



Canada's Energy Workforce

Scenario Assumptions for
National and Regional Labour
Market Outlooks to 2035

Photo courtesy of Tourmaline

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Canada

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Introduction



Careers in Energy's (CIE) national and regional labour market outlook reports provide an overview of Canada's energy workforce projections to 2035.

To produce workforce projections, CIE's labour market modelling system requires industry investment data and/or production data for each of the in-scope energy sectors (Figure 1).

Given variables that will influence Canada's future energy workforce, such as uncertainty for how new energy sources will be scaled and the pace emissions-reduction technologies will be deployed, CIE used a scenario approach for projecting workforce requirements to 2035. This report dives deeper into the scenario assumptions underlying the national and regional outlook reports.

The scenarios were developed with input from CIE's Energy Scenarios Working Group, made up of representatives from in-scope sectors. Additional industry consultations and review of secondary sources from the Canada Energy Regulator, Environment and Climate Change Canada and Rystad Energy helped fine-tune investment and production assumptions.

While the scenario assumptions and industry projections presented in CIE's national and regional outlook reports are a foundation for discussing Canada's energy workforce, they are not predictions of what will take place in the future. CIE's projections are based on

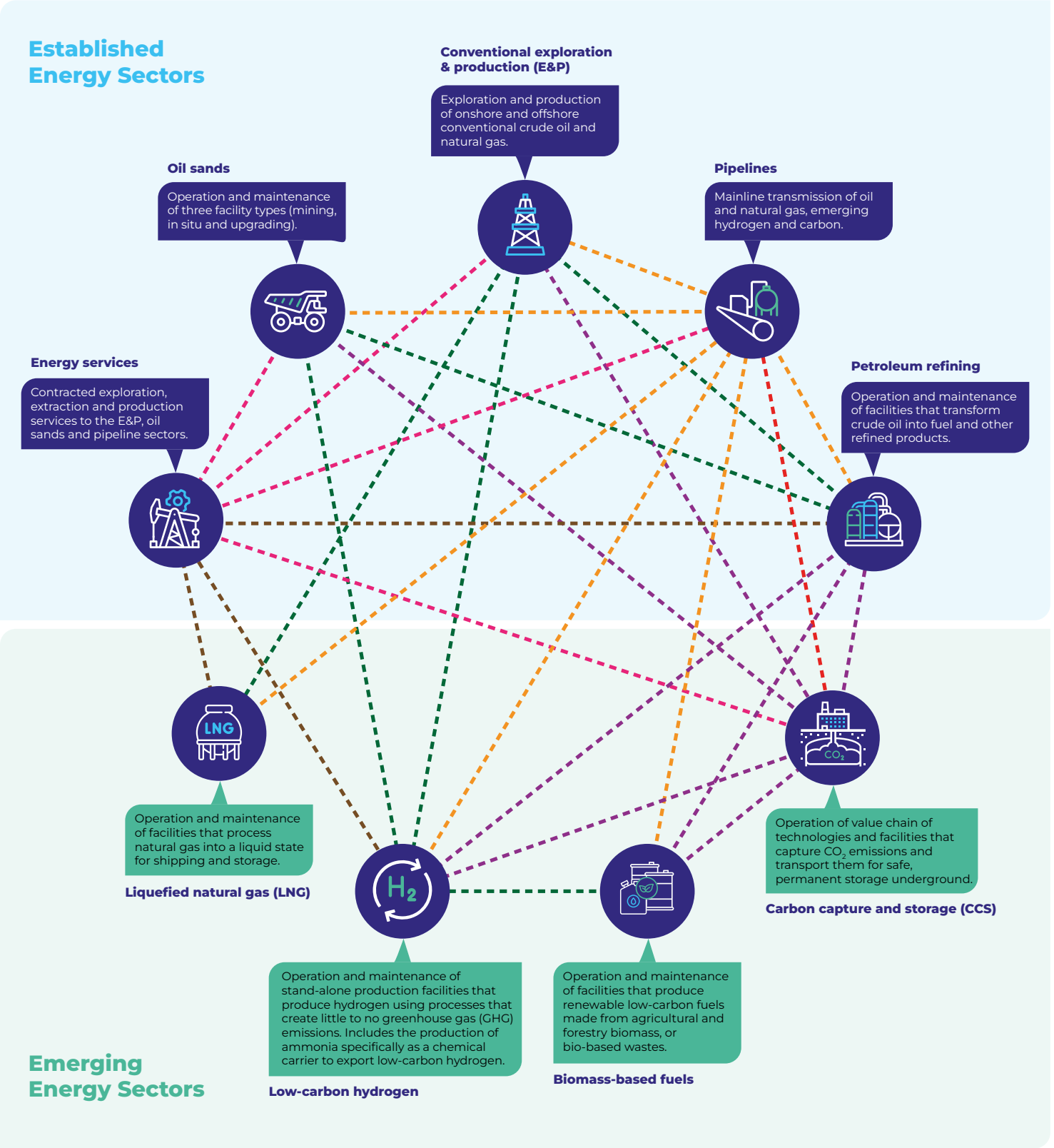
assumptions as of July 2023, allowing for analysis of possible workforce outcomes. Over the forecast period, it's likely that regulations, policies, geopolitical events and technology will evolve with an unforeseeable impact on Canada's energy industry.

