EQUITY RESEARCH

**Dennis Fong, P.Eng.**
+1 403-216-3400
Dennis.Fong1@cibc.com

**Shaz Merwat**
+1 416-956-6428
Shaz.Merwat@cibc.com

**Paul Ryu, CPA**
+1 403-216-8518
Paul.Ryu@cibc.com

**Sina Keivani, CFA**
+1 403-221-5854
Sina.Keivani@cibc.com

**October 25, 2020** **ESG**

# How Canadian Oil Sands Companies Are Aiding In The Energy Transition

## A Dive Into Canada's Role In Reducing GHG Intensity

**Sector:**
Energy


### Our Conclusion

Even when faced with a perceived existential crisis, Canadian oil sands companies are motivated and can leverage core competencies to participate in the energy transition. Projects and operations like cogeneration, carbon capture and sequestration, $CO_2$ flooding, and wind farms are not only helping to improve the GHG intensity of the electrical grid (equivalent to removing over 4.5 million cars annually from the road), but they are also driving lower supply costs for producers at competitive rates of return.

We highlight MEG as showing the lowest GHG intensity per Bbl and CNQ and SU as standout leaders in improving carbon emissions and transparent disclosure for their oil sands operations.

### Key Points

Contrary to mainstream belief, oil sands operators and government policymakers all have a mutual interest in lowering $CO_2$ and the energy-intensity of operations. It is in the oil sands companies' best interest to lower GHG intensity since ~70% of initial project costs are related to steam generation and water-handling facilities, and up to ~40% of opex is related to energy consumption.

In a demand-constrained world, and despite policymaker concerns, we do not believe the oil sands will hit the 100 MT provincial carbon emissions cap because companies have turned their attention to brownfield in situ expansions, deploying technology or employing debottlenecking techniques, which can help drive lower per Bbl costs and also decrease GHG intensity. Despite the challenging environment, the oil sands companies have an enduring nature and a track record of innovation, helping Canada maintain globally competitive ESG standards.

When isolating the upstream operations, oil sands extraction has a higher energy requirement compared to lighter grades of crude oil, and represents only up to ~30% of total GHG intensity. If emissions related to the consumption of the refined product are included, Canadian-sourced heavy barrels are competitive (within 10% of the global average for the majority of oil sands barrels even before applying the impacts of new technology).

Oil sands companies have focused on innovation and technology to remain competitive in a volatile commodity price environment and have advanced solvent/steam hybrid extraction pilot projects to commerciality. IMO's recently sanctioned Grand Rapids not only uses technology that has demonstrated up to a 30% decrease in $kgCO_2e$/Bbl vs. traditional SAGD, but it is also a retrofit project that uses existing steam generation more efficiently, allowing for production growth with little incremental (gross) GHG emissions.

*All figures in Canadian dollars unless otherwise stated.*

For required regulatory disclosures please refer to "Important Disclosures" beginning on page 24.

# Table Of Contents

# Executive Summary

Faced with the country's push to transition towards cleaner energy, Canadian oil sands companies appear to be facing an existential crisis. However, we believe these companies are not only motivated to participate in the energy transition because many initiatives to reduce GHG intensity also make operations more efficient, save costs, and improve rates of return, but have actively looked to implement many of these changes already. We also think Canadian production is resilient enough to weather this transition given the relatively lower sustaining capital cost required to maintain production compared to other jurisdictions. In the current demand-constrained commodity price environment, we believe oil sands companies will focus on capitally efficient brownfield expansions or debottlenecking initiatives that can help drive lower per Bbl costs and also help decrease GHG emissions.

### Key Points

- **Aligned interests.** Oil sands producers, climate-focused regulators and environmentally centric government policy all have a mutual interest in lowering $CO_2$ and the energy-intensity of oil operations. It is in the oil sands companies' best interest to lower GHG intensity since ~70% of their initial project costs are related to steam generation and water-handling facilities (the highest energy-intensive processes), and up to ~40% of opex is related to energy consumption.
- **Canada's barrels are more GHG-intensive.** Oil sands barrels do have a higher energy requirement when considering only the upstream components of extraction. When we include emissions related to the consumption of the final refined product, Canadian-sourced oil sands production is at most within 25% of the global average, but a majority of the production within 10% before applying the impacts to new technologies.
- **Doing more than producing and transporting oil.** Canadian companies are investing in projects that are helping reduce GHG emissions in other ways outside of extraction. These initiatives include the use of cogeneration, carbon capture and sequestration (CCS), enhanced oil recovery (EOR) using $CO_2$, renewable investments (wind farms and ethanol plants), and creating a connected network of EV charging stations. Together, we estimate these initiatives will lower Alberta's emissions by ~19.6 million tonnes of $CO_2$ per year or the equivalent of ~4.5 million cars.
- **Reservoir quality is the primary determinant.** Higher-quality reservoirs (i.e., where rock is more permeable and homogenous) require less steam for extraction, which results in lower initial capital expenses and operating costs, and less carbon intensity. We highlight Christina Lake (MEG) and Jackfish (CNQ) as having the lowest SORs (steam-oil ratio) and Primrose and Wolf Lake (CNQ) and Cold Lake (IMO) as having the highest. While technology can help oil sands assets remain competitive in a carbon-constrained world, it must be applied to high-quality reservoirs.
- **Technology is a potential game changer.** We expect technology will be the primary driver of lowering carbon intensity. For example, the use of solvents, electromagnetic energy or other advancements can lower or eliminate the use of steam. We expect $CO_2$ emission intensity can be lowered ~25% using solvent-related technologies that are now commercial, and up to ~70% to 80% using technology that is now being piloted and can almost eliminate the use of steam like EASE and NSolv. An outline of our expectations and summaries around each technology is shown on pages 14 to 25.
- **Standardization of disclosure is important.** Full adoption of ESG-based investing is becoming a major focus, and appropriate and fulsome disclosure standards are needed to improve both intra- and inter-industry comparability. We believe the mass adoption of ESG-based portfolio management and appropriate carbon-related disclosure could provide better transparency for Western Canada's role as a participant in the energy transition.

## What Is ESG And Why Does It Matter?

ESG stands for Environmental, Social and Governance and revolves around policies a company has developed to govern the sustainability of its operations. What we have seen so far is a focus on the “E” (environment) and, to a lesser extent, the “G” (governance) components of this theme. We will be looking for energy companies to provide more clarity around the “S” component, or commentary around their social impact on communities, and on local First Nations bands in particular. We expect energy companies to focus on this aspect of “ESG” more closely given increasing institutional interest. It is by addressing all components of ESG that the Canadian energy industry can move away from its international reputation as “dirty” or higher GHG oil and increase the understanding of practical initiatives that lower carbon intensity and help improve the livelihood of those in local communities.

ESG and sustainability have become and will continue to grow as an important component of investment strategy as large pension funds, endowments, mutual funds and other money managers scrutinize where and how their capital is invested. We believe that, with this increased scrutiny, access to capital will be closely related to the quality of a company’s ESG disclosure, as well as its track record showing continual improvement or outperformance in sustainability metrics.

In this introduction to ESG, our focus is on carbon emissions, technology that can help decrease the environmental impact of oil sands, how companies are improving sustainability, and our view of the current disclosure standards. We expect future publications will focus on other environmental factors like air quality and water usage, and heavy oil’s place in an EV world, as well as social factors like the impact of local oil and gas development on Indigenous peoples, and the governance of companies within the Canadian energy industry.

Many discussions about climate change specifically tend to judge in absolutes; we will endeavour to avoid this and instead help educate institutions and corporations from an objective view.

## Feel-good Investing: Disclosure And Third-party Scoring

Companies with strong social and governance practices have a tendency to outperform because they are considered to have lower potential ethical or headline risks. We believe good and fulsome ESG disclosure can help companies gain better access to capital. Unfortunately, given the early stage of ESG and sustainability reporting, we believe investors have found it difficult to appropriately screen and compare companies given the varied and unique assumptions each company has made in their own disclosure and the opacity of third-party scoring.

We believe third-party surveys (such as those that provide scoring from Sustainalytics, CDP and MSCI) can help provide a good first screening of companies on ESG criteria. It is important to understand the nature of a particular grade a company receives, which could range in meaning from quality and transparency of disclosure or establishment of corporate goals to the actual quantitative performance of positively impacting the environment or society through operations. Further, we believe some nuances aren’t fully captured by just evaluating a score on companies and the impacts each company is making towards sustainable development. Similar to financial characteristics, further digging is highly recommended (and generally required) to fully understand the potential risks and upside associated with ESG factors that could influence share price performance. Corporate adoption of TCFD (Taskforce on Climate-related Financial Disclosure) standards, use of SASB (Sustainability Accounting Standards Board) criteria to evaluate materiality of climate change risks, and the inclusion of sustainability within quarterly and annual disclosure are important steps, but can leave a lot to be desired from each investor’s criteria for investing.

We favour companies that have adopted the TCFD standards and use the SASB criteria to evaluate ESG-based risks within financial disclosure to improve transparency (even beyond the publishing of a sustainability report). We believe that transparency—both in the assumptions companies make and how they calculate quantitative metrics—is paramount in benchmarking, but that a qualitative understanding of how companies manage ESG-related risks is equally helpful for investors to gain confidence in a company's plan.

## Difficulties In Benchmarking Third-party ESG Scoring

ESG reporting and disclosure is unique to each company. Coupled with the early-stage nature of ESG scoring and carbon disclosure from an accounting perspective makes comparability difficult. Our report will focus on what companies have been doing operationally to lower carbon intensity, the nuance behind benchmarking companies, and what we view as the most important metrics and the potential holes in current disclosure. We have highlighted two anecdotal examples of situations where assumptions in surveys could unintentionally misconstrue information. We expect examples like this to be few and far between, but they illustrate the early-stage nature of some disclosure standards that aren't appropriate for oil sands-specific operations.

