"; whereas an oil refinery (regulated by AEP) is a plant for "manufacturing hydrocarbon products from oil, heavy oil, crude bitumen or synthetic crude oil" (Province of Alberta 2003a, Section 2).

These definitions are arguably overlapping, in that a plant that accepts a feedstock of crude bitumen and produces a hydrocarbon product could be classified as either (or both, simultaneously). Adding to the confusion of terms, the federal regime considers a heavy oil upgrader to be a type of refinery (Canada 2019, Sections 37 and 38). Based on practice and common interpretation, our assumption is that the main difference between the two types of facilities is that the product of a processing plant requires further refining, whereas the product of a refinery would not. This differentiation is not stated in law, however. Further, some facilities may meet both criteria at once. The approved VCI Heartland Complex, for example, will produce both a medium synthetic crude oil that requires further processing before end-use and an ultra-low sulphur diesel ready for use as a commercial energy input.

Proponents may be able to take advantage of the blurred line between processing plant and refinery. Some known partial-upgrading approaches present the option to accept multiple types of feedstock, for example, such as crude bitumen and already-processed heavy bottoms. Facilities may have the capacity to both partially upgrade bitumen and reduce the viscosity of heavy oil (e.g., cold heavy oil from the Lloydminster area) so that it is transportable by pipeline. A facility with this type of optionality in feedstock could be classified at once as both an oil sands processing plant and an oil refinery. A different regulatory framework applies to each type of facility, including different agencies responsible for regulating the facility under EPEA (the AER versus AEP). The degree of certainty associated with approval and regulation (as well as overall regulatory requirements) under one agency compared to another could influence a proponent's decisions around the nature of the facility and its product. This creates opportunities for proponents to "game the system," whereby they choose their regulator based on the perceived expected regulatory burden (Baumgartner 2007). This goes against the principles of an efficient, non-interfering regulatory system, and risks influencing proponent decisions away from the public interest. The ambiguity means the current system is not technology neutral. To address this loophole and confusion of terms, we recommend the Government of Alberta amend the EPEA regulations to clearly delimit refineries and processing plants.

Climate Change and Emissions Management Act Regime

As noted above, neither the OSCA nor EPEA regimes explicitly define upgrading. This removes any need to understand how partial upgrading will or will not be compared to full upgrading under those frameworks. This is not the case with the CCEMA regime, which supports the management of greenhouse gas emissions in the province. Upgrading is discussed in two places under CCEMA — one including a definition of the process — and specific benchmarks and emissions limits are assigned to bitumen upgrading.

First, the Standard for Establishing and Assigning Benchmarks (2019) for the CCIR (2017) explicitly defines upgrading as "the processing of oil sands bitumen to create a feedstock for further refining" (Alberta Government 2019). This definition fits partial upgrading well (and it supports our observation that, operationally, AEP and the AER differentiate processing plants from refineries based on whether or not the product requires further refining). The only product currently associated with upgrading under the standard, however, is synthetic crude oil (Alberta Government 2019, Section 2.2). As of October 2019, the Government of Alberta has proposed replacing the CCIR with the Technology Innovation and Emissions Reduction System (TIER) by January 2020 (Government of Alberta 2019b). The TIER discussion document does not specifically address partial upgrading, though it does briefly discuss proposed product definition and benchmarking for refining and upgrading (Government of Alberta 2019b). To ensure clarity around how partial-upgrading products will be benchmarked under TIER, an additional product class would need to be added to the forthcoming TIER standard to address partial upgrading, or guidance provided on how partially upgraded products fit within existing classes.

Second, the Oil Sands Emissions Limit Act (2016) (OSELA) defines upgrading emissions as "greenhouse gas emissions that are attributable to the production, at an upgrader, of synthetic crude oil or a comparable fully upgraded product prescribed by the regulations" (Province of Alberta 2016). The Act applies a product-based definition and, in doing so, excludes partial upgrading, which produces neither a synthetic crude oil nor a comparable fully upgraded product.

OSELA regulates greenhouse gas emissions for oil sands sites in Alberta and limits combined greenhouse gas emissions for all oil sands sites to 100 million tonnes of carbon dioxide equivalent (CO_2e) in any year (Province of Alberta 2016, Section 2(1)). Upgrading emissions, up to an additional maximum of 10 million tonnes in any year, are excluded from the 100-million-tonne cap (Province of Alberta 2016, Section 2(2b)). As we noted above, these emissions must be attributable to the "production, at an upgrader, of synthetic crude oil or a comparable fully upgraded product prescribed by the regulations" (Province of Alberta 2016, Section 1(l)). The Act allows Alberta's cabinet to develop regulations prescribing "fully upgraded products that are comparable to synthetic crude oil" for the purpose of determining the 10-million-tonne upgrading-emissions exclusion (Province of Alberta 2016, Section 3(c)). The reference to "fully upgraded products" comparable to synthetic crude is a barrier to inclusion of partial-upgrader emissions under the exemption limit. Partial upgraders by definition produce only partially upgraded crude oil not comparable to synthetic crude oil. We recommend

the Act be amended to expand the eligible product category to include partially upgraded products, otherwise OSELA and the Energy Diversification Act are arguably in conflict: the former restricts partial-upgrading activity, whereas the latter encourages it.

