Oil Sands Supply Outlook

Potential Supply and Costs of Crude Bitumen and Synthetic Crude Oil in Canada, 2003-2017

Breakfast Seminar
March 10, 2004

1

Agenda

- Introduction
- Study Conclusions
- Overview of Alberta's Oil Sands Industry
- Oil Sands Supply Costs
- Oil Sands Industry Issues
- Oil Sands Industry Outlook
- Wrap Up

2

CERI Oil Sands Supply Outlook

- CERI Study No. 108
- Industry Supply Costs
  - In situ technologies
  - Mining and extraction
  - Upgrading
- Industry Issues
- Bitumen and SCO Supply Projections (2003-2017)
  - 2 Unconstrained Cases
  - 3 Constrained Cases

3

Table of Contents

4

Appendices

Main Report

A. Supply Cost: Methodology and Assumptions

B. Glossary and Acronyms

C. Bibliography

Detailed Appendices

D. Project Descriptions

E. Supply Cost Economic Runs

F. Supply Cost Projections including "Projection" Model

5

Conclusions

- Alberta's oil sands industry has a very robust future given a reasonable outlook for crude oil prices
  - The industry needs crude oil prices of US$25/b (2003 real, WTI at Cushing) to recover costs and earn an adequate return on investment
  - The industry faces many challenges that must be overcome for sustained growth
  - Many projects will proceed, others will not

6

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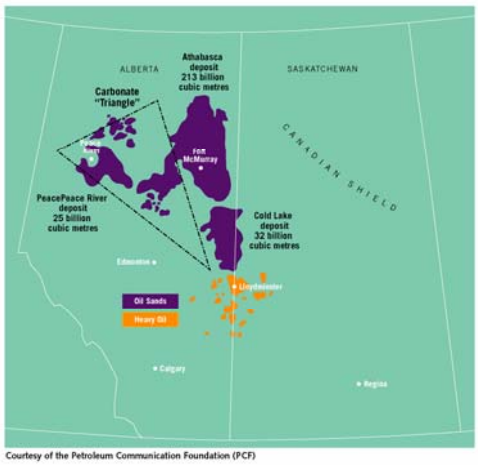
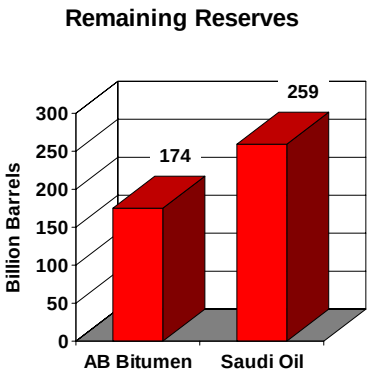
7

Resources and Reserves



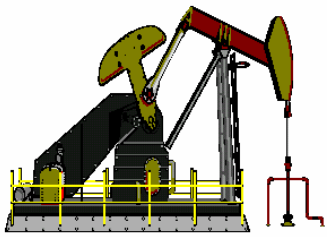
Courtesy of the Petroleum Communication Foundation (PCF)



8

Source: Alberta Energy and Utilities Board; Oil & Gas Journal

Resources and Reserves



Mineable Resources/Reserves

- **< 75m depth to top of oil sands formation**
- **Athabasca only**
- **7% of OBIP; 20% of initial established reserves; 70% of cumulative production**

In Situ Resources/Reserves

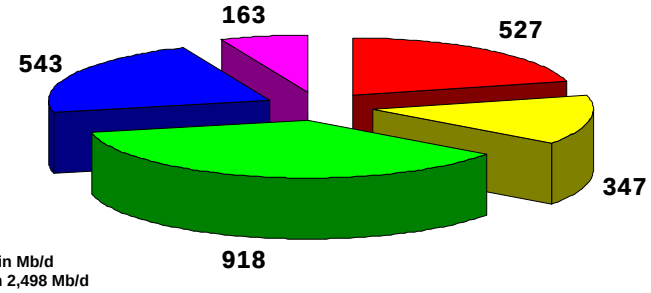
- **> 75m depth to top of oil sands formation**
- **Athabasca, CL and PR**
- **93% of OBIP; 80% of initial established reserves; 30% of cumulative production**

9

Source: Energy and Utilities Board (Year-end 2002)