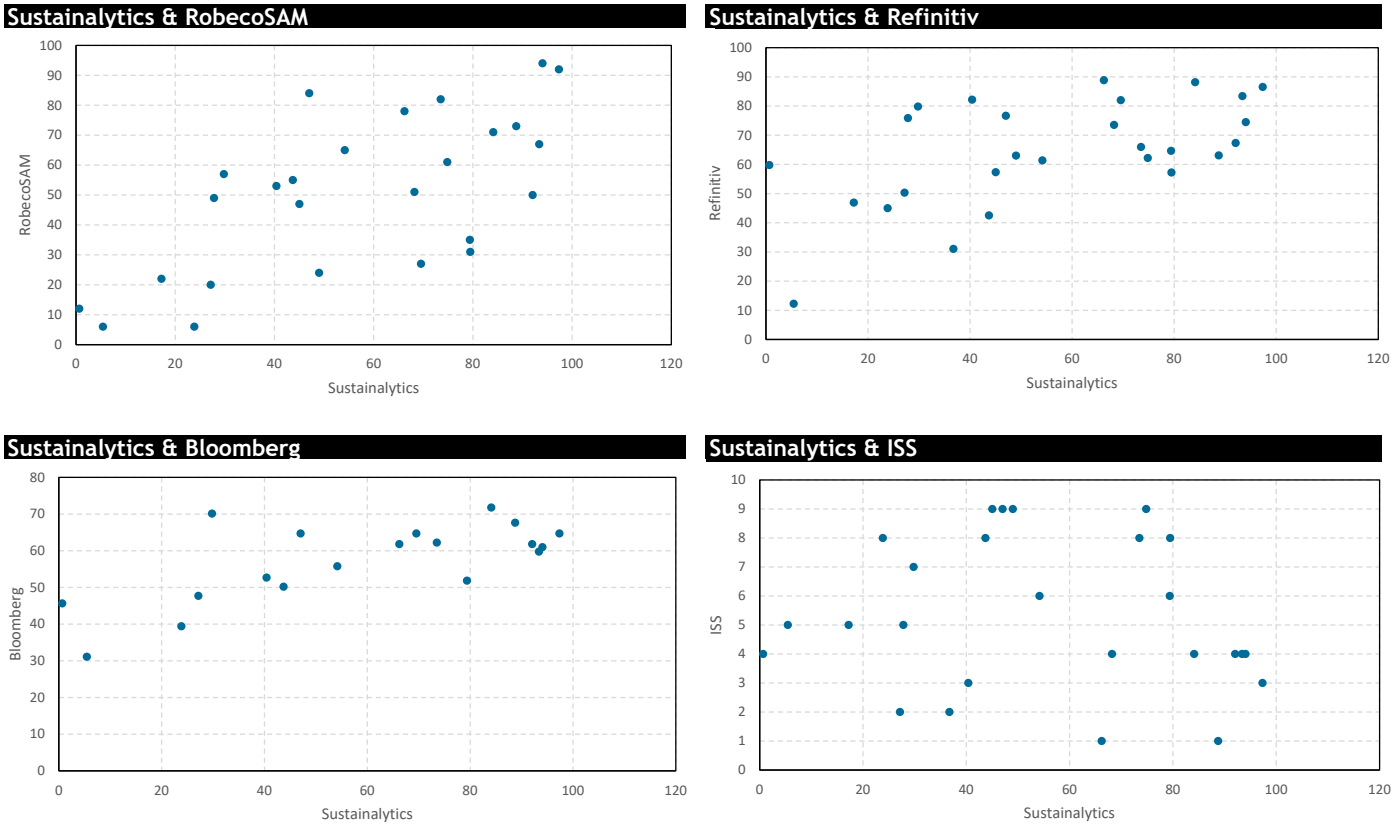
1) **Produced water/bitumen emulsion from SAGD projects.** Steam is injected into reservoirs to heat and improve mobility of heavy oil underground; the steam eventually condenses into water, and is considered "produced" along with bitumen. This water, which is >90% recycled and was injected as part of the steaming process, is counted as "new" produced volumes in some ESG surveys, skewing water consumption significantly higher.

2) **Offsetting nature of cogeneration and its impact on carbon intensity.** Companies with installed cogeneration capacity can sell excess power into the grid. As the oil sands operations use steam as part of their extraction process, capturing any excess heat to generate electricity means a more efficient use of that energy. In Alberta, the electrical grid predominantly uses higher-carbon coal-fired generators and the act of selling lower-GHG natural gas-fueled electricity would have a net positive impact to provincial GHG intensity, even if natural gas consumed at the plant was higher than its peers (or for the extraction of bitumen).

## What Are We Looking For When Evaluating ESG Scoring?

We view the use of third-party ESG scoring as helping provide benchmark comparisons between different companies and even sectors, but the key drivers of each provider's screening methodology when evaluating the space is just as, if not more, important than the numerical score or letter grade. Given there are multiple sources with potentially different screening practices and assumptions, we appreciate that this can cause variability in the rankings and scores of individual companies and even make cross-sector comparisons difficult without an acute understanding of puts-and-takes of each provider's methodologies. We highlight a correlation analysis of Sustainalytics, RobecoSAM, ISS, Refinitiv and Bloomberg ESG Disclosure in the exhibit below.

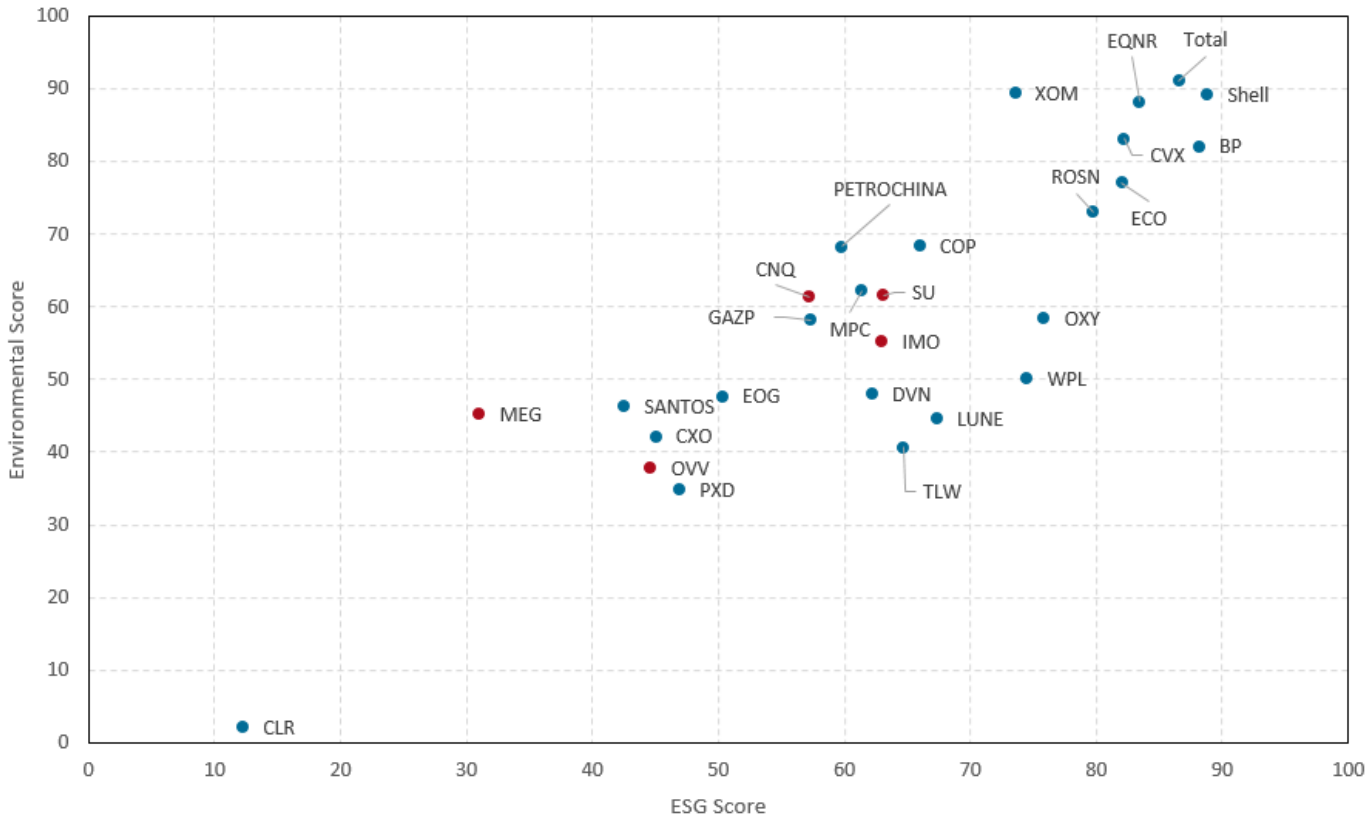
## Exhibit 1: Relationship Between Sustainalytics And RobecoSAM, Refinitiv, ISS And Bloomberg




Source: Bloomberg, Refinitiv, and CIBC World Markets Inc.

We believe it is important to be aware of the potential differences across each platform and that investors could be better served with understanding the reasons behind increases or decreases to a company's scores through time. We also understand that fundamentally the energy-intensity of extracting natural gas is significantly lower than that of conventional oil and oil sands, which can lead to unfair comparisons especially when also considering the relative end use of each commodity. We highlight that, by nature, companies with higher natural gas weightings should have lower GHG intensity and could score better on environmentally focused metrics. Notwithstanding these considerations, we view Canada to be a sustainable place to do business and the oil sands companies score competitively from a complete ESG vantage point despite showing relatively more GHG-intensive operations.