The landscape of global energy is evolving, influenced by factors such as geopolitical shifts, technological advancements and a growing demand for sustainable practices. This evolution is underscored by industry's increasing commitment to address climate change through significant investments in low-carbon energy sources, the adoption of cutting-edge technologies and the implementation of ambitious emissions-reduction initiatives. Canada will continue to play a key role in the global energy landscape as a responsible and secure supplier and will require a skilled and capable workforce to meet the needs of the evolving sector.

- Murray Elliott, President and CEO, Energy Safety Canada (ESC)



Figure 1: Expanded sector scope of CIE’s labour market modelling system



Two Scenarios: Current Measures and Opportunity

CIE evaluated two scenarios—**Current Measures** and **Opportunity**—to project a potential range of workforce requirements to 2035 for Canada and the Western, Central and Atlantic regions.

- > **Current Measures**, based on investment (Table 5) and development leading to energy production and carbon sequestration *most likely* to occur based on announced plans, policies and programs as of July 2023.
- > **Opportunity**, based on investment (Table 5) and development leading to energy production and

carbon sequestration that could *realistically* occur if competitive policies, programs, incentives and economic conditions are in place.

Both scenarios assume Canada’s carbon tax to be \$95/tonne in 2025 and \$170/tonne post-2030 (nominal) as per announced federal policy.

Scenario Assumptions for Canada

Tables 1 and 5 and Figures 2, 3 and 4 provide a summary of projected investment and development details leading to changes in Canada’s energy production across in-scope sectors and carbon sequestration.

Table 1: Canada’s outlook scenario assumptions to 2035, both scenarios		
Sector	Current Measures	Opportunity (in addition to Current Measures)
Conventional oil* and natural gas *includes heavy, light, condensates, offshore	Capital expenditures (CAPEX) increases by 36% over the forecast period due to: <ul style="list-style-type: none"> • Higher commodity pricing • Increased oil takeaway capacity as Trans Mountain Pipeline Expansion Project (TMEP) to Canada’s West Coast becomes operational • Increased demand for natural gas for LNG and NGL exports, phaseout of coke and coal power generation and hydrogen production • Bay du Nord offshore platform As a result of additional investment, production increases are realized: <ul style="list-style-type: none"> • Oil: +41% • Natural gas: +64% 	No change in onshore or offshore crude oil investment or production beyond Current Measures scenario. A 5% increase in investment in natural gas achieves additional 22% growth in production to address further demand including the need for additional 2 Bcf/d for LNG exports.
Oil sands	Increased oil prices and additional takeaway capacity via TMEP drive investment. The trajectory of CAPEX and production increases varies across facility types: <ul style="list-style-type: none"> • In situ: +17% CAPEX; +33% production • Mining: -16% CAPEX; +5% production • Upgrading: -7% CAPEX; +7% production Production growth achieved through brownfield expansion and optimization.	No change beyond Current Measures scenario. Anticipate a focus and investment in decarbonization and emissions reduction rather than additional production increases.
Petroleum refining	At approximately 2% growth, production of petroleum products remains relatively flat over the forecast period. Anticipate focused Investment on reducing emissions generated by the refining process including the use of CCS technology and low-carbon hydrogen as feedstock.	No change beyond Current Measures scenario.

Table 1: Canada's outlook scenario assumptions to 2035, both scenarios (continued)

Sector	Current Measures	Opportunity (in addition to Current Measures)
Biomass-based fuels	<p>Regulations, including Clean Fuel Regulations and provincial blending mandates, are key drivers behind a projected 121% increase in production of biomass-based fuels.</p> <ul style="list-style-type: none"> Majority of increases will come from production of biodiesel. Ethanol production is relatively flat. Total demand for biomass-based fuels is not met by domestic production. 	Additional 29% increase in production could be realized.
Low-carbon hydrogen	<p>2.5 megatonnes (MT), or 114 thousand barrels per day oil equivalent (MBOE/day) production from standalone low-carbon hydrogen plants (or ammonia plants that convert low-carbon hydrogen for export).</p> <p>Almost double Canada's current 3 MT of hydrogen production that is used for industrial applications like refineries, oil sands upgrading and chemicals and fertilizer production.</p>	Significant potential for increased demand for low-carbon hydrogen domestically and for export drive an additional 2.9 MT (175 MBOE/day) of production.
LNG	4 natural gas liquefaction trains producing approximately 19 million tonnes per annum (mtpa) of LNG for export are in operation by 2035.	2 additional trains and 14 mtpa are operational by 2035.
CCS	<p>Annual capacity to capture and sequester CO₂ increases by 248% to approximately 15 MT CO₂e by 2035.</p> <ul style="list-style-type: none"> Current capacity is approximately 4 MT CO₂e captured and sequestered by 2035. 	Annual capacity to capture and sequester CO ₂ increases by another 437% to approximately 33 MT CO ₂ e by 2035.

