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ECON 366: Energy Economics

Topic 2.3: Oil and Gas Reserves, Resources, and Financial Viability

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Reserves and Resources

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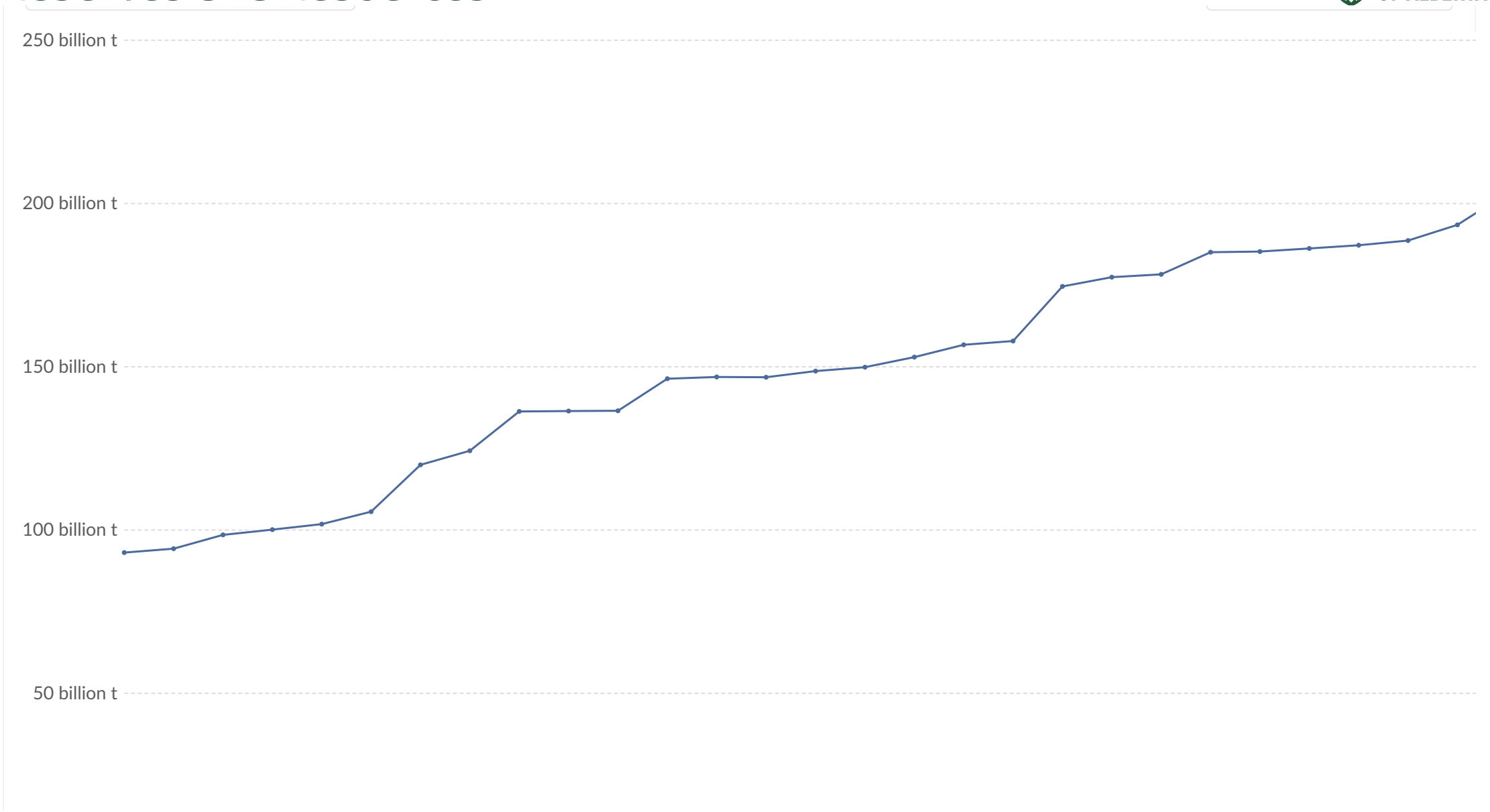
- What do you think of when you imagine an oil reserve?
  - the physical quantity of oil in the ground?
  - how much oil we *have left*?
- Reserves are an economic concept, not a physical one

- Reserves are an *endogenous* variable; they are a function of prices, technology, and markets

- Are oil reserves increasing or decreasing?