Overview - Production

Alberta's Oil Sands provided 35% of Canada's "crude oil" production in 2003



All Figures in Mb/d
Total Production 2,498 Mb/d

Synthetic Bitumen Light Heavy Condensate

10

Source: National Energy Board (Preliminary Data)

Mining Projects

- **Operating**
  - Suncor - 225 Mb/d
  - Syncrude - 260 Mb/d
  - AOSP (Muskeg River) - 155 Mb/d
- **Under Construction**
  - Syncrude Stage 3 - 110 Mb/d
- **Approved**
  - True North (Fort Hills) - 190 Mb/d
  - CNRL (Horizon) - 232 Mb/d
  - AOSP (Jackpine) - 200 Mb/d
- **Others are in various stages of the regulatory process**

11

Major In Situ Projects (>10Mb/d)

- **Operating**
  - Imperial (Cold Lake)- 150 Mb/d
  - CNRL (Primrose) - 57 Mb/d
  - Petro-Canada (MacKay River) - 30 Mb/d
  - EnCana (Christina Lake & Foster Creek) - 10 & 30 Mb/d
  - Suncor (Firebag Phase 1) - 35 Mb/d
  - JACOS (Hangingstone) - 10 Mb/d
- **Under Construction**
  - Suncor (Firebag Phase 2) - 35 Mb/d
- **Approved**
  - Suncor (Firebag Phases 3 & 4) - 70 Mb/d
  - ConocoPhillips (Surmont) - 100 Mb/d
  - OPTI/Nexen (Long Lake) - 70 Mb/d
  - Petro-Canada (Meadow Creek) - 80 Mb/d
- **Others**

12

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13

Supply Cost

- **Supply Cost is the constant dollar price needed to recover all capital expenditures, operating costs, royalties and taxes and earn a specified return on investment**
- **For this study supply costs are calculated:**
  - **In constant 2003 dollars**
  - **using a 10%/a discount rate (real) - equivalent to a discount rate of 12%/a (nominal) based on an inflation rate of 2%/a**

14

Source: CERI Study No. 108

Key Supply Cost Assumptions

Economic Assumptions

Base Year	2003
Discount Rate	10%/a (Real)
Inflation Rate	2%/a
Exchange Rate	0.75 US$/C$

Energy Costs

NYMEX Natural Gas	US$4.25/MMBtu
NYMEX - AECO Basis	US$0.50/MMBtu
Plant Gate Natural Gas	C$4.74/GJ
Plant Gate Electricity	C$40/MWh

15

Key Supply Cost Assumptions

Oil Price Differentials

MSW at Edmonton - Dilbit at Hardisty	US$7.00/b
MSW - SCO at Edmonton	US$1.00/b
Condensate Premium over MSW at Edmonton	5%

Oil Transportation Costs

MSW from Edmonton to Chicago	US$1.61/b
WTI from Cushing to Chicago	US$0.82/b

16

Bitumen Supply Costs

	Plant Gate (C$/b)	WTI @ Cushing (US$/b)
Cold Lake Primary (CHOPS)	14.51	21.57
Cold Lake CSS	17.77	25.12
Athabasca SAGD	15.64	25.10
Athabasca Mining & Extraction	15.48	24.97

CHOPS: Cold Heavy Oil Production with Sand

CSS: Cyclic Steam Stimulation

SAGD: Steam Assisted Gravity Drainage

17

Source: CERI Study No. 108

SCO Supply Costs

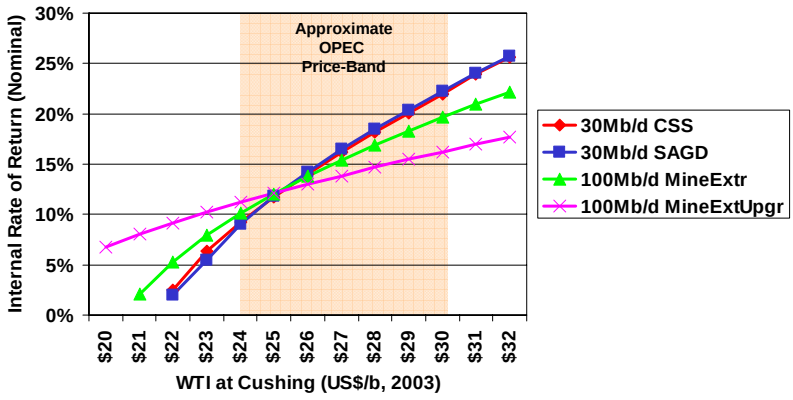
	Plant Gate (C$/b)	WTI @ Cushing (US$/b)
Mining, Extraction & Upgrading	30.50	24.90
Standalone Upgrading	12.71	N/A