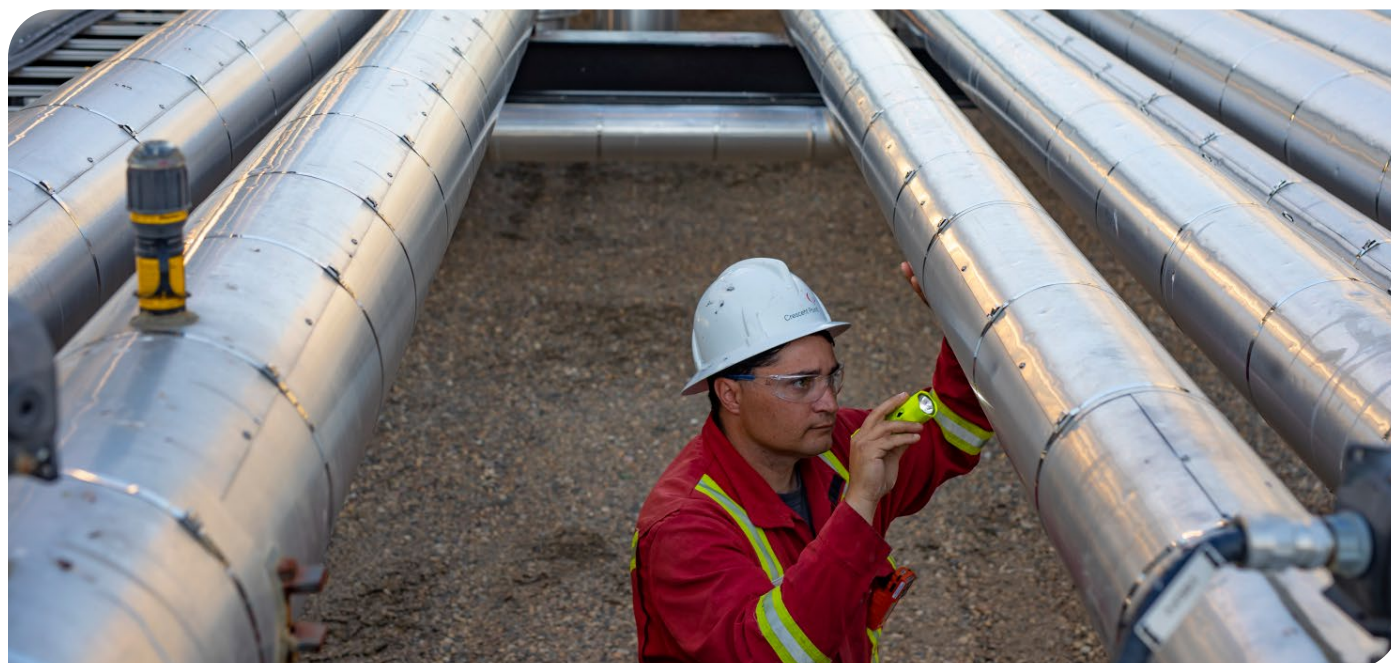


Photo courtesy of Crescent Point Energy



Figure 2: Canada's production by energy sector, 2022 and both scenarios in 2035

In thousands of barrels of oil equivalent per day (MBOE/day)

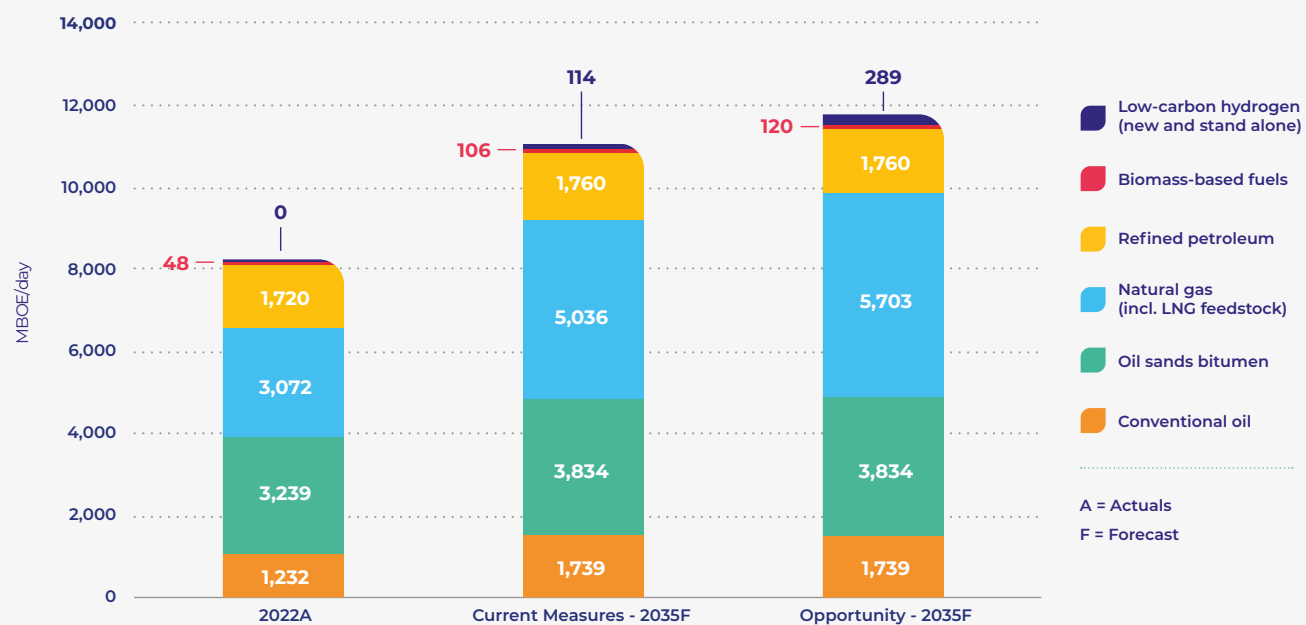


Figure 3: Canada's oil sands production by operations type, 2022 and both scenarios in 2035