While there is currently enough room to accommodate multiple partial-upgrading facilities within the OSELA 100-million-tonne cap limit, there is still potential value associated with proactively including partial-upgrading emissions under the exemption limit. Given the significant costs of technology development, partial-upgrading proponents are likely to form business and investment plans contingent on the expected economies of scale associated with broad adoption. As noted by Fellows et al. (2017), the economics of partial upgrading are expected to benefit from economies of scale as additional facilities based on existing technology become operational (since these facilities can share technology development and other costs). Because of this, proactive inclusion of partial upgrading in the exemption limit could provide significant reassurance to these firms that the emissions cap will not adversely impact their ability to realize these economies of scale.

Summary

In summary, we see that partial upgrading is not delimited anywhere in provincial or federal legislation. This opens up opportunities for interpretation and uncertainty as to how rules will be applied. In multiple cases, rules are assigned specifically to upgrading, but the assumption is that upgrading results in a fully upgraded synthetic crude oil and so there are limits to how we can relate these rules to partial upgrading. In the absence of targeted guidance, partial upgrading will be shoehorned into an existing regime designed for larger, more-intensive processing plant and refining facilities and processes.

APPLICATION PROCESSING TIMELINES

The lengthiness and unpredictability of the regulatory review and approval process timeline increases regulatory risk to partial-upgrading project proponents and investors. This issue is not unique to partial upgrading — all oil sands project proponents face uncertainty around processing timelines — but it is especially important to proponents with high-risk investment profiles, for example proponents of new technologies or more junior proponents. That is, long (and uncertain) regulatory processes disadvantage less-established firms as well as those proposing first-of-a-kind facilities. Correspondingly, the same regulatory process advantages larger, more established firms. The length and complexity of regulatory processes may prevent firms with valuable innovations from proceeding due to capital constraints, a well-recognized problem in research and development.

Specific to partial upgrading, the length of the regulatory process will depend on a variety of factors, most importantly: the type of approvals required; existing backlog and regulator capacity to process the application; the number and nature of interrogatories requested by the regulatory review agencies; whether a full provincial EIA or a federal environmental assessment is required; the holding of a public hearing (and the number

of parties with intervener status present at the hearing); and the requirement to undergo a joint-panel review. There are opportunities to improve speed of application processing, for example through full roll-out of the AER's Integrated Approach Decision platform, but most of the opportunity lies in improving certainty around what application components are required, so that proponents can plan accordingly.

We estimate that the regulatory review timeline applicable to partial-upgrading projects will range from an approximate cumulative one year at least (existing project expansion best-case scenario) to four years or more (new, standalone facility worst-case scenario). For a more junior proponent, the length of time it takes for the regulatory authorities to review an application can make or break project viability, e.g., one year could be manageable, whereas two or more years could eliminate the business case for the facility. Where lighter-touch technology approaches are required to comply with a regulatory framework and process applicable to larger, more-intensive facilities and full upgraders, this burden at the approval application stage could prevent broader implementation of promising technologies. One opportunity is for the provincial government to amend relevant EPEA and OSCA guidance to allow for scale triggers: e.g., environmental impact assessment and stakeholder-involvement requirements scaled by the size or nature of the facility. However, an unfortunate side-effect of thresholds is that they create the incentive for proponents to propose facilities just under the threshold, in order to avoid additional regulatory requirements. Any difference between a 9,999 barrel per day facility and a 10,000 barrel per day facility is marginal, and so the government should approach threshold-based triggers with caution.

The requirement to participate in a federal environmental assessment can add over a year to an application period, and thus is a major determinant of how long the application review process will take.[19] Under the current federal framework, a partial-upgrading facility is not explicitly included in the list of designated projects under the IAA, though heavy oil upgraders with a production capacity of 10,000 m^3 per day or more are (Canada 2019b). We recommend the federal government provide explicit direction on whether a partial upgrader would or would not be designated as an activity requiring federal impact assessment. This would help to add certainty and reduce regulatory risk to the proponent. Further, an in situ oil sands facility with a bitumen production capacity of 2,000 m^3 per day or more is also subject to a federal assessment, unless the facility is within a legislated hard cap on greenhouse gas emissions (Canada 2019). If the 100-megatonne CO_2e cap under OSELA is not treated as binding, this exposes all in situ projects meeting this criteria in Alberta — including those with a partial upgrader — to federal assessment. This is another leverage point for the Government of Alberta to limit the number of projects within its jurisdiction that go to federal review.

Other opportunities to improve the fluidity and predictability of the application process include: introducing criteria for when SIR (interrogatories) by the AER are justified, to improve certainty around when "time-outs" due to SIRs might occur and allow for the proponent to pre-emptively avoid SIRs by providing the necessary information;

19 Under the IAA, assessments should not exceed 300 days but may be up to 600 days if required (Canada 2019a).

the option for a proponent to request a public hearing; and a redesign of the application process to move from a continuous call format to an assigned application submission date and specified review window for each applicant.

HYDROCARBON BYPRODUCTS

A third source of regulatory uncertainty is how hydrocarbon byproducts resulting from partial upgrading will be treated. As introduced above, partial upgrading involves reducing the viscosity and density of crude bitumen so that it can flow through pipelines with no or less diluent. In current technology approaches, this is achieved through asphaltene conversion or rejection and the conversion of heavy molecules to lighter molecules (Keesom and Gieseman 2018). Asphaltenes and petroleum coke (petcoke) are two common byproducts of these processes.