**Exhibit 2: Environmental Vs. ESG Scores From Refinitiv**



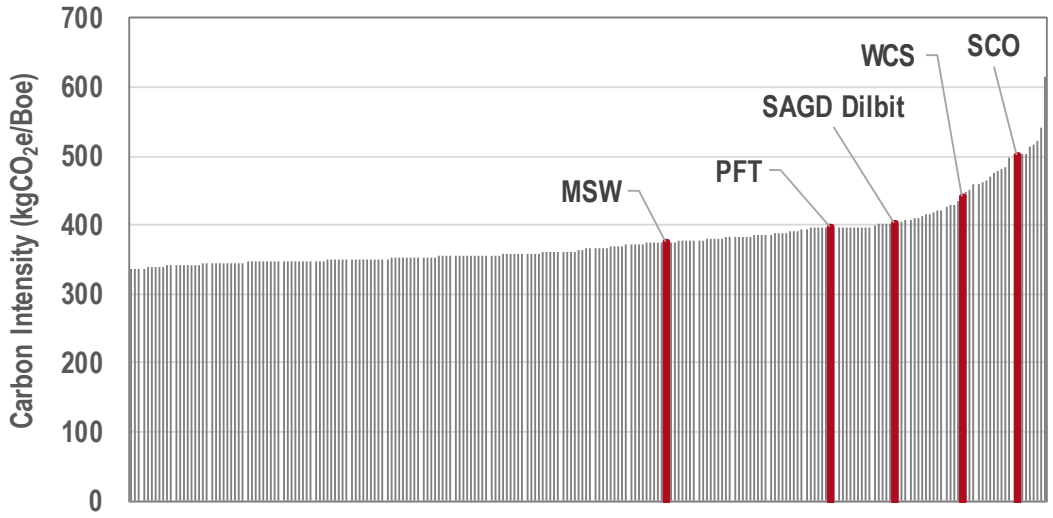

Source: Refinitiv and CIBC World Markets Inc.

We expect Western Canadian oil and gas companies will improve their scores with third-party ESG evaluators as understanding grows amongst them about the nature of the questionnaires, and as a continuous feedback loop between the corporates and evaluators increases accuracy and captures more nuance behind disclosures.

## How Have Canadian Oil Sands Companies Stacked Up?

Admittedly, oil sands operations have a higher energy requirement when only considering the upstream components of extraction; when we include emissions related to the consumption of the refined product, heavy barrels are comparable to those produced from lighter sources. While this is a stark difference, upstream extraction and processing only represent 20% to 30% of the total GHG intensity from a barrel of oil, while up to 80% of the total emissions stem from its combustion. We estimate from a well-to-wheels basis, Canadian-sourced oil sands production is at most within 25% of the global average GHG intensity of a barrel of oil, but a majority of the production is within 10% before applying the impacts of new technologies. In addition, plotting conventional oil, shale and oil sands on the same chart is an unfair comparison given the significant differences in operations and exposures to the life cycle of a barrel. For example, the heavier ends from bitumen can be used as asphalt to pave roads and will not undergo combustion (helping lower the average full-cycle intensity).

**Exhibit 3: Comparative Global Carbon Intensity (Wells To Wheels)**




Notes: Assumptions of 28 $kgCO_2e$/Bbl associated with refining and 300 $kgCO_2e$/Bbl associated with combustion.
MSW = Mixed Sweet Blend, PFT = Parafinnic Froth Treatment, SAGD = Steam Assisted Gravity Drainage, WCS = Western Canadian Select, SCO = Synthetic Crude Oil.

Source: California Air Resources Board and CIBC World Markets Inc.

We believe oil sands companies have improved their operating efficiency, which drives lower carbon intensity, as well as their disclosure, and that they are on track to meet near-term goals for improved sustainability. We are focused on how companies within our coverage universe are setting goals for further improvement in operating efficiencies, investment in new technology, application of technology, and reservoir quality (in situ).

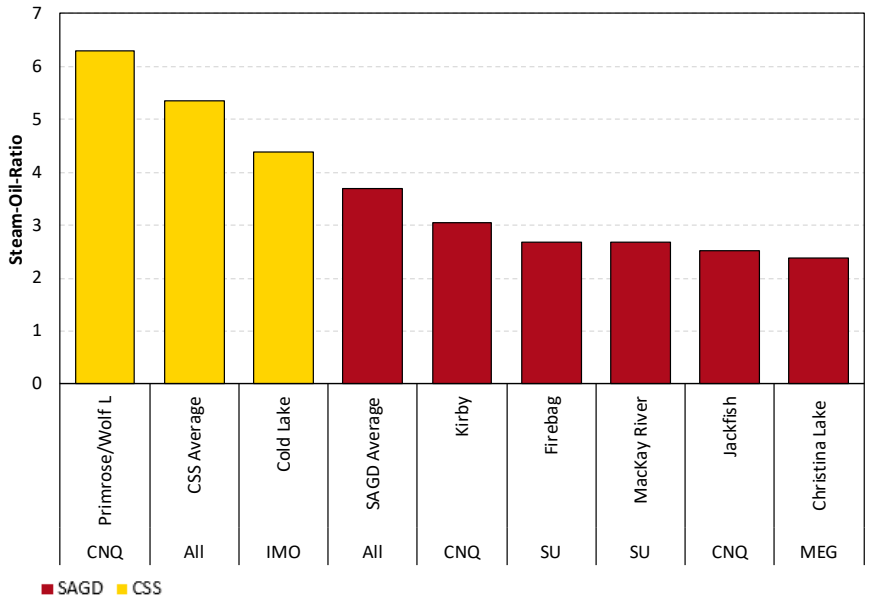
## The Oil Sands And Emissions

Oil is produced from oil sands in one of two ways: surface mining for those oil deposits that are shallow (less than ~75 metres deep), and in situ extraction for deeper (>200 metres deep) oil deposits. We estimate that 20% of the resource can be developed with surface mining, but the majority (~80%) of the resource would need to be produced through small surface disturbance well pads and in situ extraction techniques.

### In Situ Oil Sands Development

We measure energy intensity from in situ operations primarily through the steam-to-oil ratio (SOR), which is the relative amount of steam required to liberate a single barrel of bitumen and bring it to the surface. A project's SOR is influenced by oil quality (API gravity and viscosity), formation depth, permeability, oil saturation, application of technology, and the quality of the operation. A higher SOR generally indicates a lower-quality reservoir and/or a more expensive extraction process where higher initial capital spending is required to build out steam-generation and produced-water-handling capacity, but also greater energy intensity.

## Exhibit 4: 2019 Steam-to-oil Ratio By Operator




Note: Averages are not volume weighted. CSS = Cyclic Steam Stimulation

Source: AER, company reports and CIBC World Markets Inc.

SAGD (steam-assisted gravity drainage) is the predominant technology currently used for in situ development. It involves the production of steam at a central processing facility that is then injected into a horizontal well that has been drilled into an underground heavy oil deposit. The steam heats up and mobilizes the bitumen, which drains into a second parallel well drilled at the bottom of the deposit, where it is then pumped to the surface.

Looking forward, we expect companies to focus on different technologies such that new production will be increasingly derived using less energy- and water-intensive methods. In the exhibit below, we summarize our expectations for the production methods used at various Canadian future in situ developments, split between thermal in situ (i.e. SAGD) and more predominantly solvent in situ.

## Exhibit 5: Potential In Situ Developments

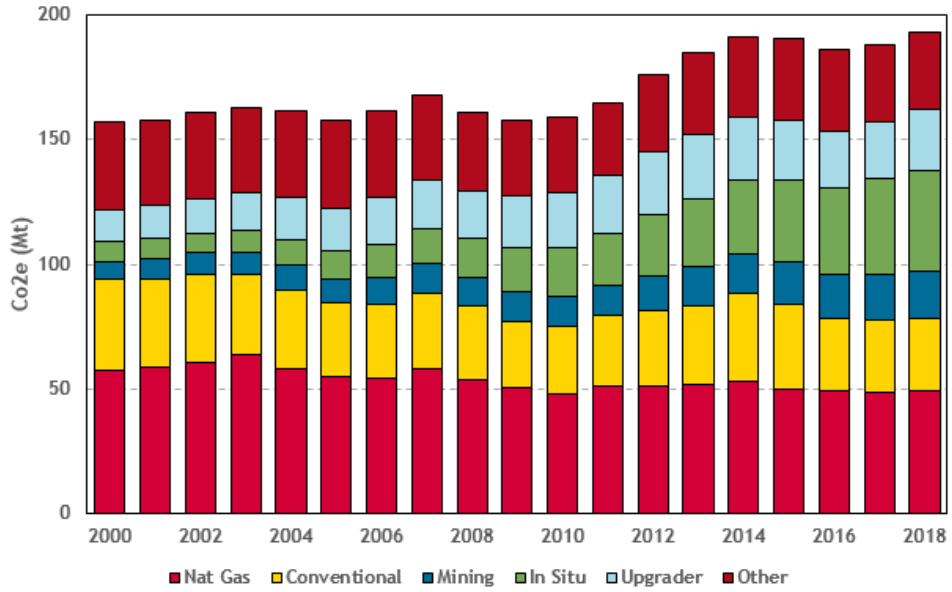
| Company | In Situ Developments | Potential Recovery Method | SOR | GHG | Potential Production Capacity (MBbl/d) |
|---|---|---|---|---|---|
| Canadian Natural | Kirby North expansion, Grouse, Gregoire, Primrose expansion, Pelican, Lindbergh | Solvent Enhanced | ~50% improvement to thermal and in situ average (CSS & SAGD) | ~50% improvement to thermal and in situ average (CSS & SAGD) | ~285 |
| Imperial Oil | Grand Rapid, Aspen | SA-SAGD | ~25% improvement to SAGD | ~25% improvement to SAGD | ~110 |
| Suncor | Meadow Creek, Lewis | ES-SAGD | improvement to thermal and in situ average | improvement to thermal and in situ average | ~250 |

Source: Company reports and CIBC World Markets Inc.

As solvent-assisted projects gain approval to be developed commercially, we believe that heavy oil production could continue to grow without an appreciable increase in overall $CO_2$ emissions; this could lower the per Bbl GHG intensity overall, and could even drive carbon emissions lower. We also highlight the improvements shown in newer oil sands mining

technology such as PFT, which shows per Bbl GHG intensity of less than half of other oil sands mining treatment technology (which is over 30 years old).