Reserves and Resources



Understanding Oil Reserves

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- Reserves are a difficult concept, since you tend to think of physical quantities
- Fossil fuel reserves are discovered, accessible, recoverable, economically viable quantities of petroleum
- Price influences both exploration and viability
- Reserves may increase or decrease over time (or not?)
- *Peak Oil* and other doomsday scenarios often caused by not understanding what we see in reserve data
- Oil sands reserves are speculative, economic figures, not simply a measure of the quantity of oil in place

Oil and gas evaluation handbook

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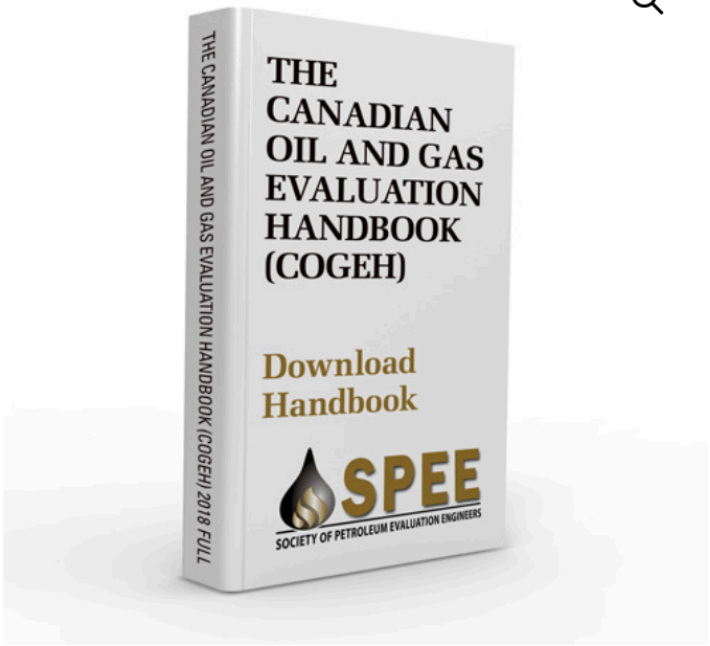

COGE Handbook PDF Download

$500.00

Download a PDF version of the **Canadian Oil and Gas Evaluation Handbook** PDF. **This document was revised on January, 2022 and contains:**
Volume 1 – Reserves Definitions and Evaluation Practices and Procedures; **Volume 2 –** Detailed Guidelines for Estimation and Classification of Oil and Gas Resources and Reserves; **Volume 3 –** CBM Reserves and Resources/International Properties/Bitumen and SAGD Reserves Resources; and the **Guidelines for the Estimation and Classification of Resources Other Than Reserves (ROTR)**

1 Add to cart

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Resources and Reserves

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Resources

> The term *resource* refers to a volume of petroleum estimated to exist in a naturally occurring accumulation within rocks and includes all known volumes and estimated volumes yet to be discovered.

The COGEH recognizes two *resource* subcategories:

- *contingent resources* are hydrocarbon deposits that are discovered but not commercially viable;
- *prospective resources* are hydrocarbon deposits that are not yet discovered.

Resources and Reserves

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Reserves

> *Reserves* refers to the remaining volume of petroleum that could be recovered from a known resource that is either already being produced or could begin production within about five years. Reserves must be recoverable under proven technology, and production must be economically viable.

The COGEH recognizes three *reserve* categories:

- *proved* (1P), *proved plus probable* (2P) and *possible* (3P) reserves;

Canadian entities are required to report on proved (1P) and proved + probable (2P) reserves under NI 51-101.

See AER ST-98

Proved (P) and Proved plus Probable (2P) Reserves

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> Proved Reserves are those quantities of Petroleum that, by analysis of geoscience and engineering data, can be estimated with reasonable certainty to be *commercially recoverable* from *known reservoirs* and under *defined technical and commercial conditions*. There should be at least *a 90% probability* that the quantities actually recovered will equal or exceed estimated proved reserves.
>
> Probable Reserves are *additional reserves* over-and-above proved reserves, estimated such that it is equally likely that actual remaining quantities recovered will be greater than or less than the sum of the estimated *Proved plus Probable* (2P) reserves (i.e. there should be at least a 50% probability that the actual quantities recovered will equal or exceed the 2P estimate).