This area of uncertainty is not unique to partial upgrading. It applies to any petroleum processing activity in Alberta that results in hydrocarbon byproducts, which includes a wide variety of crude oil processing and refining activities (though petcoke is a much more common byproduct than asphaltenes in these cases). We draw it out as being of special importance to partial-upgrading proponents, however, because broader implementation of partial upgrading will likely mean more asphaltenes produced in the province, raising the profile of the issue. The uncertainty arises from a conflict of purpose between the OSCA and CCEMA regimes. First, the primary purpose of OSCA is to "effect conservation and prevent waste of the oil sands resources of Alberta" (Province of Alberta 2000c). Hydrocarbon byproducts are considered oil sands products, which are defined as "any products obtained by processing oil sands, crude bitumen or derivatives of crude bitumen," and are therefore considered oil sands resources and meant to be conserved. The OSCR (2000) requires an operator to minimize the discard of coke, asphaltene, sulphur or other byproducts (Section 49), and, for the purpose of energy resource conservation, to get special permission from the AER for the storage or disposal of hydrocarbon effluents.

Hydrocarbon byproducts, however, are also regulated under Alberta's greenhouse gas emissions regulatory regime. The CCEMA regime is based on the principle of life-cycle greenhouse gas emissions management, and discourages the combustion of hydrocarbons (Province of Alberta 2003b). In comparison, under the OSCA regime, asphaltenes and petcoke are oil sands resources that have value as energy resources, regardless of the potential greenhouse gas impact. These two regimes are at a conflict of purpose with regards to how hydrocarbon byproducts are treated. This may pose uncertainty as to how regulatory authorities will evaluate a project that produces hydrocarbon byproducts, and especially the degree to which that project is in the public

interest.[20] Partial-upgrading proponents may want to look to operators of full-upgrading facilities that stockpile petcoke for precedence on how to reconcile the resource-conservation/greenhouse-gas-emissions conflict. Process innovation is encouraged to conserve more of the resource with a net reduction in emissions; there are examples of operators replacing petcoke combustion processes with natural-gas cogeneration units, such as the Suncor Oil Sands Coke Boiler Replacement Project, incentivized under the CCIR.

To address this issue, we recommend the Government of Alberta provide policy direction on which of the competing principles is more important — resource conservation or reduction of life-cycle greenhouse gas emissions — and how an operator should prioritize these in practice. The OSCA regime could be modernized to reflect the government's climate-related priorities.

CUMULATIVE AIRSHED EFFECTS

Like the management of hydrocarbon byproducts, the management of cumulative environmental effects is an area of potential regulatory uncertainty not unique to partial upgrading, but especially relevant for its proponents and regulators. Alberta's environmental management legislation has a strong emphasis on measuring, monitoring and managing the cumulative effects of development (Province of Alberta 2000a). Since the early 1990s, Alberta's oil sands industry has been a world leader in industry-led cumulative effects management and the development of related joint-management obligations (Hoberg and Phillips 2011). Provincial regulatory frameworks have since caught up, and several regulatory instruments now exist to manage cumulative effects. By its very nature, however, operating in a cumulative effects management landscape adds a degree of uncertainty for an individual firm: the environmental limits it is obligated to operate within are reached through collective action, over which an individual firm has little control. In this section, we discuss the framework governing cumulative airshed effects, as it is likely this issue that will cause barriers to implementation of partial upgrading at scale.

Regional Exceedances

Oil sands project proponents are required to conduct modelling at the project-application stage to show the AER that regional air-quality limits won't be exceeded because of the facility's emissions (AER 2013). In practice, however, projects showing modelled exceedances may still be approved. Before we discuss this issue in detail, and its implications for partial upgrading, it is useful to review the regulatory framework governing air quality in Alberta.

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20 Notably, the regulator may consider the proponent's intent to market the hydrocarbon byproduct in its evaluation of the economic impact of the project. It may not, however, consider the use of this byproduct by buyers in the greenhouse gas emissions assessment, as seen in the Energy Resources Conservation Board's 2009 decision on the Petro-Canada upgrader (PCOSI) in Sturgeon County (ERCB 2009). The board stated that while it "recognizes that delayed coking will produce a large volume of coke by-product it notes that PCOSI will market its coke and, therefore, add value to the bitumen. The Board finds that the use of the coke by-product outside of the proposed project is beyond the scope of this review and accordingly declines to direct PCOSI to perform a life-cycle analysis to determine future processing emissions."

The EPEA provides the regulatory framework to protect Alberta's air quality and the Alberta Ambient Air Quality Objectives and Guidelines (AAAQO) set the limits for specific emissions (Province of Alberta 2000a; Government of Alberta 2019a).[21] The four key pollutants of concern regulated under the AAAQO — i.e., those of particular importance to human and environmental health — are nitrogen oxides (NO_X), sulphur oxides (SO_X), ozone, and fine particulate matter. These limits are important to proponents of partial-upgrading facilities, as current partial-upgrading technologies rely on the combustion of natural gas and mixed hydrocarbon gases as fuel inputs and, as a result, a facility would likely produce NO_X, SO_X and ozone (Keesom and Gieseman 2018). Construction of a facility would also likely contribute to increased fine particulate matter due to truck activity.