In thousands of barrels of oil equivalent per day (MBOE/day)

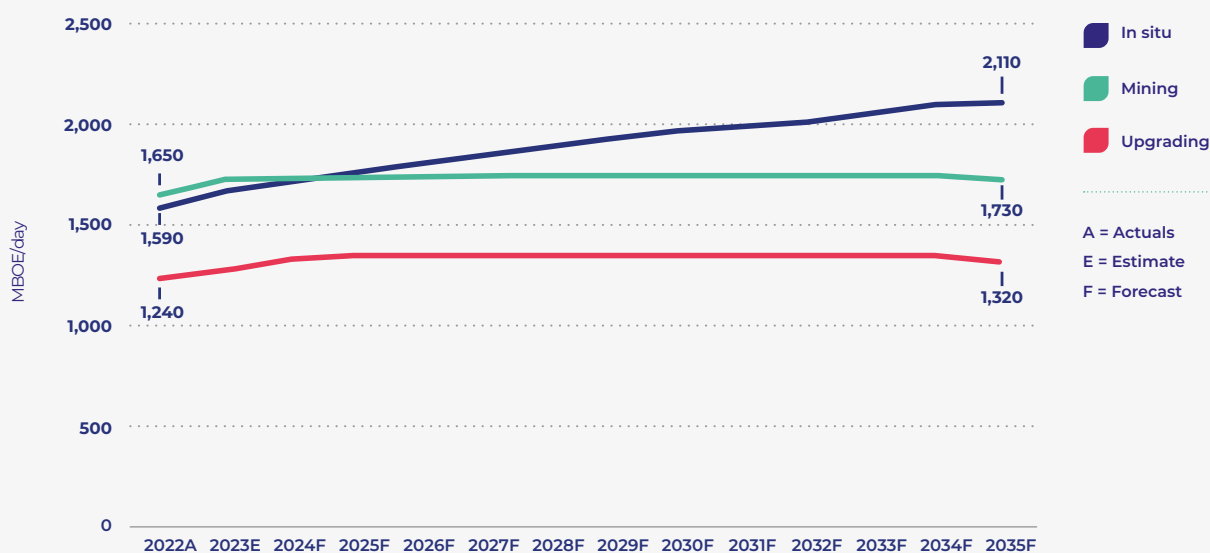
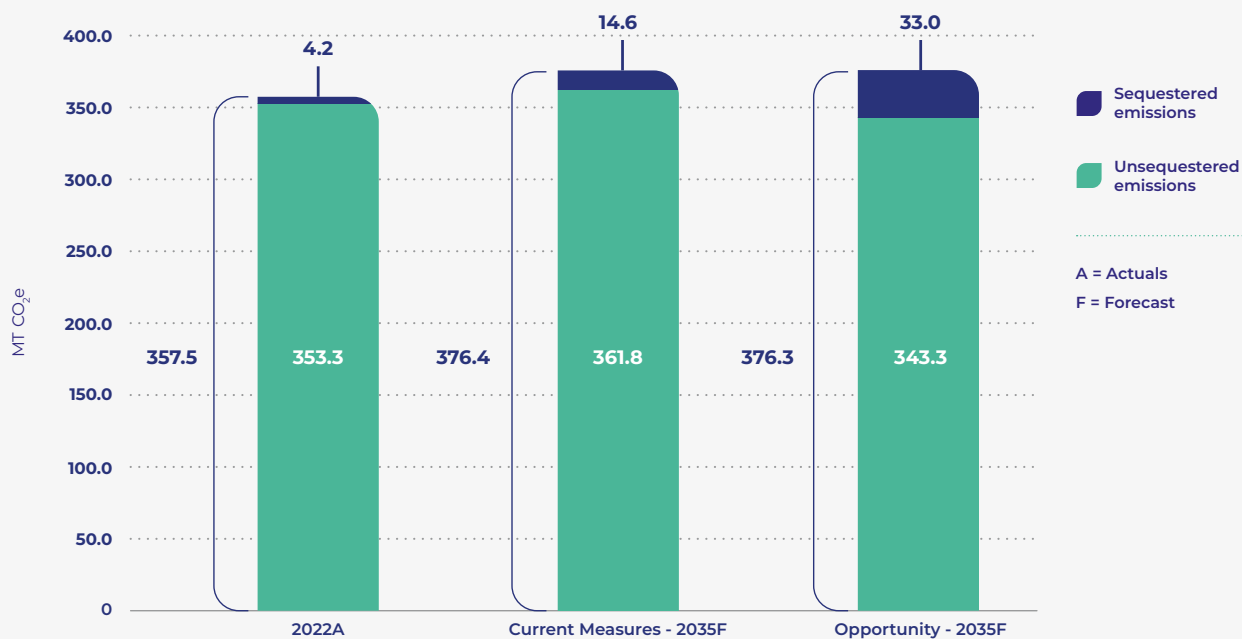


Figure 4: Canada's oil and gas and industrial CO₂ emissions and sequestration, 2022 and both scenarios in 2035

In megatonnes of carbon dioxide equivalent (MT CO₂e)



Scenario assumptions for Western Canada

The Western region includes British Columbia (BC), Alberta (AB), Saskatchewan (SK) and Manitoba (MB). Tables 2 and 5 and Figures 5, 6 and 7 provide a

summary of projected investment and development details leading to changes in Western Canada's energy production across in-scope sectors and carbon sequestration.