Discovery

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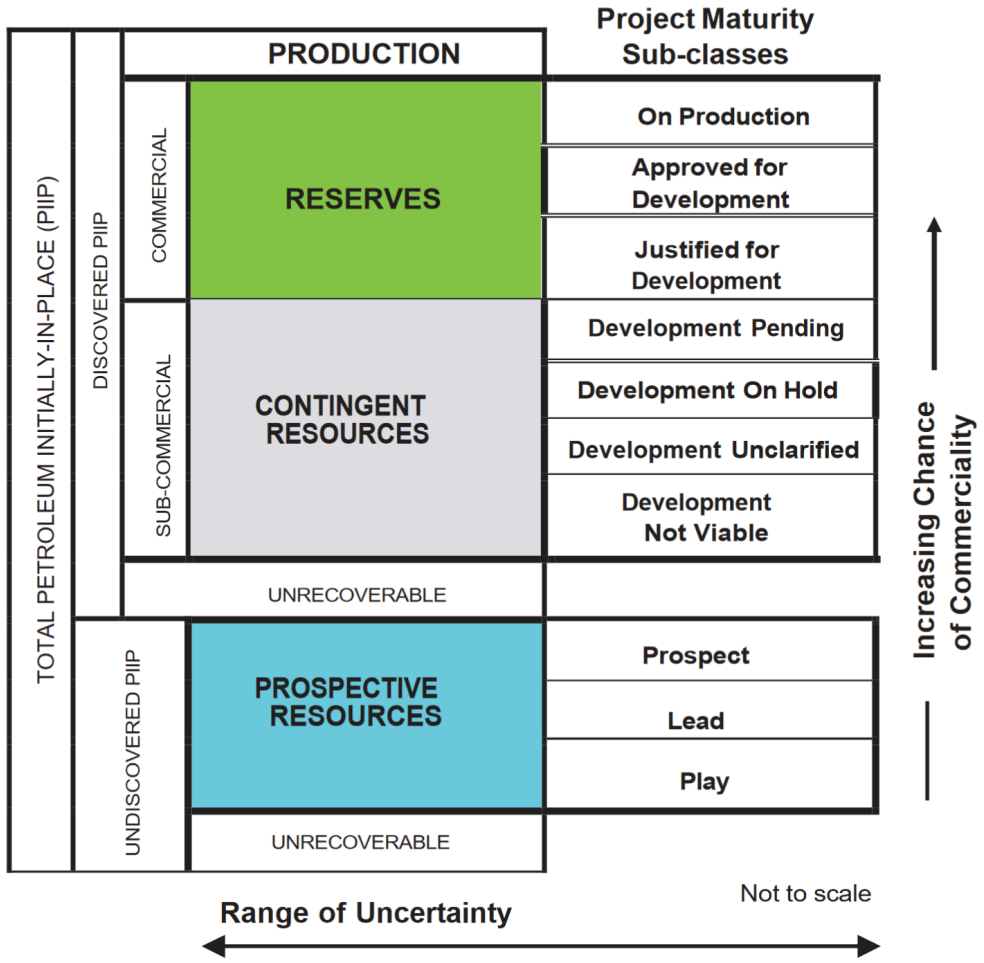
> A *discovered petroleum accumulation* is determined to exist when **one or more exploratory wells** have established through **testing, sampling, and/or logging** the existence of a **significant quantity** of **potentially recoverable** hydrocarbons and thus have established a known accumulation.

See SPE PRMS

PRMS



See SPE PRMS

Alberta Bitumen Reserves

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Table R3.1 In-place volumes and established reserves of crude bitumen (10^9 m^3)

Recovery method	Initial volume in-place	Initial established reserves	Cumulative production	Remaining established reserves	Remaining established reserves under active development
Mineable	20.8	6.16	1.06	5.10	3.37
In situ	272.3	21.9	0.75	21.2	0.43
Total	**293.1**	**28.1**[a]	**1.81**	**26.3**[a]	**3.80**[a]

[a] Any discrepancies are due to rounding.

Alberta Crude Oil Reserves

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Table R4.1 Reserves and production changes in crude oil (10^6 m^3)			
	2022	2023	Change
Initial established reserves[a]			
Light-medium	2728.3	2757.1	+28.8
Heavy	482.5	496.4	+13.9
Total	3210.8	3253.5	+42.7
Cumulative production[b]			
Light-medium	2524.6	2545.6	+21.0
Heavy	411.6	420.0	+8.4
Total	2936.2	2965.6	+29.4
Remaining established reserves[a]			
Light-medium	203.8	211.6	+7.8
Heavy	70.9	76.4	+5.5
Total	274.7	288.0	+13.3
Annual production			
Light-medium	20.6	21.3	+0.7
Heavy	7.7	8.4	+0.7
Total	28.3	29.7	+1.4

[a] Any discrepancies are due to rounding.

[b] Change in cumulative production is a combination of annual production and all adjustments to previous production records.

See AER ST-98

Classifying Oil Reserves

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Companies may also report more detailed reserve breakdowns:

- developed vs undeveloped
- producing vs non-producing
- hydrocarbon type
- location
- extraction technology

US vs Canadian disclosure

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US disclosure is based on historic prices and costs

- future prices assumed to follow the trailing 12-month average price, calculated as the average of the first-day-of-the-month price for of the previous 12 months prior to the end of the reporting period
- SEC used to use single day value, pre-2008
- 2009 changes also included bitumen as a potential oil reserve!