The AAAQO air-quality limits are set at the regional level and not at the facility level, and all industrial facilities in Alberta must be designed and operated such that ambient air quality in a facility's airshed remains below the ambient air-quality objectives (Government of Alberta 2019a). The AER is the authority responsible for ensuring that oil sands projects meets these requirements and it relies on the AAAQO for guidance on how to assess facility design and performance (AER 2018a). Importantly, however, the AAAQO framework lacks enforcement mechanisms: an exceedance of a limit (i.e., when the ambient air-quality level for a specific air contaminant is higher than the level prescribed) triggers only mandatory reporting by individual facility operators, and no management response (Government of Alberta 2019a). The management response is left up to the discretion of the responsible Director.

To help the AER evaluate how a facility will contribute to regional air quality, an oil sands project proponent must conduct air-dispersion modelling at the application stage and discuss any modelling results not in compliance with the AAAQO (AER 2013, Section 6.1). The emissions inventory, study area size and modelling approach must be sufficient to determine the effects of emissions on humans and the environment from both the proposed project and other existing, approved and announced projects (EUB 2007). The prescribed air-dispersion modelling method is acknowledged by the AER to be "predictive and conservative," and when evaluating a project's contribution to regional air quality, the AER will take in to account both the modelled data as well as actual air-quality data collected over time leading up to the time of application, in order to compare results and gauge conservativeness of the model (AER 2018a).

We found four cases of facilities — three upgraders and one partial upgrader, all of which were based in the AIH — where exceedances were modelled at the application stage and the project was still approved by the regulator (EUB 2007; ERCB 2009; ERCB 2010; AER 2018a). In these cases, ex ante modelled exceedances were accepted if: (1) they were due to non-routine events, an acceptable justification was provided and the proponent agreed to put in place a management plan to deal with those events (EUB 2007); or (2) the main source of the cause of the exceedance is an emissions source other than the proposed facility (ERCB 2009; ERCB 2010; AER 2018a). The size of the airshed footprint

[21] This framework deals with non-greenhouse gas emissions only. Greenhouse gas emissions are dealt with under CCEMA.

of the facility, the nature of the activity that causes the exceedance, and existing and planned industrial activity in the surrounding area are taken in to account by the regulator when determining management requirements (EUB 2007; ERCB 2009; AER 2018a).

The AAAQO limits are not meant to be "pollute-up-to" allowances, but rather absolute ceilings to avoid, with the expectation that pollution prevention and continuous improvement over time at the facility level should keep air quality well below the ambient air-quality objectives (ESRD 2012). Alternatively, restricting development is another mechanism to prevent increases in regional emissions. This matters for partial-upgrading proponents, as the current and projected air quality in the surrounding area will factor in to the decision to approve or deny the project. Cumulative airshed effects may only determine facility operations, as they did in the above four cases, or may prevent project approval altogether. If the AAAQO limits are treated as hard limits, this means it will likely be more difficult to get new facilities approved. Industrial activity in the two regions where a partial upgrader is likely — the AIH and the oil sands area — is increasing, and cumulative airshed effects will only become more important and will likely have an increased bearing on project-approval decisions moving forward.[22] The issue is especially pertinent in the AIH, where regional air-quality limits are nearing exceedance (Government of Alberta 2017).

Federally, the Canadian Ambient Air Quality Standards (CAAQS) set the limits for specific air contaminants (CCME 2019). The AAAQO objectives are based on the CAAQS, though exceedances of a CAAQS limit triggers mandatory management actions in response (unlike the AAAQO, which triggers only reporting). These federal standards are especially important to future proponents of partial-upgrading facilities located in the AIH, because more stringent NO_X and SO_X CAAQS limits will come in to effect in 2020 (CCME 2019), and the AIH airshed — the Capital Region[23] — will likely be in exceedance of these limits by that time (Government of Alberta 2017). Exceedance of regional limits may be a barrier to approval of a standalone partial upgrader in the AIH altogether; at the very least, the facility would be required to put mitigation measures in place. Project proponents have begun voluntary compliance with the incoming CAAQS despite the new limits not coming in to force until 2020 (AER 2018a).

We recommend that, in response to approaching exceedances of CAAQS and AAAQO regional ambient air-quality limits, the Government of Alberta mandate management actions by operators, for example, retrofits to improve efficiency ratings, instead of capping airshed entry for the AIH. Encouraging more-efficient operations by all, instead of restricting the entry of some will allow for more equitable, responsive development decisions. Further, the government should amend regulations under EPEA to require management responses to exceedances of AAAQO objectives and provide guidance around how the response actions should be designed. Giving the AAAQO legal teeth

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22 Over $25 billion has been invested in new and expanding facilities within the AIH region and another $18 to $24 billion is expected over the next 15 years (AEP 2018).

23 The Capital Region is defined as the area including the Capital Region Board, which represents 24 municipalities surrounding the City of Edmonton and Elk Island National Park (AEP 2019).

will improve certainty around how it will be implemented and enforced. Finally, in airsheds where ambient air quality is approaching regional limits, for example the AIH, it would be prudent for the provincial government to identify clear regional-planning targets and priorities that link to project-level approvals, as is consistent with effective integrated natural resource management (Council of Canadian Academies 2019). The government may allocate priority for entry into the airshed to certain types of facilities, for example "value-added" processing, based on regional-development objectives identified through regional assessments.