Table 2: Western Canada's outlook scenario assumptions to 2035, both scenarios

Sector	Current Measures	Opportunity <i>(in addition to Current Measures)</i>
Conventional oil* and natural gas *includes heavy, light, condensates, offshore	CAPEX increases by 35% over the forecast period due to: <ul style="list-style-type: none"> • Higher commodity pricing • Increased oil takeaway capacity as TMEP to Canada's West Coast becomes operational • Increased demand for natural gas for LNG and NGL exports, phase-out of coke and coal power generation and hydrogen production. As a result of additional investment, production increases are realized: <ul style="list-style-type: none"> • Oil: +43% • Natural gas: +64% 	No change in onshore crude oil investment or production beyond Current Measures scenario. A 6% increase in investment in natural gas achieves an additional 22% growth in production to address further demand including the need for additional 2 Bcf/d for LNG exports.
Oil sands	Increased oil prices and additional takeaway capacity via TMEP drive investment. The trajectory of CAPEX and production increases varies across facility types: <ul style="list-style-type: none"> • In situ: +17% CAPEX; +33% production • Mining: -16% CAPEX; +5% production • Upgrading: -7% CAPEX; +7% production Production growth achieved through brownfield expansion and optimization.	No change beyond Current Measures scenario. Anticipate a focus and investment in decarbonization and emissions reduction rather than additional production increases.
Petroleum refining	Petroleum refineries are located in 3 of 4 provinces included in the Western region—BC, AB and SK. At 4% growth, production of petroleum products remains relatively flat over the forecast period. Anticipate focused Investment on reducing emissions generated by the refining process including the use of CCS technology and low-carbon hydrogen as feedstock.	No change beyond Current Measures scenario.
Biomass-based fuels	Regulations, including Clean Fuel Regulations and provincial blending mandates are key drivers behind a projected 228% increase in production of biomass-based fuels. There are biomass-based fuels operations across all 4 provinces included in the Western Outlook.	Additional 31% increase in production could be realized.



Table 2: Western Canada's outlook scenario assumptions to 2035, both scenarios (continued)

Sector	Current Measures	Opportunity (in addition to Current Measures)
Low-carbon hydrogen	1 MT (54 MBOE/day) production from standalone low-carbon hydrogen plants (or ammonia plants that convert low-carbon hydrogen for export).	Significant potential for increased demand for low-carbon hydrogen domestically and for export drive an additional 1.9 MT (103 MBOE/day) of production.
LNG	All of Canada's LNG export facilities are on BC's West Coast. 4 natural gas liquefaction trains producing approximately 19 mtpa of LNG for export are in operation by 2035.	2 additional trains and 14 mtpa are operational by 2035.
CCS	All the expansion of CCS operations included in the national outlook is in the Western region. Annual capacity to capture and sequester CO ₂ increases by 248% to approximately 15 MT CO ₂ e by 2035. • Current capacity is approximately 4 MT CO ₂ e captured and sequestered by 2035.	Annual capacity to capture and sequester CO ₂ increases by another 437% to approximately 33 MT CO ₂ e by 2035.

Figure 5: Western Canada's production by energy sector, 2022 and both scenarios in 2035

In thousands of barrels of oil equivalent per day (MBOE/day)