Canadian disclosure is based on forecast prices and costs

Canadian disclosure

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Sproule

McDaniel

GLJ

Price Deck Sample

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GLJ (2025-01) Pricing Tables 1 / 7 75%

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3

GLJ

Table 1
GLJ Ltd.
Crude Oil and Natural Gas Liquids
Price Forecast
Effective January 1, 2025

			United States		Europe	Canada					
Year	Inflation %	CADUSD Exchange Rate CAD/USD	WTI Crude Oil (39.6 API, 0.24%S) Cushing, OK Constant 2025 $ USD/bbl	WTI Crude Oil (39.6 API, 0.24%S) Cushing, OK Then Current USD/bbl	Brent Crude Oil (38.3 API, 0.37%S) UK Then Current USD/bbl	MSW, Light Crude Oil (40 API, 0.3%S) at Edmonton Then Current CAD/bbl	WCS Crude Oil (20.9 API, 3.5%S) at Hardisty Then Current CAD/bbl	Heavy Crude Oil Proxy (12 API) at Hardisty Then Current CAD/bbl	AWB* Crude Oil (22 API, 3.93% S) at Edmonton Then Current CAD/bbl	Cold Lake Crude Oil (21.3 API, 3.61%S) at Hardisty Then Current CAD/bbl	Light Sour Crude Oil (38 API, 1.1%S) at Cromer Then Current CAD/bbl
2015	1.10	0.783	62.70	48.78	53.60	57.20	44.82	39.25	40.71	43.71	55.49
2016	1.40	0.755	55.16	43.38	45.05	53.08	38.96	32.78	35.74	38.23	51.46
2017	1.60	0.771	63.85	50.94	54.80	62.84	50.53	44.74	46.75	48.69	62.09
2018	2.30	0.772	79.86	64.73	71.55	69.22	49.52	39.42	44.98	48.02	72.94
2019	1.90	0.754	68.79	57.02	64.24	69.16	58.75	54.11	54.66	57.09	69.65
2020	0.70	0.746	46.68	39.44	43.28	45.28	35.56	30.45	34.47	36.59	45.45
2021	3.40	0.798	79.83	67.92	70.78	79.71	68.74	62.14	65.87	67.84	80.10
2022	6.80	0.769	107.15	94.23	98.89	119.60	97.07	89.65	93.83	96.86	118.45
2023	3.90	0.741	82.59	77.63	82.22	99.56	80.44	72.14	77.90	80.22	97.29
2024 (est)	2.40	0.730	77.56	75.72	79.83	98.10	84.65	72.53	82.94	84.31	96.28
2025 Q1	0.00	0.700	70.50	70.50	74.50	89.00	82.14	75.10	80.50	82.14	87.67
2025 Q2	0.00	0.700	71.00	71.00	75.00	90.00	82.86	75.72	81.20	82.86	88.65
2025 Q3	0.00	0.710	71.50	71.50	75.50	93.15	82.39	75.20	80.75	82.39	91.76
2025 Q4	0.00	0.710	72.00	72.00	76.00	93.15	82.68	75.52	81.02	82.68	91.76
2025 Full Year	0.00	0.705	71.25	71.25	75.25	91.33	82.52	75.39	80.87	82.52	89.96
2026	2.00	0.730	72.06	73.50	77.50	93.32	82.20	75.88	80.55	82.20	91.92
2027	2.00	0.750	73.05	76.00	80.08	96.45	82.67	76.27	81.01	82.67	95.00
2028	2.00	0.750	74.00	78.53	82.69	99.82	84.97	78.23	83.27	84.97	98.32
2029	2.00	0.750	74.00	80.10	84.34	101.80	86.80	79.98	85.06	86.80	100.27

See GLJ Pricing PDF or Excel

Example: Suncor Reserve Declaration

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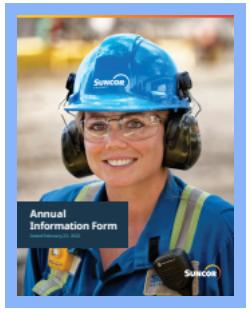
ADA_Suncor English AIF_100 pg 1 / 24 100%



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See Suncor 2022 AIF excerpt

Example: Suncor 2015 Reserve Declaration

See Suncor 2015 AIF excerpt

Key concept review

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- Reserves and resources
- 1P 2P reserves, contingent resources
- US vs Canadian disclosure
- Suncor info: NPV10, boe, etc. (not specific numerical details, but basic concepts)