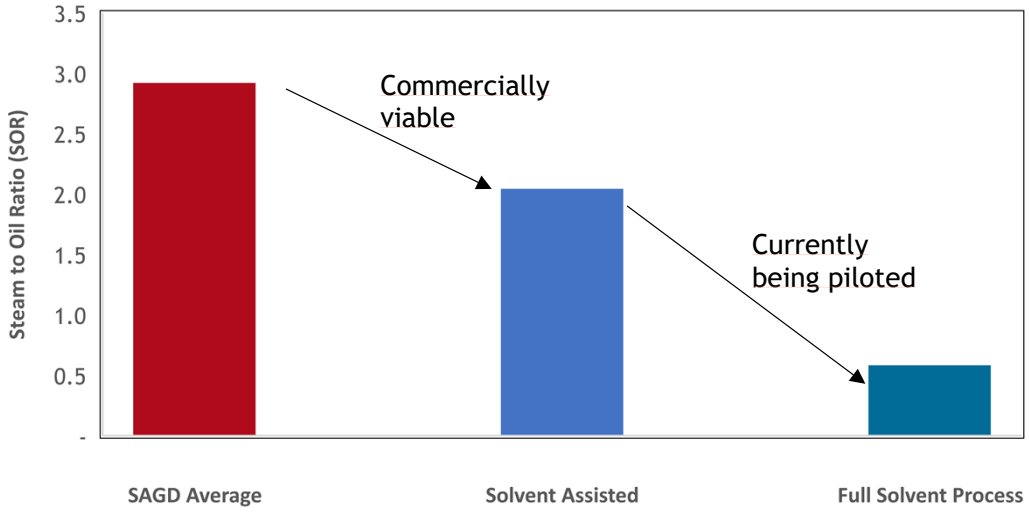
**Exhibit 6: Oil And Gas Sector GHG Emissions For Canada**




Source: Natural Resources Canada and CIBC World Markets Inc.

We have seen a trend of improving carbon intensity through the use of more efficient boilers, partial upgrading techniques for mining, conversion of high carbon coke-fired boilers to cogeneration, autonomous haul (AHS) technology, and higher usage of in situ vs. mining extraction. We expect debottlenecking initiatives at the oil sands mines and the potential use of solvents could drive further reductions in energy intensity by up to ~70% on future projects.

**Exhibit 7: Estimated SOR improvements From Solvent Technology**




Source: Alberta Energy Regulator, company reports and CIBC World Markets Inc.

Given the large fixed costs of oil sands operations, improving output efficiently through debottlenecking or the use of technology will aid in lowering carbon intensity and unit supply cost, making barrels more competitive for a world in the middle of an energy transition. We believe it is unlikely that any greenfield oil sands mining project will be sanctioned given the

upfront capital costs, the current commodity price, and the longer-term outlook for oil demand.

## How Are Canadian Energy Companies Improving Sustainability?

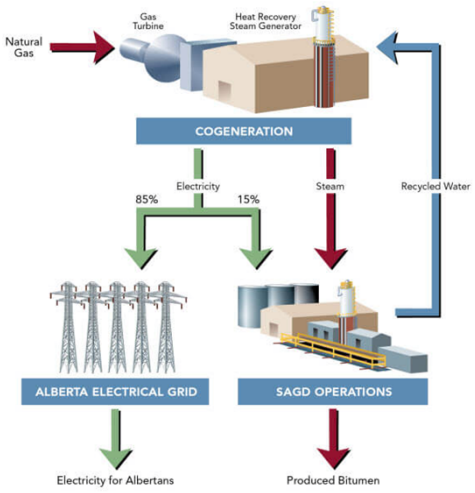
Outside of applying new technology to the extraction of bitumen, we believe companies in the WCSB are embracing the energy transition and investing in projects that have positive impacts on GHG emissions. Below, we explore specific examples of how companies are trying to reduce their reliance on coal-fired electrical generation, using carbon capture and sequestration (CCS) and enhanced oil recovery (EOR), helping to develop wind farms, and building out Canada's first connected EV charging station network.

### Greening The Grid

The carbon emissions of oil sands companies depend on each facility's unique energy requirements for extracting crude oil or bitumen as well as its source of energy. Companies have used three primary sources of power in the oil sands: coke-fired boilers, power off the grid, and cogeneration. It continues to be in the best interest for oil sands producers to improve the efficiency of their energy consumption, and we believe cogeneration is the most efficient method of heat and power generation.

Cogeneration is a process involving the combustion of natural gas to generate heat (steam) and electricity. The heat/steam is used in extraction processes for the oil sands facility and the excess electricity is fed back into the province's grid. Cogeneration units are sized for their steam requirements, but can produce excess electricity as a "by-product".

**Exhibit 8: Cogeneration Process**




Source: MEG Energy.

A high proportion of Alberta's electricity is generated through the combustion of coal. By using cogeneration units at their facilities, companies contribute to lowering the carbon intensity of the provincial grid because they are using natural gas to generate power for both their operations and also to feed back into the provincial grid. In the exhibit below, we highlight the oil sands facilities and refineries where cogeneration is being used. We estimate these facilities are helping offset over 2.5 GWh of coal-based power generation with natural gas-based cogeneration; this helps reduce GHG intensity from Alberta by ~8.3 million $tCO_2e$ annually, which is the equivalent of removing 1.9 million cars from the road each year.

**Exhibit 9: Major Cogeneration Plants**

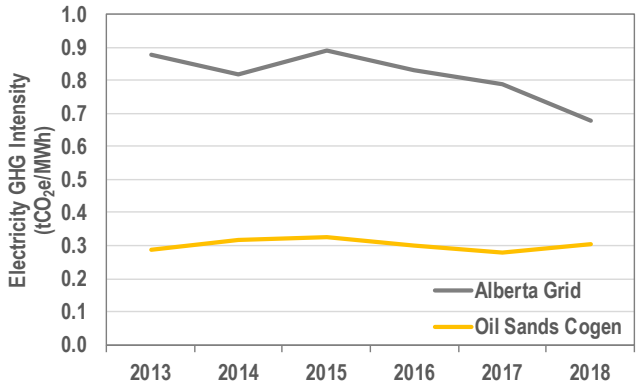
| Operating Company | Cogen Plants | Power Production Capacity (MWh) |
|---|---|---|
| Suncor | Base Plant | 50 |
| | Fort Hills | 199 |
| | Firebag | 497 |
| | Mackay River | 207 |
| | Poplar Creek | 376 |
| Imperial | Strathcona | 43 |
| | Sarnia | 95 |
| | Nanticoke | 10 |
| | Kearl | 84 |
| | Cold Lake | 340 |
| | Syncrude | 500 |
| MEG | Christina Lake | 200 |
| Canadian Natural | Horizon | 210 |
| | Muskeg River | 210 |
| | Primrose | 100 |

Source: AESO, company reports and CIBC World Markets Inc.

We believe projects like Suncor's Base Plant coke-fired boiler retirement program will improve the company's $CO_2$ emissions, and also help reduce other pollutants like NOx and SOx to minimal levels. This project has the added benefit of removing an aged piece of equipment, thereby lowering sustaining capital costs, decreasing $CO_2$ emissions (gross), and helping improve the Alberta grid's GHG intensity. The cumulative impact of cogeneration from Suncor's Base Mine oil sands facilities (vs. coal-fired electrical generation) could offset ~2.5 million tonnes of annual $CO_2$ emissions from the grid in Alberta, which is equivalent to removing 580,000 cars from the road.

We note that cogeneration represents a near-term benefit for oil sands companies in Alberta's energy transition only as long as the province relies on coal-fired generation. Currently, cogeneration allows companies to recoup their initial capital investment by improving the efficiency of their operations, selling power back to the grid, and earning carbon credits. If the provincial grid transitions to low-intensity generation (such as from solar, wind or other renewables), cogeneration would then become an above-average carbon contributor. At that point, oil sands companies would lose the positive economics around installing cogeneration capacity.

**Exhibit 10: Alberta Power Grid Carbon Intensity**




Note: Cogen emissions are calculated net of emissions associated with heat/steam.

Source: Alberta Environment and Parks, Environment and Climate Change Canada and CIBC World Markets Inc.

## Carbon Capture And Sequestration (CCS)

Through the process of upgrading bitumen, $CO_2$ is produced when heavy oil is upgraded into synthetic light oil or refined into products like gasoline, jet fuel and diesel. The Quest CCS facility extracts $CO_2$ from the process, pressurizes the gas and permanently injects it underground into a reservoir. Quest is 70% owned by Canadian Natural Resources and is operated as a part of the Athabasca Oil Sands Project (AOSP), which was acquired by CNQ in 2017. Quest captures and stores approximately one million tonnes of $CO_2$ per year or the equivalent of emissions from 230,000 vehicles.

Canadian Natural also captures carbon at its Horizon facility and the recently completed North West Refinery. Together these projects capture and remove up to ~2.7 million tonnes of $CO_2$ per year, or the equivalent of ~625,000 vehicles.

## $CO_2$ Injection To Enhance Oil Recovery (EOR)

A specific example of how Western Canadian energy companies are using $CO_2$ to enhance oil recovery is the Weyburn unit's carbon sequestration project (operated by Whitecap Resources). The unit purchases carbon dioxide from the Boundary Lake Dam Power Station in Estevan, Saskatchewan and a coal gasification project in North Dakota and injects it into the reservoir helping maintain oil production. The project has production of ~23,400 Boe/d and a shallow decline rate of 3% to 5% because of the EOR scheme. The company estimates ~1.8 million tonnes of $CO_2$ are injected into the reservoir each year and over 31 million tonnes have been injected since 2000, which is the equivalent of removing ~7.2 million cars from the road for a year.

## Wind Farms

Suncor started spending on the Forty Mile Wind Power Project located in southeastern Alberta. The pace of development has slowed to ~2 years because of the COVID-19 pandemic, but was not halted. With the installation of 400 MWh of power production capacity through two phases, we estimate that Suncor can help reduce the GHG intensity of Alberta's electrical grid by an amount equivalent to removing ~635,000 cars from the road. The project is expected to be completed in two phases with the first (200 MWh) phase having been sanctioned. In total, the company currently has ~111 MW of gross wind-generated power between its facilities in Alberta, Saskatchewan and Ontario. In the exhibit below, we highlight the wind farms under construction or currently operating that are owned and controlled by Canadian energy companies.