Applicability of Regional Plans

Finally, Alberta Land-Use Framework regional plans also play a role in cumulative airshed effects management and the implementation of these plans is not uniform across firms or regions. As we discuss above, only the regulatory details plans of approved regional plans are binding by law (Province of Alberta 2009). However, the AER has started to mandate that proponents comply with not-yet-approved plans. As an example, in the Capital Region, which falls within the North Saskatchewan Regional Plan boundaries and encompasses the AIH, the AER required that proponents comply with air-quality management provisions under the sub-regional plan of the not-yet-approved draft regional plan (EUB 2006; ERCB 2009; ERCB 2010). Specifically, proponents are mandated to participate in the regional air-quality monitoring initiative led by the Fort Air Partnership (FAP). These regional plan requirements are not uniformly applied, however, and some proponents of projects in the Capital Region are negotiating to get out of participating in the FAP. It is unclear how the AER will apply provisions under the draft North Saskatchewan Regional Plan moving forward, adding uncertainty to proponents of projects in the AIH. To address this confusion and ensure fair and equal treatment, we recommend that the AER produce a bulletin explaining how sub-regional plan frameworks are applied in project approval decisions and how the binding limits and frameworks of a regional plan will be rolled out once a plan is approved.

PENDING LEGISLATION

In addition to gaps in the existing regulatory framework, pending legislation also poses uncertainty for partial-upgrading proponents. Again, this uncertainty is not unique to partial upgrading, but is still worth noting. Here, we briefly discuss proposed legislation that would have impacts on partial upgrading, if such legislation were put into force.

Canada Clean Fuel Standard

The Government of Canada is currently developing a Clean Fuel Standard (CFS) for all liquid, gaseous and solid fuels used in Canada. The regulations will be developed in two phases, starting with a focus on liquid fuels. The government aims to publish the final regulations for liquid fuels in 2020; they would come in to effect in 2022. The December 2018 Regulatory Design Paper puts forward a goal to lower the carbon intensity of liquid fossil fuels by approximately 11 per cent by 2030; the standard would apply a performance-based approach and establish life-cycle carbon-intensity requirements for fuels (ECCC 2018). If outputs have a specific emissions intensity, this affects the inputs

refineries can use. As a more emissions-intensive source of oil (Gordon et al. 2015), this disadvantages the oil sands, including synthetic oil produced via partial or full upgrading. The Clean Fuel Standard will then influence refinery demand for oil sands-produced oil, influencing the economics of oil sands development and partial upgrading in particular. However, to the extent that partial upgrading is less emissions-intensive than full upgrading, the Clean Fuel Standard may advantage partial-upgrading facilities.

OVERVIEW OF OPPORTUNITIES

We have identified a variety of gaps and areas of uncertainty in Alberta's regulatory framework that may hinder the effective, responsible implementation of partial upgrading at scale. Many of these issues can be addressed at once — often simply through more specified guidance from the regulator. Some of the issues, especially those not restricted to partial upgrading, would require a more substantive overhaul of existing processes. Below, we summarize these opportunities for improving certainty and closing gaps in the existing framework.

Recommendation: Explicitly delimit partial upgrading and provide guidance on how applicable rules differ between different types of processing-plant facilities.

Specific opportunities:

- Define partial upgrading under IAA, OSCA, EPEA and CCEMA.
    - Specific to CCEMA: (a) add new process-unit modules to account for the benchmarking of different technology approaches under CCIR/TIER; (b) add partial upgrading and its product to the OSELA and consider exempting partial-upgrader emissions and expanding the upgrader/refinery exempted emissions cap to include partial-upgrader emissions.
- Produce a specified enactment-direction document — at both the federal and provincial level — delimiting (1) oil sands processing plants and heavy-oil refineries and (2) upgraders and partial upgraders.
- Harmonize the use of terms across jurisdictions.
- Take a forward-looking approach and begin the process of separating out processing plants from the regulatory framework for oil and gas development. This could streamline regulation and reduce the need to distinguish between different types of processing activities, as discussed above.

Recommendation: Improve the efficiency and predictability of the regulatory approval application process for oil sands projects.

Specific opportunities:

- Implement the AER integrated-decision approach platform.
- Allow for scale provisions in application requirements. In particular, consider setting tiers of requirements for an EIA report and stakeholder involvement relative to the scale of the project and its potential impacts.

- Redesign the application and review process: to address the application backlog, consider moving from a continuous-call format to an assigned application submission date and specified review window for each applicant.
- Establish clear criteria for when SIRs are justified.
- Provide the option for a proponent to proactively request a public hearing.
- Federal level: provide clear guidance on whether/when a partial upgrader would be subject to a federal environmental assessment.
- Create a separate regulatory process for oil sands development activities and oil sands processing facilities, fit for each purpose.

Recommendation: Address the conflict of purpose between the OSCA and CCEMA regimes.

Specific opportunities:

- Provide policy direction on which of the competing principles is more important — resource conservation or reduction of life-cycle greenhouse gas emissions — and how an operator should prioritize these in practice.
- Modernize the OSCA regime to reflect the government's climate-related priorities.