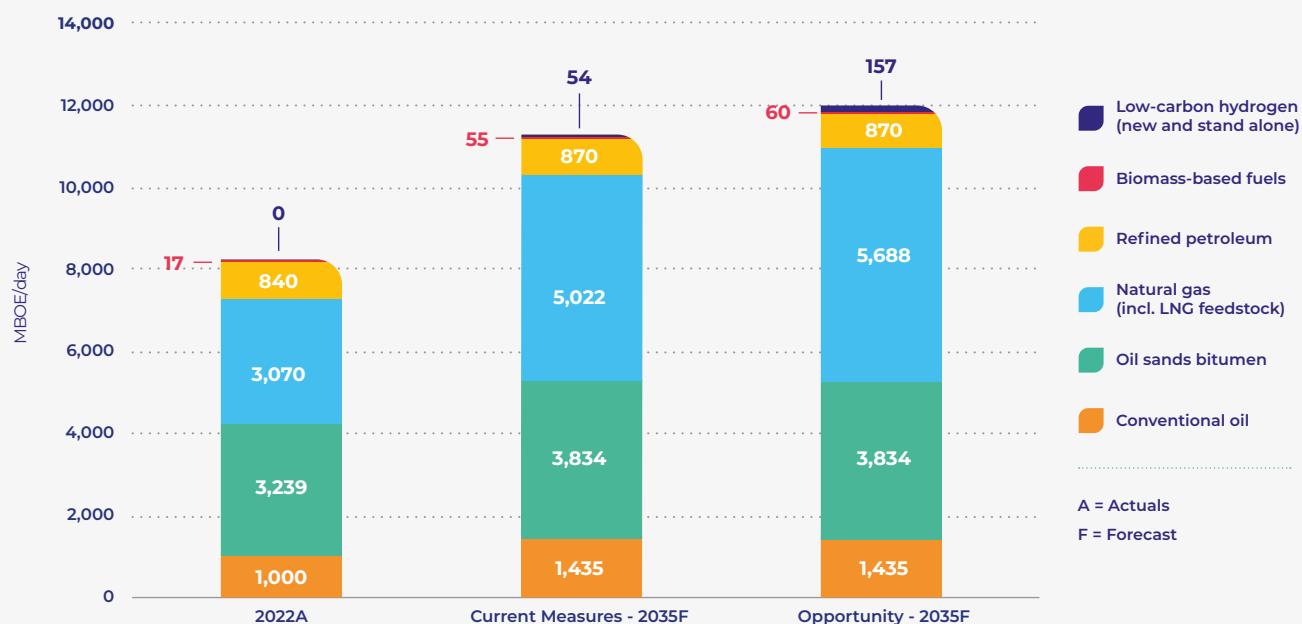


Figure 6: Western Canada's oil sands production by operations type, 2022 and both scenarios in 2035

In thousands of barrels of oil equivalent per day (MBOE/day)

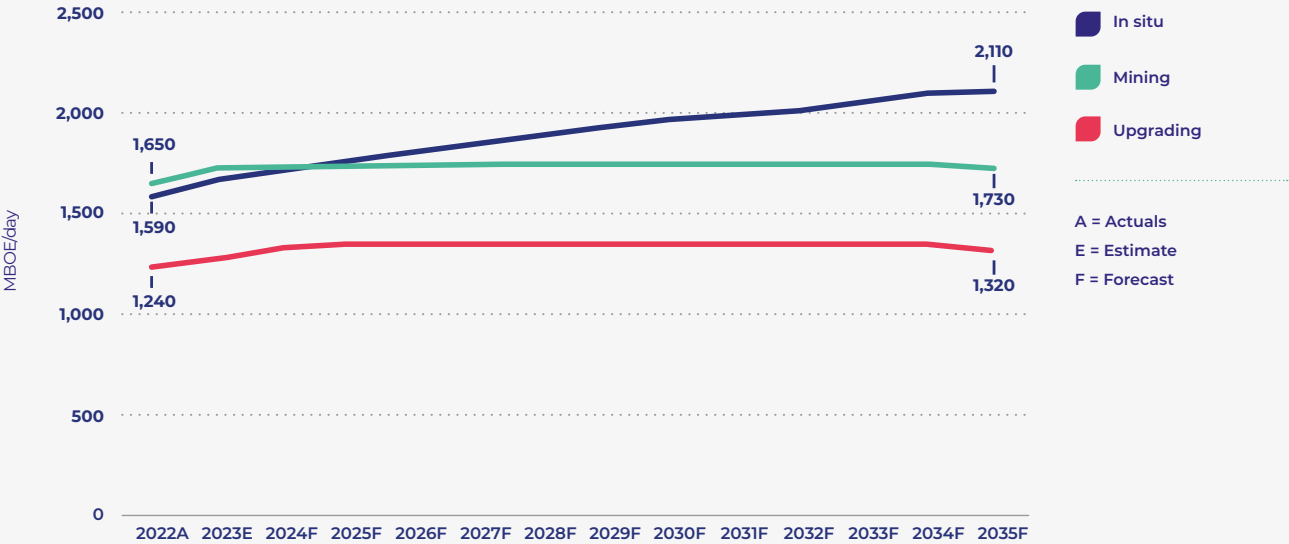


Figure 7: Western Canada's oil and gas and industrial CO₂ emissions and sequestration, 2022 and both scenarios in 2035

In megatonnes of carbon dioxide equivalent (MT CO₂e)



Scenario assumptions for Central Canada

The Central region includes Ontario (ON) and Quebec (QC). Tables 3 and 5 and Figure 8 provide a summary of

projected investment and development details leading to changes in Central Canada’s energy production across the region’s in-scope sectors.

Table 3: Central Canada’s outlook scenario assumptions to 2035, both scenarios

Sector	Current Measures	Opportunity (in addition to Current Measures)
Conventional oil* and natural gas *includes heavy, light, condensates, offshore	Despite an increase in CAPEX of approximately 29% over the forecast period, the region’s oil production remains relatively stable and natural gas production decreases. <ul style="list-style-type: none">• Oil: +19%• Natural gas: -44%	No change in investment or production beyond Current Measures scenario.
Petroleum refining	Petroleum refineries are located in both ON and QC. At 2% growth, production of petroleum products remains relatively flat over the forecast period. Anticipate focused Investment on reducing emissions generated by the refining process including the use of CCS technology and low-carbon hydrogen as feedstock.	No change beyond Current Measures scenario.
Biomass-based fuels	Regulations including Clean Fuel Regulations and provincial blending mandates are key drivers behind a projected 6% increase in production of biomass-based fuels. There are biomass-based fuels operations in both ON and QC.	Additional 9% production could be realized.
Low-carbon hydrogen	There are small amounts of low-carbon hydrogen currently in production in the Central region. There is no additional production forecast in the Current Measures scenario.	Approximately 1 MT (47 MBOE/day) of low-carbon hydrogen production is added to address increased demand in the region—mainly for transportation.