**Exhibit 11: Future Wind Power Projects**

| Company | Wind Farm name | Location | Power Generation Capacity (MWh) |
|---|---|---|---|
| Suncor | Forty Mile | Southeastern Alberta | 400 |
| Enbridge | Saint-Nazaire | France | 480 |
| | Dunkirk | France | 600 |
| | Fecamp | France | 498 |
| | Courseulles-sur-Mer | France | 450 |

Source: Company reports and CIBC World Markets Inc.

In total, Canadian energy companies have ownership in ~5.1 GW of wind-generated power (both onshore and offshore).

### Other Sustainability Investments

Beyond the investments we have already outlined, Canadian companies are engaged in other projects that are helping with the energy transition, including creating an interconnected highway of charging stations across Canada; building infrastructure to capture fugitive emissions from oil wells; implementing cogeneration at natural gas plants; and investing in corn-based ethanol and transitionary fuels. As corporate citizens and under the current regulatory and policy infrastructure, we believe Canadian companies are both environmentally and financially motivated to pursue investments that improve sustainability metrics, lower GHGs, and contribute to the energy transition.

**Exhibit 12: Petro-Canada EV Charging Network**


Source: Suncor Energy.

## Investment In Technology

Notwithstanding the increasingly popular view that we could reach peak oil demand in the next two decades, we believe technological advancement provides a competitive edge to oil sands companies through a carbon-constrained and potentially demand-constrained

environment. For in situ development, we believe new development will be focused on the application of solvent-steam hybrid technologies in the near term, which have been proven to decrease carbon intensity by up to 35%, and on solvent-only technologies in the longer term, which could reduce GHG emissions by up to 80% and are still being piloted.

There has been a great deal of focus around the 100 megatonne provincial $CO_2$ limit on the oil sands and its implications for production growth in the region. Given the volatility of commodity prices and the world's current view of long-term oil consumption, we believe that the Alberta oil sands will not hit its $CO_2$ limit and can continue to show production growth to meet any near-term demand growth. We view a slower growth profile—mostly driven by debottlenecking, the application of technology, and brownfield in situ development—to more closely match global demand post-pandemic. A summary of the technology used to extract bitumen from in situ deposits are highlighted in the exhibit below.

**Exhibit 13: Summary Of In Situ Technologies**

| Technology | Description | Energy Use Performance Indicators | Direct (fuel use) GHG Emissions |
|---|---|---|---|
| SAGD | Uses steam for 30 MBbl/d bitumen production | SOR of 3 Bbl/Bbl 35,910 GJ/d natural gas and 300 kWh/d electricity required | 60.4 kgCO2eq/Bbl from direct natural gas use emissions |
| SA-SAGD | Uses a combination of steam and solvents for bitumen extraction | 33%-36% SOR reductions and 35% natural gas use reduction relative to SAGD base. 10.8%-38% bitumen production uplift | 15%-20% emissions reduction relative to the SAGD base |
| Nsolv/CSP | Pure condensing solvent is used for bitumen extraction | 75% reduction in SAGD energy intensity. OPEX is similar to that of SAGD base. No bitumen uplift. | 75%-80% reduction in SAGD direct fuel-derived emissions |
| ESEIEH | Uses electromagnetic heating combined with pure solvents for bitumen extraction | Reduces energy intensity of the SAGD base case by 75%. OPEX is $10/Bbl (2015 values). No bitumen uplift | Potential to reduce GHG emissions by 45%-59% |

Source: Canadian Energy Research Institute, company reports and CIBC World Markets Inc.

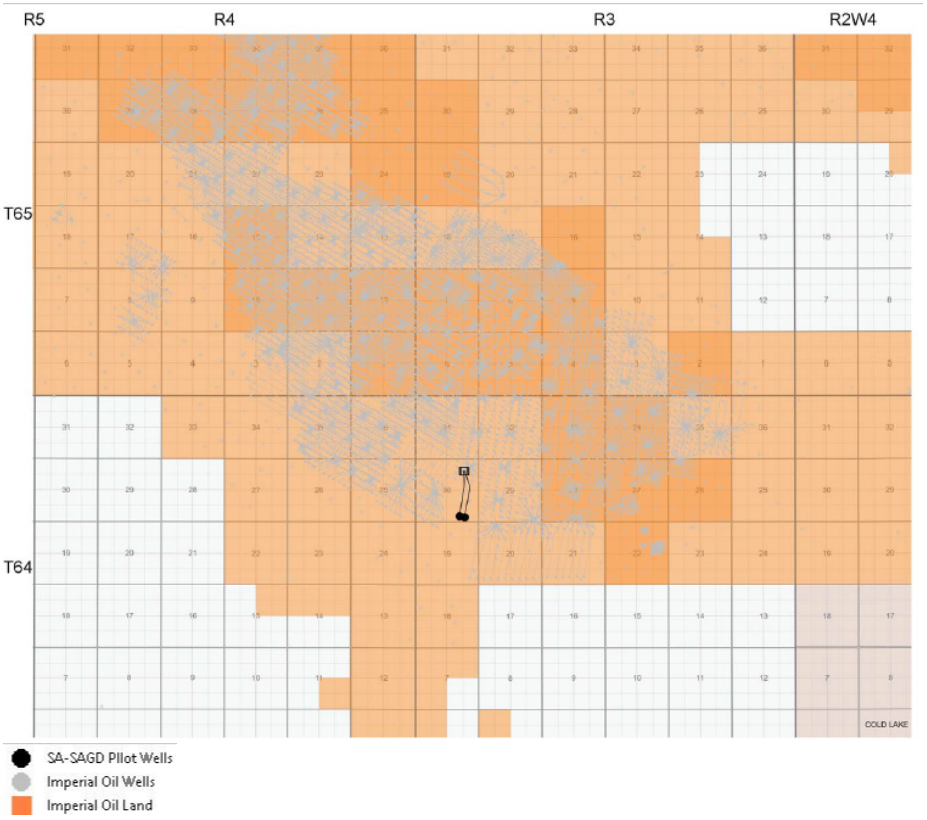
## Steam/Solvent Processes

Using solvents (in the form of propane, butane or condensate) with steam-based SAGD helps mobilize the bitumen by applying heat and physical/chemical interactions to lower its viscosity and allow it to flow more readily during production/extraction. The introduction of solvents lowers the water and energy requirements to extract a similar quantity of oil compared to using steam only. While a similar steam capacity for the facility would be initially built out, adding solvents allows for increased oil output, resulting in a lower SOR and a decrease in per Bbl carbon intensity of 15% to 35%. In addition, depending on the solvent used, there is a partial-upgrading effect that occurs in the reservoir that improves bitumen realized pricing. We expect the first commercial steam/solvent project will be the Imperial Oil Grand Rapids development, which is using underutilized steam-generation capacity from another development in the Cold Lake region.

## Solvent-assisted SAGD (SA-SAGD)

With its 2019 investor day, Imperial announced its plans to develop the Grand Rapids formation in the Cold Lake region with excess steam capacity from its underperforming Nabiye project, which would reduce its initial capital outlay. The company also indicated that it would be using SA-SAGD, which involves co-injecting condensate (diluent) with steam to lower bitumen viscosity and decrease capital costs. SA-SAGD was piloted at Cold Lake, where the wells showed a decrease in SORs of ~25%.

**Exhibit 14: Imperial Oil—SA-SAGD pilot location**




Source: geoSCOUT, Company reports and CIBC World Markets Inc.

The company estimates an initial cost of $450 million for 15,000 Bbl/d (capital efficiency of $30,000/Bbl/d) and expects to ramp up production to ~50,000 Bbl/d through multiple phases. Future phases will be incorporated as steam capacity comes available, suggesting the company will use existing steam generation capacity more efficiently, and grow production without contributing significantly to gross carbon emissions.

Further to the Grand Rapids projects, Imperial had sanctioned (and then slowed spending) on the Aspen project, which includes two 75,000 Bbl/d phases at a cost of ~$2 billion each. The simple way of thinking about the advantages of SA-SAGD is that the 75,000 Bbl/d facility would only require the steam generation and water treatment capacity of a ~50,000 Bbl/d processing plant, reducing the initial capital costs and the per barrel energy intensity of extraction.

## Full Solvent Processes

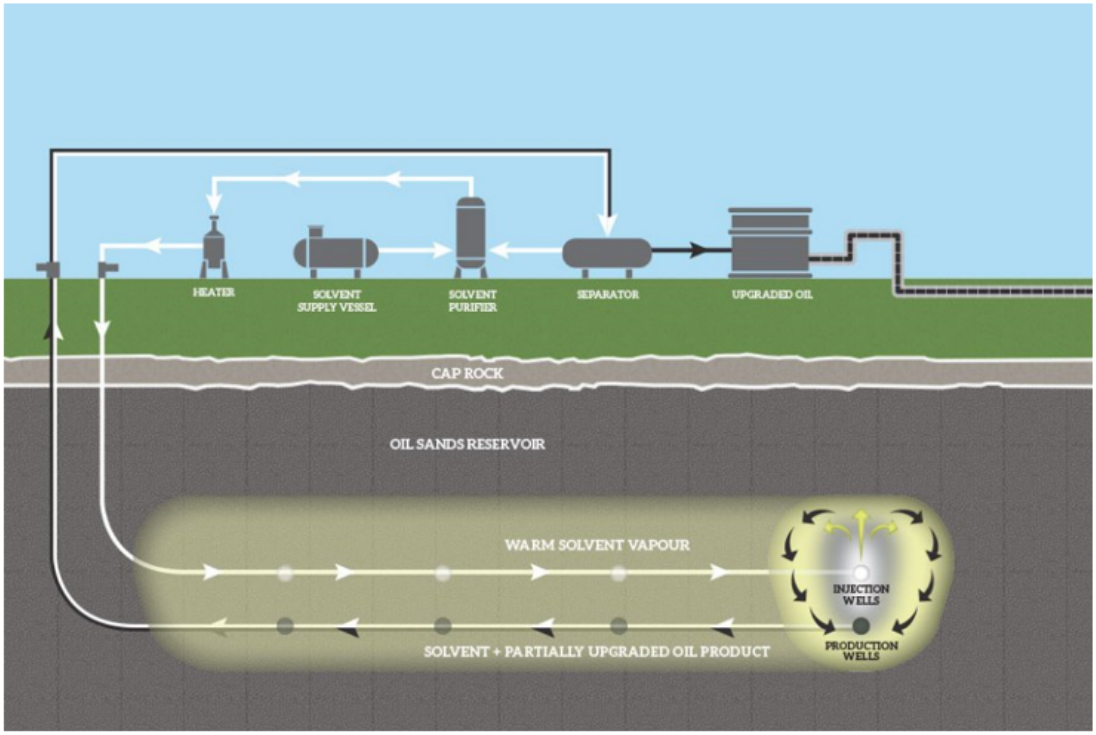
Non-aqueous processes replace the use of steam with 100% solvent; examples include Suncor's NSolv process or Imperial's cyclic solvent process (CSP). We expect full solvent processes can reduce energy requirements by ~75% to 80% compared to a SAGD development. Furthermore, they can significantly decrease initial capital spending by up to ~50% compared to more traditional SAGD.