SCO: Synthetic Crude Oil

18

Source: CERI Study No. 108

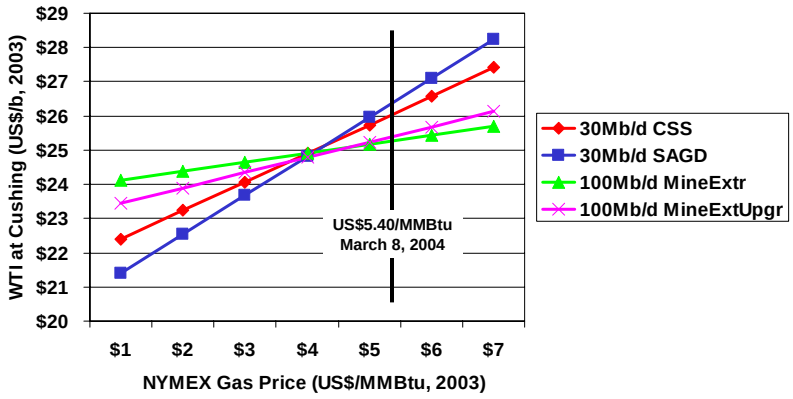
IRR vs. WTI Price



19

Source: CERI Study No. 108

Supply Cost vs. Gas Price



20

Source: CERI Study No. 108

SAGD Capital Costs

30 Mb/d Hypothetical Project	CAPEX (C$MM, 2003)
Initial G&G and stratigraphic test wells	11
Initial well pairs (30), well pads and gathering lines	93
Central plant	260
Total initial capital cost	364
Sustaining capital cost (30-year life)	410
Total capital cost (30-year life)	774

Initial capital cost $12,100 per b/d of capacity

21

Source: CERI Study No. 108

Athabasca SAGD Project Costs

Project	Capacity (Mb/d)	Capital Cost (C$ MM)
BlackRock Orion Phase 1	10	150
BlackRock Orion Phase 2	10	120
CNRL Kirby Phase 1	15	200
Deer Creek Joslyn Phase 2	30	275
Devon Jackfish	35	400
EnCana Christina Lake	10	113
EnCana Foster Creek Phase 1	30	290
Husky Tucker	30	400
Petro-Canada MacKay River	30	290
Suncor Firebag Phase 1	35	610

Average Cost C$12,100 per b/d of capacity

22

SAGD Operating Costs

(per barrel of produced crude bitumen)

30 Mb/d Hypothetical Project	
Natural gas use	**1.02 Mcf/b**
Electricity use	**10 kWh/b**
Other operating costs	**C$2.40/b**
Total operating cost (at design capacity)	**C$7.90/b**

23

Source: CERI Study No. 108

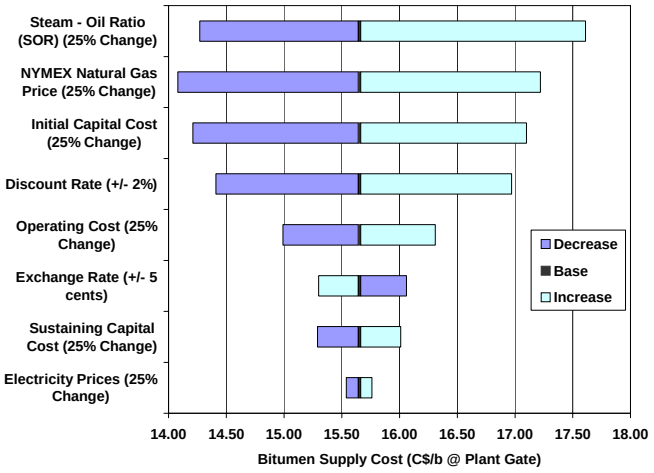
SAGD Bitumen Supply Cost

(Real C$/b, 2003)	Discounted	Undiscounted
Return on Investment	Included	2.45
Fixed Capital	5.29	2.46
Operating Working Capital	0.10	0.02
Natural Gas	5.30	5.05
Other Operating Costs	2.91	2.85
Abandonment Costs	0.01	0.05
Royalties	0.93	1.33
Income Taxes	1.10	1.44
Total Supply Cost	15.64	15.64