Photo courtesy of Enbridge



Figure 8: Central Canada's production by energy sector, 2022 and both scenarios in 2035

In thousands of barrels of oil equivalent per day (MBOE/day)

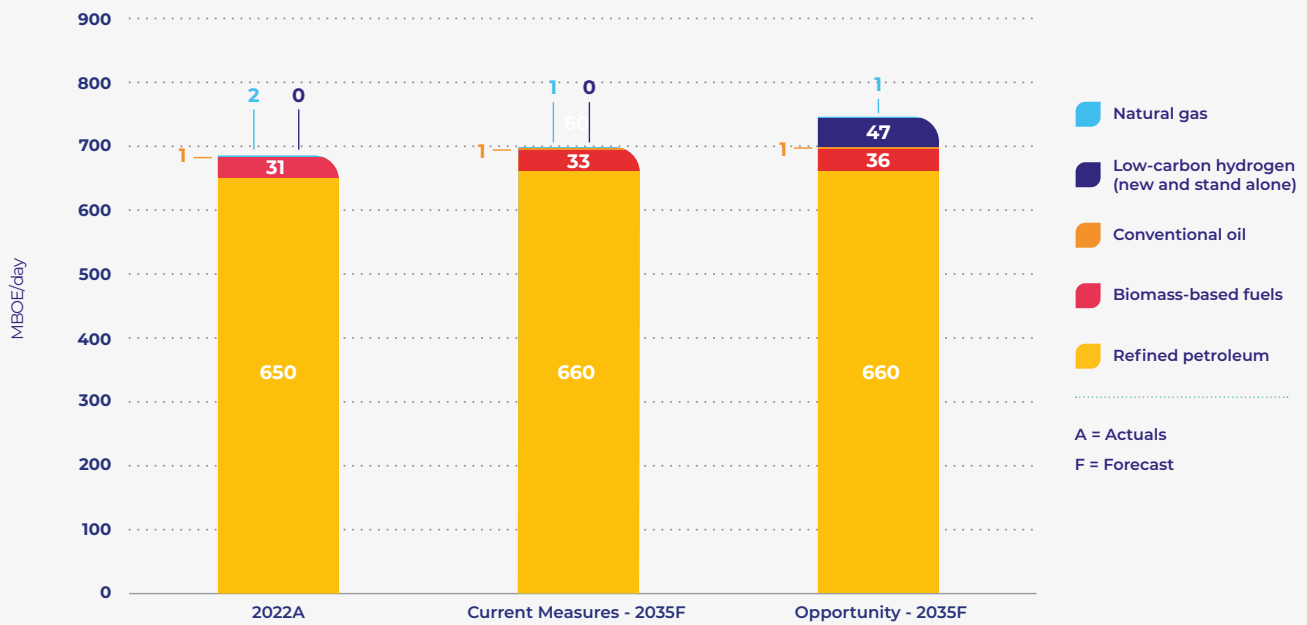


Photo courtesy of CAPP



Scenario assumptions for Atlantic Canada

The Atlantic region includes New Brunswick (NB), Nova Scotia (NS), Prince Edward Island (PE) and Newfoundland and Labrador (NL). Tables 4 and 5 and

Figure 9 provide a summary of projected investment and development details leading to changes in Atlantic Canada’s energy production across the region’s in-scope sectors.

Table 4: Atlantic Canada’s outlook scenario assumptions to 2035, both scenarios		
Sector	Current Measures	Opportunity (in addition to Current Measures)
Conventional oil* and natural gas *includes heavy, light, condensates, offshore	CAPEX increases by 83% over the forecast period mainly due to investment in Bay du Nord offshore platform projected to be operational by 2031. • Regional oil production increases by 31% • Some offshore exploration is likely to occur • Investment in natural gas production in NB results in growth in production to address increased local and Northeastern US demand during winter months	No change in oil or natural gas investment and production beyond Current Measures scenario.
Petroleum refining	NB is home to Canada’s largest petroleum refinery. Production of petroleum products remains flat over the forecast period. Anticipate focused Investment on reducing emissions generated by the refining process including the use of CCS technology and low-carbon hydrogen as feedstock.	No change beyond Current Measures scenario.
Biomass-based fuels	Regulations, including Clean Fuel Regulation, and conversion of the Come-by-Chance oil refinery to renewable fuel production are key drivers behind the establishment of a biomass-based fuels sector in the region. 18 MBOE/day is projected in the Current Measures scenario.	Additional 33% production could be realized.
Low-carbon hydrogen	1.2 MT (60 MBOE/day) of low-carbon hydrogen production is projected for the region using wind power and electrolysis. A significant portion of the low-carbon hydrogen could be converted to low-carbon ammonia and exported to European markets.	Additional 0.5 MT (25 MBOE/day) of low-carbon hydrogen production is added to the region to address increased domestic and export demand.