### NSolv Process

Suncor launched its patented warm solvent pilot in 2014 at its Dover lease; by mid-2016, it had processed ~100 MBbl of cumulative partially upgraded production. The NSolv process involves injecting pure, heated solvent (such as propane or butane) vapour into the reservoir where it condenses, heats the reservoir, and mixes with the bitumen. This process lowers the

viscosity of the bitumen, which improves the gravity drainage, and also leaves the oil's high-carbon asphaltenes behind. This results in a partially upgraded oil product that requires less diluent/transportation costs and could garner a premium price.

**Exhibit 15: Suncor's NSolv Process**




Source: Suncor Energy.

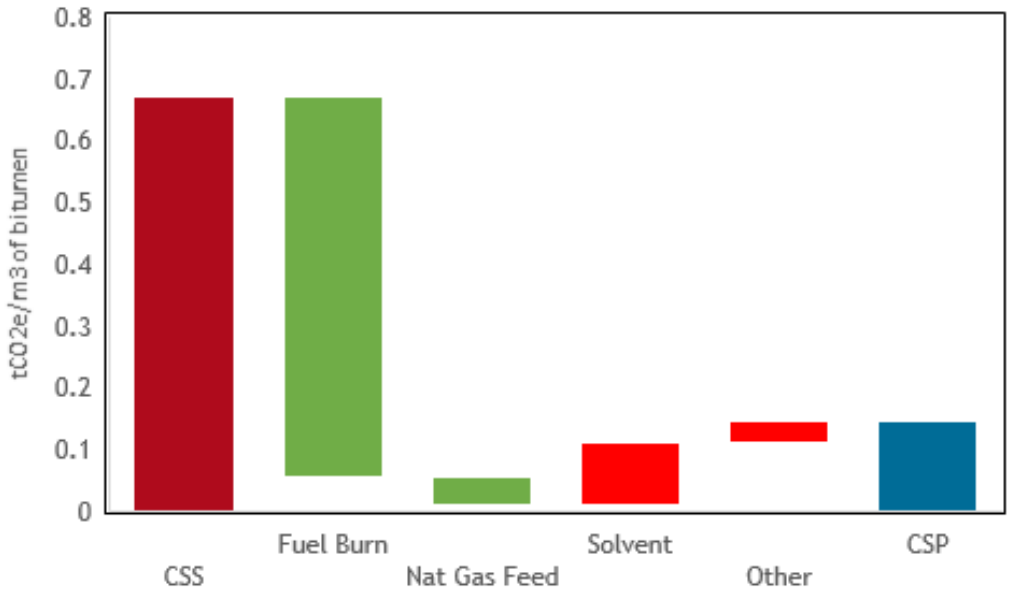
Once the partially upgraded oil is pumped above ground, the surface facility separates the oil, water and solvent; the solvent is purified and recycled back into the formation. Given the low operating temperatures (40 – 60 degrees C), the energy requirements are significantly lower compared to the higher temperatures required for traditional SAGD techniques or even solvent/steam processes. The partial upgrading of the bitumen leaves ~3% of asphaltenes in the bitumen compared to ~16% in other processes. The main concern from this method of extraction is the hold up, or the amount of solvent that stays in the reservoir and needs to be replaced during operations.

**Cyclic Solvent Process (CSP)**

CSP is a non-thermal, in situ bitumen recovery process that uses injected solvent to lower the viscosity of the bitumen and enable production from the sub-surface. This is a cyclic process that involves an injection phase, a mixing phase, and finally a production phase. This cycle occurs over multiple years until bitumen production becomes uneconomic (that is, not enough bitumen is produced in a particular cycle relative to the solvent injected). Imperial Oil began its $100 million pilot at its Cold Lake operations in 2014, and it has so far had encouraging results. Unlike NSolv, CSP is a late-life technique that is able to increase oil recovery from a partially depleted reservoir without using steam. Imperial instead redirects steam for use in new locations. This process improves the company's overall efficiency in extraction. For example, Imperial expects to improve its overall oil recovery from 30%-40% to 50%-60% by using warm solvents to aid in extraction.

Compared to Cyclic Steam Stimulation (CSS), a technique widely used in the Cold Lake regions, the pilot was able to achieve a ~80% reduction in emissions. Some 50% of the emissions for CSP are indirect (Scope 2)—that is, they are related to processing and extraction of the required make-up solvent.

**Exhibit 16: Estimated GHG Intensity—Cyclic Solvent Process Vs. Other Processes**



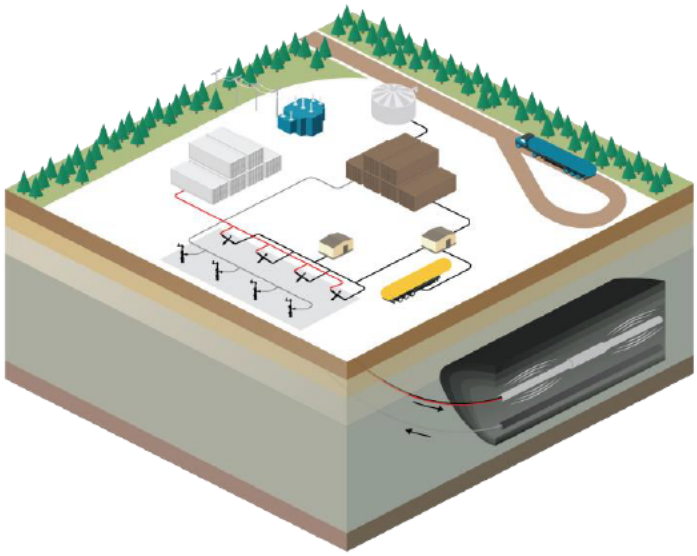

Notes: Other=Facility electricity, and oil and water processing; CSP=Cyclic Solvent Process.

Source: Emissions Reduction Alberta, company reports and CIBC World Markets Inc.

## Electromagnetic Heating

Electromagnetic (EM) heating uses radio waves to heat latent water in reservoirs, which in turn heats the bitumen and renders it mobile. In the ESEIEH (enhanced solvent extraction incorporating electromagnetic heating) process, electromagnetic energy is used to heat the reservoir and is combined with a light hydrocarbon solvent that is used to mobilize and produce the bitumen. This application eliminates the need for water and, consequently, for water handling and steam generation, which significantly decreases the energy intensity, GHG emissions and thermal losses of production.

**Exhibit 17: EASE Project Site**



Source: Suncor Energy.

This technique is expected to reduce carbon emissions by ~70% (if using AB grid) or ~50% (if using a 45% efficient cogeneration unit) compared to traditional SAGD. A consortium including Suncor, Devon and Harris Corporation constructed a pilot project at Suncor's Dover asset, which started in 2015. The consortium expects results in 2022 that could help it determine the commerciality of the technology.

## Application Of Technology

Oil and gas companies have been fast adopters of new technology that helps increase the efficiency of extraction, improve the safety of operations, and provide greater access to resources. Developments that are already incorporated into projects include reducing the use of steel at well pads, shrinking the size of equipment on surface, and reducing material required for expansions of the central processing facilities. While the smaller well pads mean a lower surface footprint (less disturbance of trees), the lower steel requirements drive lower capital costs and indirect GHG emissions from manufacturing. The more standardized design also contributes to decreased capital costs with less wasted materials, more efficient construction and less at-site work.

### Autonomous Haul Systems

Autonomous Haul Systems (AHS), or driverless systems, are an advancement that can help oil sands projects improve safety, increase efficiency, and decrease maintenance capital costs. Cost savings go beyond the G&A implications of avoiding the cost of hiring drivers for each of the super heavy haul trucks, but also extends to smaller items like improving tread wear on tires, naturally grading the roads with the trucks (rather than employing separate equipment to maintain the gravel paths), and improving fuel management and routes/pathing through better computer-driven load management of the vehicles. Suncor has estimated that deployment of AHS on its mine sites could lower costs by ~$1/Bbl through improved efficiency. The company already deployed AHS completely at its Steepbank mine in 2018, and recently announced its expectation to have a full deployment of the system at Fort Hills by year-end 2020.

**Exhibit 18: Sensors And Equipment On Haul Trucks For AHS**


Source: Imperial Oil.

Imperial Oil and Canadian Natural have also been actively implementing the technology at their respective mines. Imperial currently has 22 vehicles with AHS deployed at Kearl with plans to complete installation by 2023. Canadian Natural was running an AHS pilot at the Jackpine mine through 2018. Once satisfied with the pilot, it plans to convert its ~140+ truck fleet (across all three mines) in stages from 2022 to 2025 at an estimated total cost of ~$275 million to $325 million, and with projected cost savings of $0.30 to $0.50 per Bbl.

## Drones

The use of drones has proliferated as the technology advanced and costs decreased. We note that oil and gas companies have been using drones for over 15 years as a replacement for dated and expensive land surveys when planning drilling locations and pipelines. More recently, with the requirements of social distancing and smaller gatherings, companies have also used drones to conduct inspections on towers, which has improved safety and lowered costs associated with turnarounds.