24

Source: CERI Study No. 108

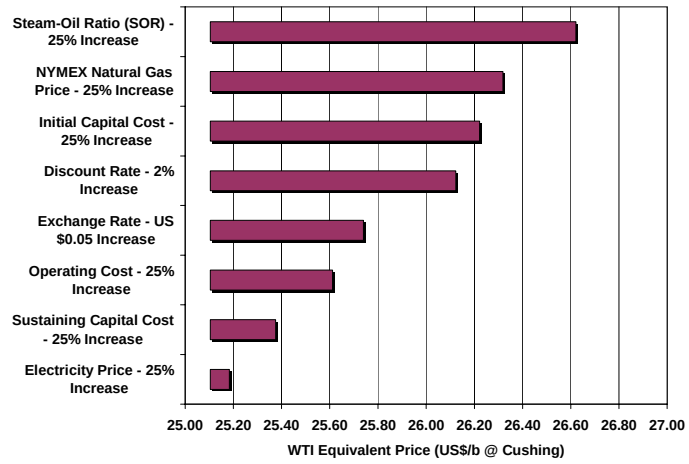
SAGD Supply Cost Sensitivities



25

Source: CERI Study No. 108

SAGD WTI Price Sensitivities



26

Source: CERI Study No. 108

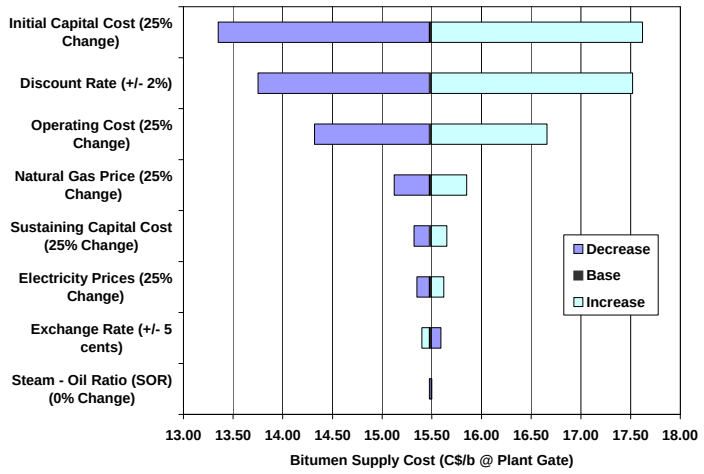
Mining Bitumen Supply Cost

(Real C$/b, 2003)	Discounted	Undiscounted
Return on Investment	Included	3.40
Fixed Capital	6.50	2.16
Operating Working Capital	0.12	0.02
Natural Gas	1.25	1.25
Other Operating Costs	5.06	5.01
Abandonment Costs	0.01	0.04
Royalties	1.17	1.73
Income Taxes	1.36	1.85
Plant Gate Supply Cost	15.48	15.48

27

Source: CERI Study No. 108

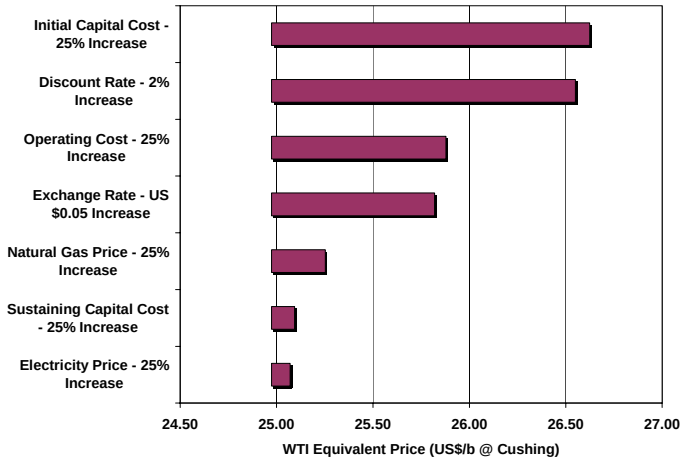
Mining Supply Cost Sensitivities



28

Source: CERI Study No. 108

Mining WTI Price Sensitivities



29

Source: CERI Study No. 108

Bitumen Supply Cost Summary

(Real C$/b, 2003)	CHOPS	CSS	SAGD	M&E
Return on Investment	Included	Included	Included	Included
Fixed Capital	4.82	8.57	5.29	6.50
Working Capital	0.08	0.15	0.10	0.12
Natural Gas	0.00	4.07	5.30	1.25
Other Operating	8.24	2.68	2.91	5.06
Abandonment	0.03	0.01	0.01	0.01
Royalties	0.67	1.21	0.93	1.17
Taxes	0.66	1.31	1.10	1.36
Supply Cost	14.51	17.99	15.64	15.48
WTI Equivalent (US$/b)	21.57	25.12	25.10	24.97