Recommendation: Increase certainty around how individual facilities will be treated when regional ambient air-quality objectives are exceeded or nearing exceedance.

Specific opportunities:

- Mandate management actions by operators instead of capping airshed entry for the AIH.
- Clarify expectations for proponents to comply with not-yet-approved regional plans; clarify rollout of binding limits and frameworks once regional plans come in to effect.
- Align the approval process for entry into the AIH airshed with government policy objectives (e.g., prioritizing value-added processing activities).

CONCLUSION

Partial upgrading has the potential to provide economic benefits to Alberta at a lower environmental cost than traditional oil sands processing approaches. The Government of Alberta has taken steps to support the implementation of partial-upgrading technologies, but an enabling regulatory environment must be in place if the full benefits of this investment are to be realized. We reviewed existing Alberta and federal frameworks in an effort to determine how partial upgrading would be regulated. We found, in general, a partial upgrader would be treated as an oil sands processing plant, and the same rules and processes would apply.

The appropriateness of lumping all processing plants together is questionable: these plants can vary widely in inputs, outputs, purposes and potential impacts; inefficiency is certain as firms must comply with broad, potentially irrelevant overarching rules. A risk is that light-touch technology approaches in particular — e.g., those with fewer emissions, fewer waste products and no asphaltene production — will be lumped in with more-intensive approaches and bear the same total regulatory burden. For example, a proponent of an early commercial-stage technology showing a well-below-baseline life-cycle greenhouse gas emissions profile and contributing directly to the objectives of the Energy Diversification Act (2018) may be required to meet application requirements and monitoring and reporting requirements that were designed for large-scale processing plants. The time and resources needed to meet these requirements may prevent the proponent from moving forward with the application process, when in fact approval of the project may be clearly in the public interest.

The most important factors for determining which regulations and approvals apply are not related to technology. Instead, the size, location and nature of the facility (e.g., project expansion or standalone merchant facility) have the greatest bearing on regulatory burden. This is because what most determines the applicable regulatory framework is what crosses the plant boundaries, and not what happens inside. Our review revealed the key causes of regulatory uncertainty are: (1) lack of explicit definition of partial upgrading under law; (2) unpredictable regulatory review and approval timelines; (3) regional commitment to cumulative effects measurement and management; and (4) competing priorities around greenhouse gas emissions management and hydrocarbon development.

REFERENCES

Alberta Energy. 2016. Alb*erta at a Crossroads: Royalty Review Advisory Panel Report 2016.* https://open.alberta.ca/dataset/01b3af57-350c-43ec-8c73-d70fe74523cb/resource/94fca310-354d-4604-bccb-d897c2f68b91/download/2016-royalty-framework-report.pdf.

---. 2018. *Alberta's Partial Upgrading Program Final Application Information and Guidelines.* Version 2.0. July 13.

Alberta Environment and Sustainable Resource Development [ESRD]. 2012. *Capital Region Air Quality Framework.* June. https://open.alberta.ca/dataset/6b5aefc2-581b-4d1b-a5d9-d0dc5d03a85f/resource/95b1c819-b462-4d7f-9526-5eb4258e66fc/download/2012-capitalregionairqualitymanagementframework.pdf.

Alberta Energy Regulator [AER]. 2013. *Draft Directive 023: Oil Sands Project Applications.* May. https://www.aer.ca/documents/directives/DraftDirective023_20130528.pdf.

---. 2014. *Environmental Protection and Enhancement Act Guide to Content for Energy Project Applications.* March. https://www.aer.ca/documents/applications/EPEA_GuideEnergyProjectApplications.pdf.

---. 2017. *Directive 071: Emergency Preparedness and Response Requirements for the Petroleum Industry.* February. https://www.aer.ca/documents/directives/Directive071.pdf.

---. 2018a. *Decision 2018 ABAER 003: Value Creation Inc., Applications to Amend the Heartland Upgrader Project Approvals, Alberta's Industrial Heartland Area.* May 8. https://www.aer.ca/documents/decisions/2018/2018-ABAER-003.pdf.

---. 2018b. *Directive 056: Energy Development Applications and Schedules.* October. https://www.aer.ca/documents/directives/Directive056.pdf.

---. 2018c. *Estimated Application Processing Timelines.* October 31. https://www.aer.ca/regulating-development/project-application/application-processes.

---. 2019a. *Bulletin 2019-03 Applications for Partial Upgraders.* February 19. https://www.aer.ca/documents/bulletins/Bulletin-2019-03.pdf.

---. 2019b. "Environmental Protection and Enhancement Act." Accessed March 21. https://www.aer.ca/regulating-development/project-application/application-legislation/environmental-protection-and-enhancement-act.

Alberta Energy and Utilities Board [EUB]. 2006. *Decision 2006-085: Shell Canada Limited, Application to Expand the Scotford Upgrader, Strathcona County, Fort Saskatchewan.* August 29. https://www.aer.ca/documents/decisions/2006/2006-085.pdf.

---. 2007. *Decision 2007-058: North West Inc. Application to Construct and Operate an Oil Sands Upgrader in Sturgeon County.* August 7. https://www.aer.ca/documents/decisions/2007/2007-058.pdf.