Figure 9: Atlantic Canada's production by energy sector, 2022 and both scenarios in 2035

In thousands of barrels of oil equivalent per day (MBOE/day)

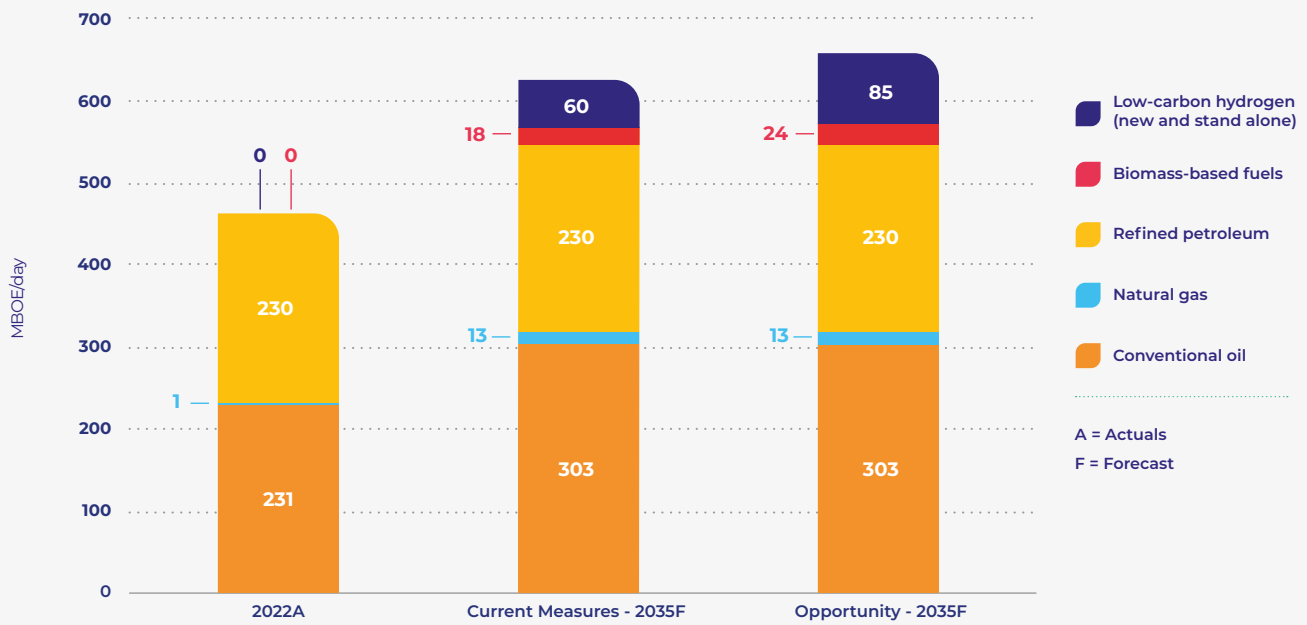


Photo courtesy of Irving Oil



Table 5 outlines national and regional outlook assumptions for conventional E&P and oil sands capital expenditures (CAPEX) and operating expenditures (OPEX).

Table 5: Conventional E&P and oil sands CAPEX and OPEX, both scenarios, 2022-2035

Region	Expenditure	In \$2021 millions		
		2022A	Current Measures (2035F; % change from 2022)	Opportunity (2035F; % change from 2022)
National	Conventional E&P CAPEX	\$16,286	\$22,160 (+36%)	\$23,025 (+41%) CAPEX projected to reach a high of \$26,748 in 2029 as spending ramps up to meet increased demand for natural gas in the Western region and prior to Bay Du Nord coming onstream in 2031.
	Conventional E&P OPEX	\$22,274	\$32,853 (+48%)	\$33,261(+49%)
	Oil sands total CAPEX	\$9,209	\$9,217 (0%)	No change in oil sands expenditures beyond Current Measures scenario.
	In situ CAPEX	\$4,130	\$5,292 (+28%)	
	Mining CAPEX	\$3,779	\$3,162 (-16%)	
	Upgrading CAPEX	\$1,300	\$1,300 (0%)	
	Oil sands OPEX	\$27,012	\$31,335 (+16%)	
Western	Conventional E&P CAPEX	\$14,980	\$20,192 (+35%)	\$21,057 (+41%) CAPEX projected to reach a high of \$23,921 in 2028 as spending ramps up to meet increased demand for natural gas.
	Conventional E&P OPEX	\$21,224	\$31,708 (+50%)	\$32,115 (+51%)
	Oil sands total CAPEX	\$9,209	\$9,217 (0%)	No change in oil sands expenditures beyond Current Measures scenario.
	In situ CAPEX	\$4,130	\$5,292 (+28%)	
	Mining CAPEX	\$3,779	\$3,162 (-16%)	
	Upgrading CAPEX	\$1,300	\$1,300 (0%)	
	Oil sands OPEX	\$27,012	\$31,335 (+16%)	
Central	Conventional E&P CAPEX	\$21	\$27 (+29%)	No change in conventional E&P expenditures beyond Current Measures scenario.
	Conventional E&P OPEX	\$16	\$20 (+20%)	
Atlantic	Conventional E&P CAPEX	\$1,025	\$1,878 (+83%) CAPEX projected to reach a high of \$3,281 in 2030 as spending ramps up prior to Bay Du Nord coming onstream in 2031.	No change in conventional E&P expenditures beyond Current Measures scenario.
	Conventional E&P OPEX	\$890	\$1,038 (+16%)	

Access detailed data on CIE's interactive dashboard

Find all the information and data from CIE's labour market outlooks—including workforce projections by year, region, sector and occupation—online at [CareersinEnergy.ca](https://careersinenergy.ca)



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