30

Source: CERI Study No. 108

SCO Supply Cost Summary

(Real C$/b, 2003)	Mining/Extraction	Upgrading	Total
Return on Investment	Included	Included	Included
Fixed Capital	7.48	5.53	13.00
Working Capital	0.14	0.09	0.23
Natural Gas	1.44	0.78	2.22
Other Operating	5.82	5.11	10.93
Abandonment	0.01	0.01	0.01
Royalties	1.35	0.00	1.35
Taxes	1.56	1.20	2.76
Supply Cost	17.80	17.99	30.50
WTI Equivalent (US$/b)			24.90

31

Source: CERI Study No. 108

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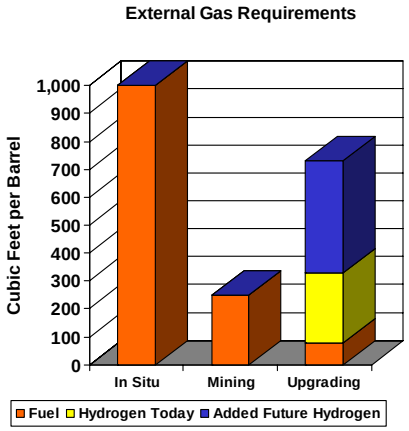
32

Industry Issues

- Environmental
- Capital Costs and Labour Availability/Productivity
- Energy Requirements, Sources and Costs
- Water Requirements and Supply
- Diluent Requirements and Supply
- Infrastructure Constraints
- Market Constraints
- Gas Over Bitumen

33

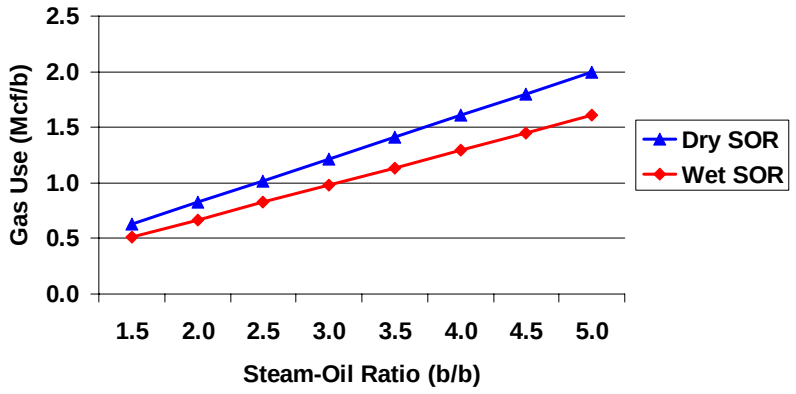
Oil Sands Gas Requirements



- Thermal in situ projects are very large energy consumers – Gas use depends on recovery performance
- Gas use for upgrading is higher for production of higher quality synthetic crude oil

34

Thermal In Situ Gas Use



35

Source: CERI Study No. 108

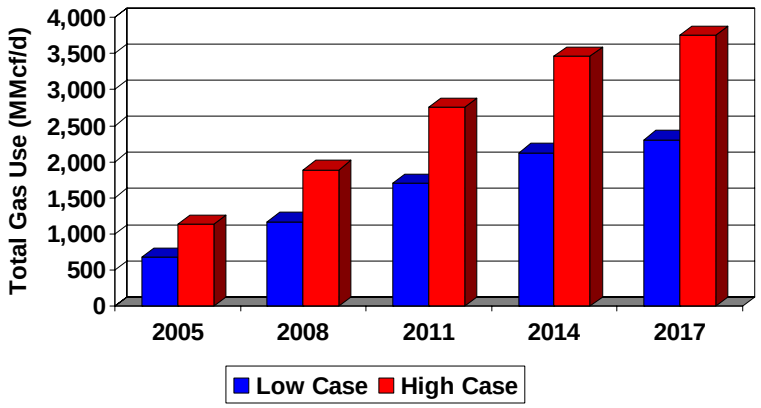
Gas Use Assumptions (Mcf/b)