Alberta Government. 2012. *Lower Athabasca Regional Plan 2012-2022.* August. https://landuse.alberta.ca/LandUse%20Documents/Lower%20Athabasca%20Regional%20Plan%202012-2022%20Approved%202012-08.pdf.

---. 2013. *Cumulative effects management system within the industrial heartland and capital region.* April. https://open.alberta.ca/publications/cumulative-effects-management-heartland-capital.

---. 2014. *Energy Ministerial Order 105/2014; Environment and Sustainable Resource Development Ministerial Order 53/2014.* October 31. https://www.aer.ca/documents/actregs/MO105_2014.pdf?0.9198879073129194.

---. 2016. *Energy Ministerial Order 39/2016; Environment and Parks Ministerial Order 16/2016.* March 30. https://www.energy.alberta.ca/Travel/AR78396DMsSignedMOAREPS2016.pdf?0.18347009532787983.

---. 2018. *The Ministry of Energy Annual Report 2017/18.* June. https://open.alberta.ca/dataset/cbd7147b-d304-4e3e-af28-78970c71232c/resource/cfc76a94-3a1b-4220-b3e1-6f10fb72a4fe/download/energy-annual-report-2017-2018.pdf.

---. 2019. *Standard for Establishing and Assigning Benchmarks, Carbon Competitiveness Incentive Regulation.* Version 2.3. January. https://open.alberta.ca/dataset/c7d90ca6-88b3-4b71-9ba8-0ebe6d70c065/resource/97ba67a2-caa1-42a7-9d9f-28d60b65e5ea/download/standard-for-establishing-and-assigning-benchmarks-v2.3.pdf.

Baumgartner, F. R. 2007. "EU Lobbying: A view from the US." *Journal of European Public Policy* 14 (3), 482-488.

Canada. 2019a. *Information and Management of Time Limits Regulations: SOR/2019 283.* http://www.gazette.gc.ca/rp-pr/p2/2019/2019-08-21/html/sor-dors283-eng.html.

---. 2019b. *Physical Activities Regulations: SOR/2019-285.* https://www.impactassessmentregulations.ca/8869/documents/18357/download.

Canadian Association of Petroleum Producers [CAPP]. 2018. "Update: A Competitive Policy and Regulatory Framework for Alberta's Upstream Oil and Natural Gas Industry." Canadian Association of Petroleum Producers 2018-0041. https://www.capp.ca/publications-and-statistics/publications/325035.

Canadian Council of Ministers of the Environment [CCME]. 2019. "CAAQS." Accessed Mar. 21. https://www.ccme.ca/en/current_priorities/air/caaqs.html.

Council of Canadian Academies. 2019. *Greater Than the Sum of Its Parts: Toward Integrated Natural Resource Management in Canada.* Council of Canadian Academies. https://cca-reports.ca/reports/the-state-of-knowledge-and-practice-of-integrated-approaches-to-natural-resource-management-in-canada/.

Energy Diversification Advisory Committee. 2018. *Diversification, Not Decline: Adapting to the new energy reality.* https://open.alberta.ca/dataset/e9b60ddd-26f8-4f54-ae43-b03b23fb3925/resource/56b02374-e500-427c-a737-b1a632459aa6/download/goa-00905-edac-book-final-web.pdf.

Energy Resources Conservation Board [ERCB]. 2009. *Decision 2009-002: Petro-Canada Oil Sands Inc., Application to Construct and Operate an Oil Sands Upgrader in Sturgeon County.* January 20. https://www.aer.ca/documents/decisions/2009/2009-002.pdf.

---. 2010. *Decision 2010-030: TOTAL E&P Canada Ltd., Application to Construct and Operate an Oil Sands Upgrader in Strathcona County.* September 16. https://www.aer.ca/documents/decisions/2010/2010-030.pdf.

Environment and Climate Change Canada [ECCC]. 2018. Clean Fuel Standard Regulatory Design Paper. December. https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/clean-fuel-standard-regulatory-design-paper-2018-en-1.pdf.

Fellows, G. Kent and Aidan Hollis. 2013. "Funding innovation for treatment for rare diseases: adopting a cost-based yardstick approach." *Orphanet Journal of Rare Diseases* 8(1), 180. doi: 10.1186/1750-1172-8-180.

Fellows, G. Kent, Robert Mansell, Ronald Schlenker and Jennifer Winter. 2017. "Public-Interest Benefit Evaluation of Partial-Upgrading Technology." *The School of Public Policy Publications* 10 (1). doi: 10.11575/sppp.v10i0.42615.g30496.

Gordon, Deborah, Adam Brandt, Joule Bergerson and Jonathan Koomey. 2015. *Know Your Oil: Creating a Global Oil-Climate Index.* Carnegie Endowment for International Peace. https://carnegieendowment.org/2015/03/11/know-your-oil-creating-global-oil-climate-index-pub-59285.

Government of Alberta. 2014. *The Government of Alberta's Guidelines on Consultation with First Nations on Land Management and Resource Management, 2013.* July 28. http://indigenous.alberta.ca/documents/First_Nations_Consultation_Guidelines_LNRD.pdf.pdf?0.3310840202472094.

---. 2017. *North Saskatchewan Region Air Zone CAAQS Response Government of Alberta Action Plan.* September. https://open.alberta.ca/dataset/833bd7f4-197a-4541-9dc7-9528d820e05d/resource/8f3c3b9c-f628-44a7-b022-c0ca7f21a194/download/northsaskatchewancaaqs-actionplan-sep2017.pdf.