## Digital, AI And Remote Operations

Part of improving operations is also improving the gathering and processing of data. Historically, there was a large human-capital component to the analysis of the trillions of data points from any aspect of day-to-day operations. The energy industry has gathered significant amounts of data and has recently paired up with leaders in AI and digital technology to improve efficiencies and drive costs lower. Because these technologies could be applied to many aspects of oil companies' operations, we believe it would be a disservice to provide

only a partial analysis here, and plan to revisit this topic with a more fulsome discussion in a subsequent report. Some emerging digital technologies in the energy industry include:

1) Remote operations centres.

2) Partnerships with leading technology firms.

3) Cloud computing and storage.

4) Real-time communication and tracking.

5) Robotics and automation.

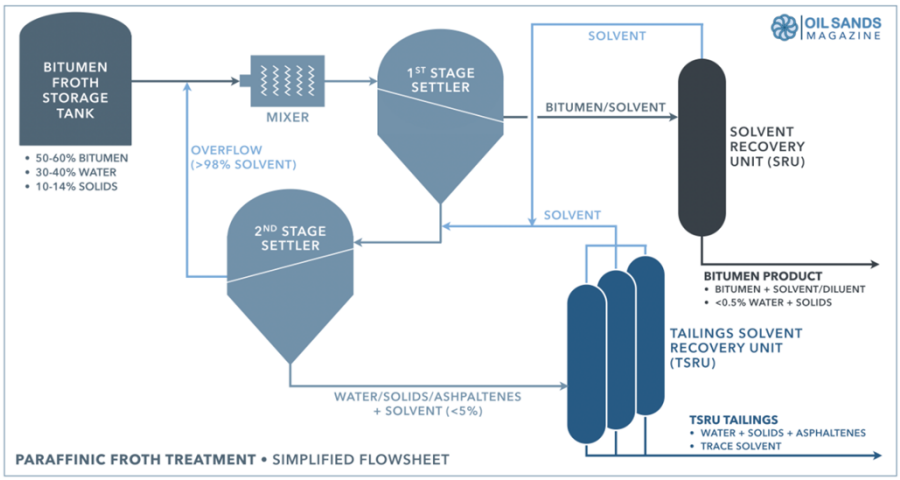
6) Predictive analysis and AI.

Across the oil sands companies, we believe there is well over ~$1 billion of potential annual efficiencies or savings that could be driven from digital initiatives. Further to this, with better uptime, less commuting (and site travel), and fewer unplanned outages, AI and digital technology could enable these companies to lower GHG emissions and improve sustainability metrics.

## Paraffinic Froth Treatment (PFT)

PFT is an extraction technique that uses a paraffinic solvent to remove water and fine solids from bitumen froth, and replaces another extraction method, called NFT, which used a naphthenic solvent instead. PFT has multiple benefits, including a lower energy intensity and a clean bitumen production (asphaltenes have been largely removed) that meets pipeline specifications; however, it does leave some asphaltenes and a high amount of sulphur in the bitumen (and not all refineries can accept these barrels).

**Exhibit 19: Paraffinic Froth Treatment Process Diagram**




Source: Oil Sands Magazine.

The primary benefit of using PFT is that the partially upgraded bitumen can still be processed by a high-conversion refinery without an intermediate upgrading step. This reduces the energy intensity significantly, as well as GHG emissions per barrel. Currently, Canadian Natural's Jackpine and Muskeg River projects, Imperial Oil's Kearl project, and Suncor's Fort Hills project all use PFT (rather than the traditional NFT).

## Tailings Management

Tailings are a mixture of water, sand and clay found naturally in oil sands deposits that remain following the mining extraction process. Tailings are transported via pipelines and deposited into ponds, where the majority of the solids (mostly sand) settle to the bottom. Smaller particles of clay and silt remain in suspension and can take significantly longer periods of time to settle. Finding ways to treat these fine tailings (FT) or mature fine tailings (MFT) in a faster and more cost-effective manner help promote better sustainability in the oil sands and could reduce abandonment costs associated with the projects. More than 90% of tailings form coarse tailings deposits and are used to backfill the mine and for construction purposes, which require no treatment before reclamation. The remaining less than 10% of tailings form fine tailings deposits, which are treated to enable future reclamation in a variety of forms.

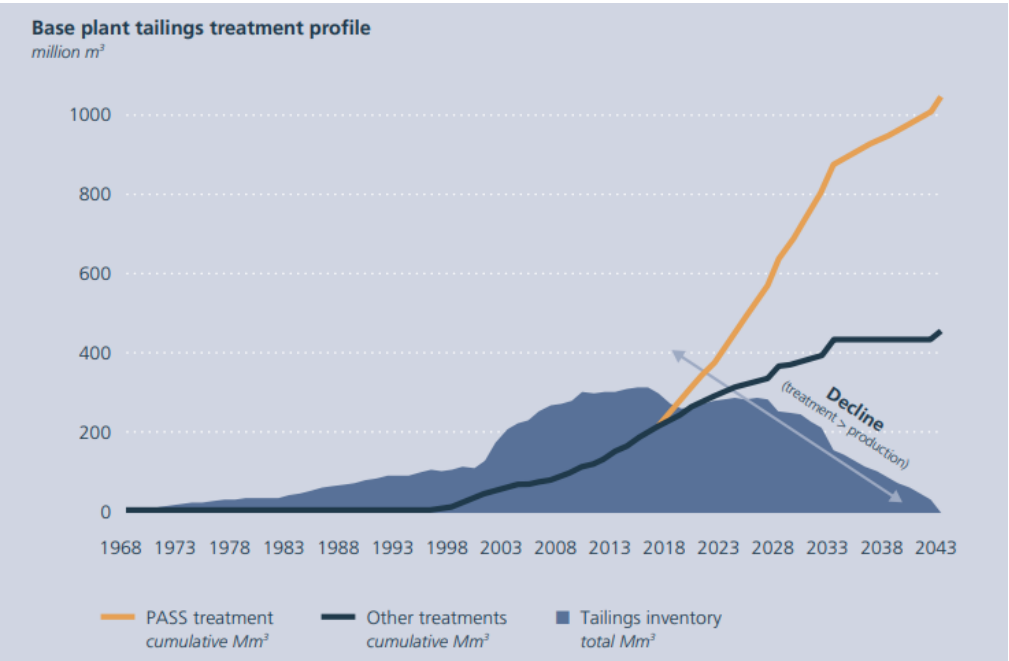
Companies are pursuing technologies individually to help promote an accelerated dewatering of tailings ponds and more efficient management of tailings, but they are also contributing towards a collaborative effort on research through participation with Canada's Oil Sands Innovation Alliance (COSIA). Below, we highlight technologies we believe could help reduce the use of tailings ponds and decrease abandonment liability associated with the oil sands.

### Permanent Aquatic Storage Structure (PASS)

PASS is a fluid tailings treatment program that increases the volume a company can process in a more sustainable manner. Developed by Suncor, it allows the company to rapidly dewater the fluid tailings by coagulating the clay particles in a safe manner and releasing the water, which eventually forms into an aquatic body. This technology was demonstrated at the newly formed Lake Miwasin in 2018, and will be monitored for the next 15 years.

In 2019, PASS technology treated ~25 million cubic meters (~157 million barrels) of fluid tailings or 2.3 times the 2019 volume of fluid tailings produced, and is a key reason Suncor's Base Plant's untreated tailings inventory decreased. Suncor plans to implement PASS at its Fort Hills operations. We believe technologies like PASS could eventually decrease and potentially retire portions of the tailings ponds in an accelerated fashion.

**Exhibit 20: PASS Accelerates Reclamation**




Source: Suncor Energy.

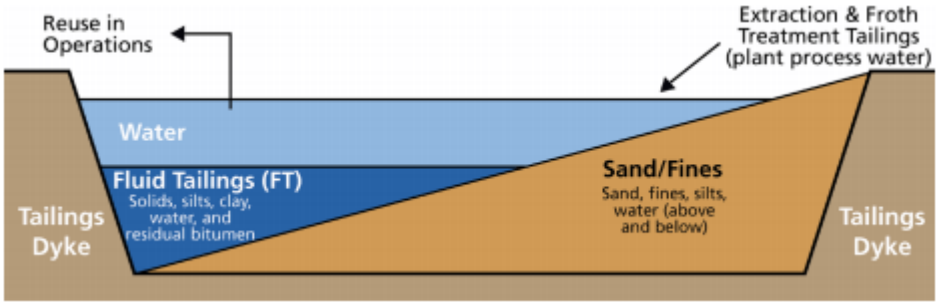
### In-pit Extraction Process (IPEP)

Canadian Natural recently paused its field pilot project of IPEP because of the COVID-19 pandemic, but the technology would replace the traditional extraction process by processing the bitumen right at the mine face. The extraction facilities are modular components and would be mobile, decreasing GHG emissions associated with haul trucks and lower hot water usage for hydrotransport of bitumen by an estimated total of up to 40% compared to more traditional extraction methods. Canadian Natural has shown that IPEP can produce dry stackable tailings that would eliminate the need for tailings ponds. If successful, the project could reduce oil sands costs by $2-$3 per Bbl.

### Non-segregated Tailings (NST) And $CO_2$ injection

At Horizon, Canadian Natural uses the NST process to dewater its tailings by using cyclone separators to separate the coarse particles and thickeners and remove fine particles and water prior to being sent to the tailings ponds. Further to this, $CO_2$ is captured at the plant and injected/dissolved into the water, which further advances the capture of fine particles and accelerates dewatering. This also has the positive impact of increasing water recycling and lowering natural gas usage at the facility.

**Exhibit 21: Tailings Management At Canadian Natural Resources' Horizon Mine**




Source: Canadian Natural Resources.

# Important Disclosures

**Analyst Certification:** Each CIBC World Markets Inc. research analyst named on the front page of this research report, or at the beginning of any subsection hereof, hereby certifies that (i) the recommendations and opinions expressed herein accurately reflect such research analyst's personal views about the company and securities that are the subject of this report and all other companies and securities mentioned in this report that are covered by such research analyst and (ii) no part of the research analyst's compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed by such research analyst in this report.