	Low Case	High Case
Thermal In Situ	0.90	1.20
Mining	0.20	0.30
Upgrading	0.30	0.70

36

Source: CERI Study No. 108

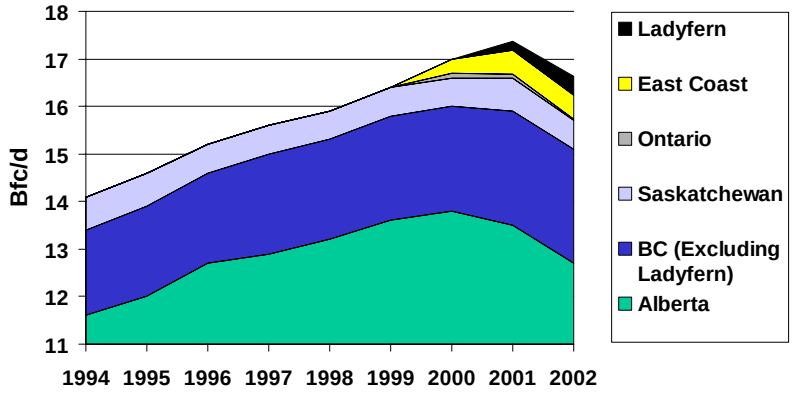
Oil Sands Gas Use – Unconstrained Projection



37

Source: CERI Study No. 108

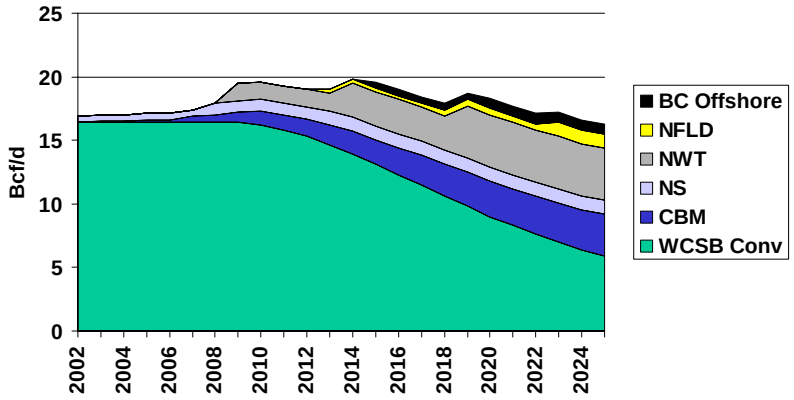
Historical Canadian Natural Gas Production



38

Source: CERI Study No. 107

Projected Canadian Natural Gas Production



39

Source: CERI Study No. 107

Implications

- Oil sands industry will compete for natural gas supply with other North American gas consumers
- Resultant strong natural gas prices will provide incentives for:
  - Further efficiency improvements
  - New recovery technologies
  - Fuel substitution

40

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41

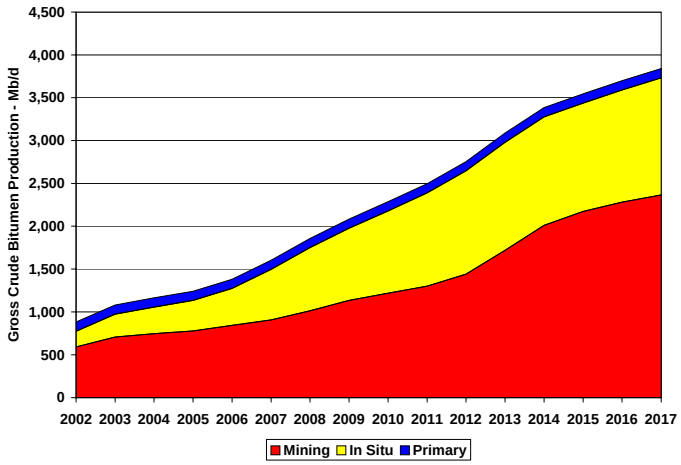
Bitumen and SCO Supply Projections

- Case 1 Unconstrained
- Case 2 Adjusted Unconstrained
- Case 3 High (US$32/b)
- Case 4 Reference (US$25/b)
- Case 5 Low (US$18/b)