---. 2018. *Upgraders and Refineries Facts and Stats.* November. https://open.alberta.ca/dataset/98c15cad-c5d9-4d96-b39c-423210a3050c/resource/7367e817-4fea-4744-a80c-0a81ce5fc907/download/factsheet-upgraders-and-refineries.pdf.

---. 2019a. *Alberta Ambient Air Quality Objectives and Guidelines Summary.* January. https://open.alberta.ca/dataset/0d2ad470-117e-410f-ba4f-aa352cb02d4d/resource/4ddd8097-6787-43f3-bb4a-908e20f5e8f1/download/aaqo-summary-jan2019.pdf.

---. 2019b. *Alberta's Proposed Technology Innovation and Emissions Reduction System: Discussion Document.* July 9. https://open.alberta.ca/dataset/8c6d1e31-cd21-4d08-ba25-688c533a3cec/resource/b8ae91bf-8626-485c-a86d-9209a0a24a4c/download/discussion-document-tier-engagement.pdf.

---. 2019c. "Attracting investment in petrochemicals." October 23. https://www.alberta.ca/release.cfm?xID=64693C0FB74D7-F065-9297-32348E2C11FB5D74.

Hoberg, George and Jeffrey Phillips. 2011. "Playing defence: Early responses to conflict expansion in the oil sands policy subsystem." *Canadian Journal of Political Science/Revue canadienne de science politique* 44 (3): 507-527. doi: 10.1017/S0008423911000473.

House of Commons of Canada. 2019. Bill C-69: An Act to enact the Impact Assessment Act and the Canadian Energy Regulator Act, to amend the Navigation Protection Act and to make consequential amendments to other Acts (Royal Assent). June 21. Accessed July 12, 2019. https://www.parl.ca/DocumentViewer/en/42-1/bill/C-69/royal-assent.

Keesom, Bill and John Gieseman. 2018. "Bitumen Partial Upgrading 2018 Whitepaper." Jacobs Consultancy. https://albertainnovates.ca/wp-content/uploads/2018/05/Bitumen-Partial-Upgrading-2018-Whitepaper-2433-Jacobs-Consultancy-rev7.pdf.

Province of Alberta. 1993a. *Approvals and Registrations Procedure Regulation.* Alberta Regulation 113/1993 with amendments up to and including Alberta Regulation 89/2013: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Regs/1993_113.pdf.

---. 1993b. *Environmental Assessment (Mandatory and Exempted Activities) Regulation.* Alberta Regulation 111/1993 with amendments up to and including Alberta Regulation 54/2017: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Regs/1993_111.pdf.

---. 1993c. *Environmental Assessment Regulation.* Alberta Regulation 112/1993 with amendments up to and including Alberta Regulation 89/2013: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Regs/1993_112.pdf.

---. 2000a. *Environmental Protection and Enhancement Act.* Revised Statutes of Alberta, 2000 Chapter E-12: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/acts/e12.pdf.

---. 2000b. *Oil and Gas Conservation Act.* Revised Statutes of Alberta, 2000 Chapter O-6: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Acts/O06.pdf.

---. 2000c. *Oil Sands Conservation Act.* Revised Statutes of Alberta, 2000 Chapter O-7: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Acts/O07.pdf.

---. 2003a. *Activities Designation Regulation.* Alberta Regulation 276/2003 with amendments up to and including Alberta Regulation 125/2017: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/regs/2003_276.pdf.

---. 2003b. *Climate Change Emissions and Management Act.* Statutes of Alberta, 2003 Chapter C-16.7: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Acts/C16P7.pdf.

---. 2009. *Alberta Land Stewardship Act.* Statutes of Alberta, 2009 Chapter A-26.8: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Acts/A26P8.pdf.

---. 2011. *Alberta Land Stewardship Regulation.* Alberta Regulation 179/2011 with amendments up to and including Alberta Regulation 114/2016: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Regs/2011_179.pdf.

---. 2012. *Responsible Energy Development Act.* Statutes of Alberta, 2012 Chapter R-17.3: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Acts/r17p3.pdf.

---. 2013a. *Alberta Energy Regulator Rules of Practice.* Alberta Regulation 99/2013 with amendments up to and including Alberta Regulation 71/2018: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Regs/2013_099.pdf.

---. 2013b. *Responsible Energy Development Act General Regulation.* Alberta Regulation 90/2013: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Regs/2013_090.pdf.

---. 2016. *Oil Sands Emissions Limit Act.* Statutes of Alberta, 2016 Chapter O-7.5: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Acts/O07p5.pdf.

---. 2017. *Carbon Competitiveness Incentive Regulation.* Alberta Regulation 255/2017 with amendments up to and including Alberta Regulation 199/2018: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Regs/2017_255.pdf.

---. 2018. *Energy Diversification Act.* Statutes of Alberta 2018 Chapter E-9.6: Alberta Queen's Printer. http://www.qp.alberta.ca/documents/Acts/E09P6.pdf.

Tombe, Trevor. 2015. "Better off Dead: 'Value Added' in Economic Policy Debates." *The School of Public Policy Publications* 8 (9). doi: https://doi.org/10.11575/sppp.v8i0.42508.

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