**Potential Conflicts of Interest:** Equity research analysts employed by CIBC World Markets Inc. are compensated from revenues generated by various CIBC World Markets Inc. businesses, including the CIBC World Markets Investment Banking Department. Research analysts do not receive compensation based upon revenues from specific investment banking transactions. CIBC World Markets Inc. generally prohibits any research analyst and any member of his or her household from executing trades in the securities of a company that such research analyst covers. Additionally, CIBC World Markets Inc. generally prohibits any research analyst from serving as an officer, director or advisory board member of a company that such analyst covers.

In addition to 1% ownership positions in covered companies that are required to be specifically disclosed in this report, CIBC World Markets Inc. may have a long position of less than 1% or a short position or deal as principal in the securities discussed herein, related securities or in options, futures or other derivative instruments based thereon.

Recipients of this report are advised that any or all of the foregoing arrangements, as well as more specific disclosures set forth below, may at times give rise to potential conflicts of interest.

CIBC World Markets Inc. does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that CIBC World Markets Inc. may have a conflict of interest that could affect the objectivity of this report. Investors should consider this report as only a single factor in making their investment decision.

Analysts employed outside the U.S. are not registered as research analysts with FINRA. These analysts may not be associated persons of CIBC World Markets Corp. and therefore may not be subject to FINRA Rule 2241 restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

# CIBC World Markets Inc. Stock Rating System

| Rating | Abbreviation | Description |
|---|---|---|
| **Stock Ratings** | | |
| Outperformer | OP | Stock is expected to outperform similar stocks in the coverage universe during the next 12-18 months. |
| Neutral | NT | Stock is expected to perform in line with similar stocks in the coverage universe during the next 12-18 months. |
| Underperformer | UN | Stock is expected to underperform similar stocks in the coverage universe during the next 12-18 months. |
| Not Rated | NR | CIBC World Markets does not maintain an investment recommendation on the stock. |
| Restricted | R | CIBC World Markets is restricted (due to potential conflict of interest) from rating the stock. |
| **Sector Ratings (note: Broader market averages refer to S&P 500 in the U.S. and S&P/TSX Composite in Canada.)** | | |
| Overweight | O | Sector is expected to outperform the broader market averages. |
| Marketweight | M | Sector is expected to equal the performance of the broader market averages. |
| Underweight | U | Sector is expected to underperform the broader market averages. |
| None | NA | Sector rating is not applicable. |

"Speculative" indicates that an investment in this security involves a high amount of risk due to volatility and / or liquidity issues.

## CIBC World Markets Inc. Price Chart

For price and performance charts, please visit CIBC on the web at https://researchcentral.cibcwm.com/rcportal/pricecharts or write to CIBC World Markets Inc., 161 Bay Street, 4th Floor, Toronto, ON M5H 2S8, Attn: Research Disclosure Chart Request.

## Important Disclosure Footnotes

**For important disclosure footnotes for companies mentioned in this report that are covered by CIBC World Markets Inc., click here: CIBC Disclaimers & Disclosures**

**Companies mentioned in the report but not listed are not covered by fundamental research at CIBC.**

**Ratings Distribution*: CIBC World Markets Inc. Coverage Universe**

| (as of 25 Oct 2020) | Count | Percent | Inv. Banking Relationships | Count | Percent |
|---|---|---|---|---|---|
| Outperformer | 154 | 52.4% | Outperformer | 154 | 100.0% |
| Neutral | 126 | 42.9% | Neutral | 125 | 99.2% |
| Underperformer | 7 | 2.4% | Underperformer | 7 | 100.0% |
| Restricted | 7 | 2.4% | Restricted | 7 | 100.0% |

Important disclosures required by applicable rules can be obtained by visiting CIBC World Markets on the web at https://researchcentral.cibcwm.com/rcportal/legaldisclaimer. Important disclosures for each issuer can be found on Research Central Website by navigating through the following path: Company & Industry Research < Companies Listing < Ticker < Company page. Access to the system for our dissemination policy can be found at the bottom of each page on the Research Central website. These important disclosures can also be obtained by writing to CIBC World Markets Inc., 161 Bay Street, 4th Floor, Toronto, ON M5H 2S8, Attention: Research Disclosures Request.

# Legal Disclaimer

This report is issued and approved for distribution by (a) in Canada, CIBC World Markets Inc., a member of the Investment Industry Regulatory Organization of Canada ("IIROC"), the Toronto Stock Exchange, the TSX Venture Exchange and a Member of the Canadian Investor Protection Fund, (b) in the United Kingdom, CIBC World Markets plc, is Authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority, (c) in Australia to wholesale clients only, CIBC Australia Ltd, a company regulated by the ASIC with AFSL license number 240603 and ACN 000 067 256, and (d) in Japan, CIBC World Markets (Japan) Inc., a registered Type 1 Financial product provider with the registration number Director General of Kanto Finance Bureau #218 (collectively, "CIBC World Markets") and (e) in the United States either by (i) CIBC World Markets Inc. for distribution only to U.S. Major Institutional Investors ("MII") (as such term is defined in SEC Rule 15a-6) or (ii) CIBC World Markets Corp., a member of the Financial Industry Regulatory Authority ("FINRA"). U.S. MIIs receiving this report from CIBC World Markets Inc. (the Canadian broker-dealer) are required to effect transactions (other than negotiating their terms) in securities discussed in the report through CIBC World Markets Corp. (the U.S. broker-dealer). CIBC World Markets Corp. accepts responsibility for the content of this research report.

This report is provided, for informational purposes only, to institutional investor and retail clients of CIBC World Markets in Canada, and does not constitute an offer or solicitation to buy or sell any securities discussed herein in any jurisdiction where such offer or solicitation would be prohibited. This document and any of the products and information contained herein are not intended for the use of Retail investors in the United Kingdom. Such investors will not be able to enter into agreements or purchase products mentioned herein from CIBC World Markets plc. The comments and views expressed in this document are meant for the general interests of wholesale clients of CIBC Australia Ltd.

This report has been prepared by the CIBC group and is issued in Hong Kong by Canadian Imperial Bank of Commerce, Hong Kong Branch, a registered institution under the Securities and Futures Ordinance, Cap 571 (the "SFO"). This report is intended for "professional investors" only (within the meaning of the SFO) and has been prepared for general circulation and does not take into account the objectives, financial situation or needs of any recipient. Any recipient in Hong Kong who has any questions or requires further information on any matter arising from or relating to this report should contact Canadian Imperial Bank of Commerce, Hong Kong Branch at Suite 3602, Cheung Kong Centre, 2 Queen's Road Central, Hong Kong (telephone number: +852 2841 6111). Orders for Hong Kong listed securities will be executed by Canadian Imperial Bank of Commerce, Hong Kong Branch. Canadian Imperial Bank of Commerce, Hong Kong Branch has entered into an arrangement with its broker-dealer affiliates worldwide to execute orders for securities listed outside of Hong Kong for Hong Kong clients.

This report is intended for distribution in Singapore solely to "institutional investors" (within the meanings of the Financial Advisers Act (Chapter 110 of Singapore)).

The securities mentioned in this report may not be suitable for all types of investors. This report does not take into account the investment objectives, financial situation or specific needs of any particular client of CIBC World Markets. Recipients should consider this report as only a single factor in making an investment decision and should not rely solely on investment recommendations contained herein, if any, as a substitution for the exercise of independent judgment of the merits and risks of investments. The analyst writing the report is not a person or company with actual, implied or apparent authority to act on behalf of any issuer mentioned in the report. Before making an investment decision with respect to any security recommended in this report, the recipient should consider whether such recommendation is appropriate given the recipient's particular investment needs, objectives and financial circumstances. CIBC World Markets suggests that, prior to acting on any of the recommendations herein, Canadian retail clients of CIBC World Markets contact one of our client advisers in your jurisdiction to discuss your particular circumstances. Non-client recipients of this report who are not institutional investor clients of CIBC World Markets should consult with an independent financial advisor prior to making any investment decision based on this report or for any necessary explanation of its contents. CIBC World Markets will not treat non-client recipients as its clients solely by virtue of their receiving this report.

# Legal Disclaimer (Continued)

Past performance is not a guarantee of future results, and no representation or warranty, express or implied, is made regarding future performance of any security mentioned in this report. The price of the securities mentioned in this report and the income they produce may fluctuate and / or be adversely affected by exchange rates, and investors may realize losses on investments in such securities, including the loss of investment principal. CIBC World Markets accepts no liability for any loss arising from the use of information contained in this report, except to the extent that liability may arise under specific statutes or regulations applicable to CIBC World Markets.

Information, opinions and statistical data contained in this report were obtained or derived from sources believed to be reliable, but CIBC World Markets does not represent that any such information, opinion or statistical data is accurate or complete (with the exception of information contained in the Important Disclosures section of this report provided by CIBC World Markets or individual research analysts), and they should not be relied upon as such. All estimates, opinions and recommendations expressed herein constitute judgments as of the date of this report and are subject to change without notice.

Nothing in this report constitutes legal, accounting or tax advice. Since the levels and bases of taxation can change, any reference in this report to the impact of taxation should not be construed as offering tax advice on the tax consequences of investments. As with any investment having potential tax implications, clients should consult with their own independent tax adviser.

This report may provide addresses of, or contain hyperlinks to, Internet web sites. CIBC World Markets has not reviewed the linked Internet web site of any third party and takes no responsibility for the contents thereof. Each such address or hyperlink is provided solely for the recipient's convenience and information, and the content of linked third party web sites is not in any way incorporated into this document. Recipients who choose to access such third-party web sites or follow such hyperlinks do so at their own risk.

Although each company issuing this report is a wholly owned subsidiary of Canadian Imperial Bank of Commerce (“CIBC”), each is solely responsible for its contractual obligations and commitments, and any securities products offered or recommended to or purchased or sold in any client accounts (i) will not be insured by the Federal Deposit Insurance Corporation (“FDIC”), the Canada Deposit Insurance Corporation or other similar deposit insurance, (ii) will not be deposits or other obligations of CIBC, (iii) will not be endorsed or guaranteed by CIBC, and (iv) will be subject to investment risks, including possible loss of the principal invested. The CIBC trademark is used under license.