42

Source: CERI Study No. 108

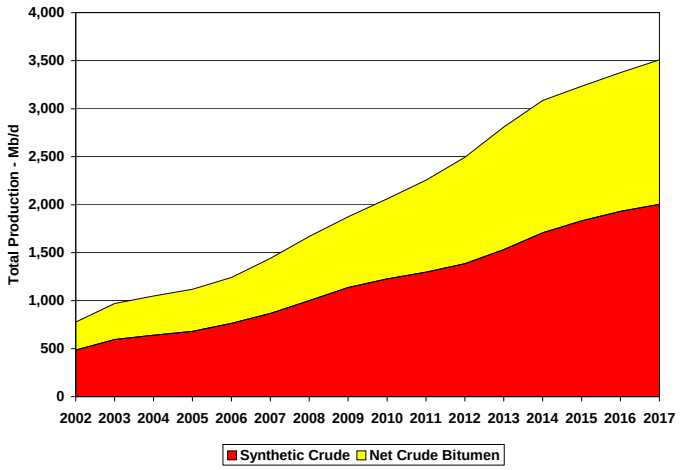
Unconstrained Supply Projection



43

Source: CERI Study No. 108

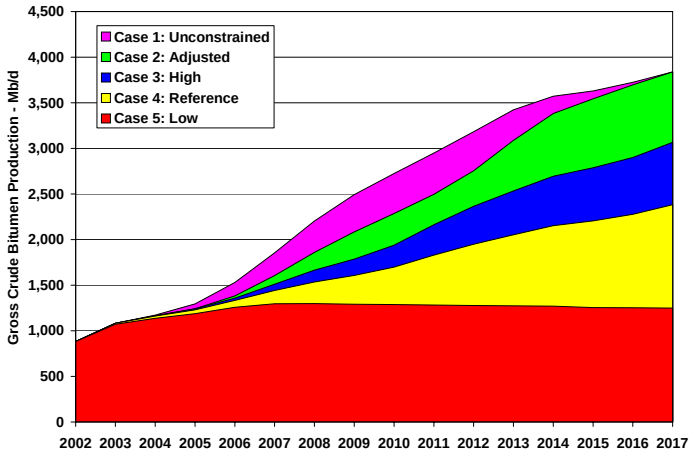
Unconstrained Supply Projection



44

Source: CERI Study No. 108

All Supply Projections



45

Supply Outlook in 2017 (million barrels per day)

	SCO	Bitumen	Total
Unconstrained	2.0	1.5	3.5
High (US$32/b)	1.6	1.2	2.8
Reference (US$25/b)	1.3	0.9	2.2
Low (US$18/b)	0.8	0.3	1.1

46

Capital Spending (C$ billions per year)

	Total
Unconstrained	6.2
High (US$32/b)	4.4
Reference (US$25/b)	3.1
Low (US$18/b)	1.0

47

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48

Conclusions

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  - **The industry needs crude oil prices of US$25/b (2003 real, WTI at Cushing) to recover costs and earn an adequate return on investment**
  - **The industry faces many challenges that must be overcome for sustained growth**
  - **Many projects will proceed, others will not**

49

Possible Follow-up Studies

- **Energy and Hydrogen Supply Options for Alberta's Oil Sands**
  - **Natural gas, coal, fuel oils, nuclear, bitumen, coke and other bitumen residues**
  - **New technologies**
  - **Comparative technical, economic, environmental impact and risk assessment**
- **Oil Sands Cogeneration Opportunities**
  - **In situ, mining/ extraction and upgrading**
  - **Transmission capacity**
  - **Domestic and export market opportunities**
  - **Comparative technical, economic, environmental impact and risk assessment**

50

1-Day Seminars

- Comprehensive overview of CERI's Oil Sands Outlook
- Demonstration of CERI's "Supply Cost" and "Projection" models
- Locations and Timing
  - Fort McMurray March 23
  - Edmonton March 24
  - Calgary April 1

51

Handout Material

- Compact Disk
  - Today's Presentation
  - CERI Media Release
  - Report Table of Contents
  - Registration Form for 1-Day Seminars
  - Expressions of Interest for Follow-up Studies
  - Other CERI Information

52

Thanks

- Other Members of CERI Study Team
  - Melanie Stogran
  - Pauline Chan
  - Kok-sum (Sam) Chan
- Study Sponsors
- CERI Members
- CERI Conference Staff

53

Questions?

54