



# **Society of Petroleum Engineers**

## **Opportunities in the Canadian Oil Sands**

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Peters & Co. Limited**

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# Agenda

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- 1. Production Growth Forecasts**
- 2. Resource Overview & Classification**
- 3. In Situ Overview & Emerging Technologies**
- 4. Mining & Upgrading Overview**
- 5. Environmental Issues**
- 6. Heavy Oil Market Outlook**
- 7. Natural Gas Demand For Oil Sands**
- 8. Oil Sands Transactions**

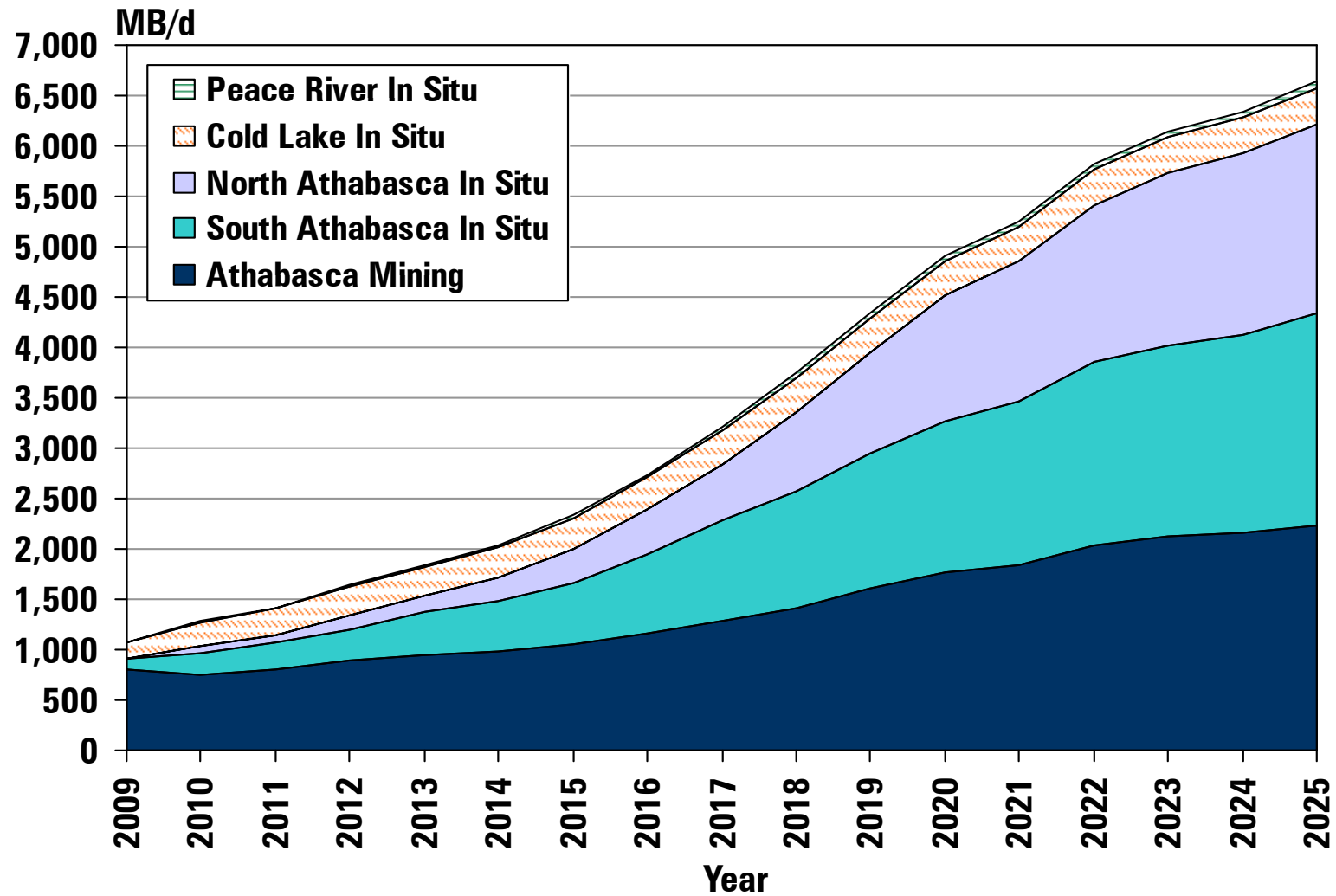
## Overview and Major Themes

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- **Production from the oil sands set to increase significantly over the next decade**
  - Based on our risked forecast production will increase from ~1.5 MMB/d currently to ~2.0 MMB/d by 2015 and 3.5 MB/d by 2020.
- **High oil prices are required to reach break-even economics**
  - SAGD: US\$50/B WTI
  - Mining (No Upgrading): US\$60/B WTI
  - Mining (With Upgrading): >US\$100/B WTI
- **Capital spending is expected to surpass the previous peak in 2007/2008**
  - We forecast spending will peak at \$22 billion in 2014, 20% higher than the previous peak and compared to \$12 billion in 2009 based on our risked production forecast.

# Oil Sands Production Forecast – Unrisked Bitumen and Upgraded Crude Oil

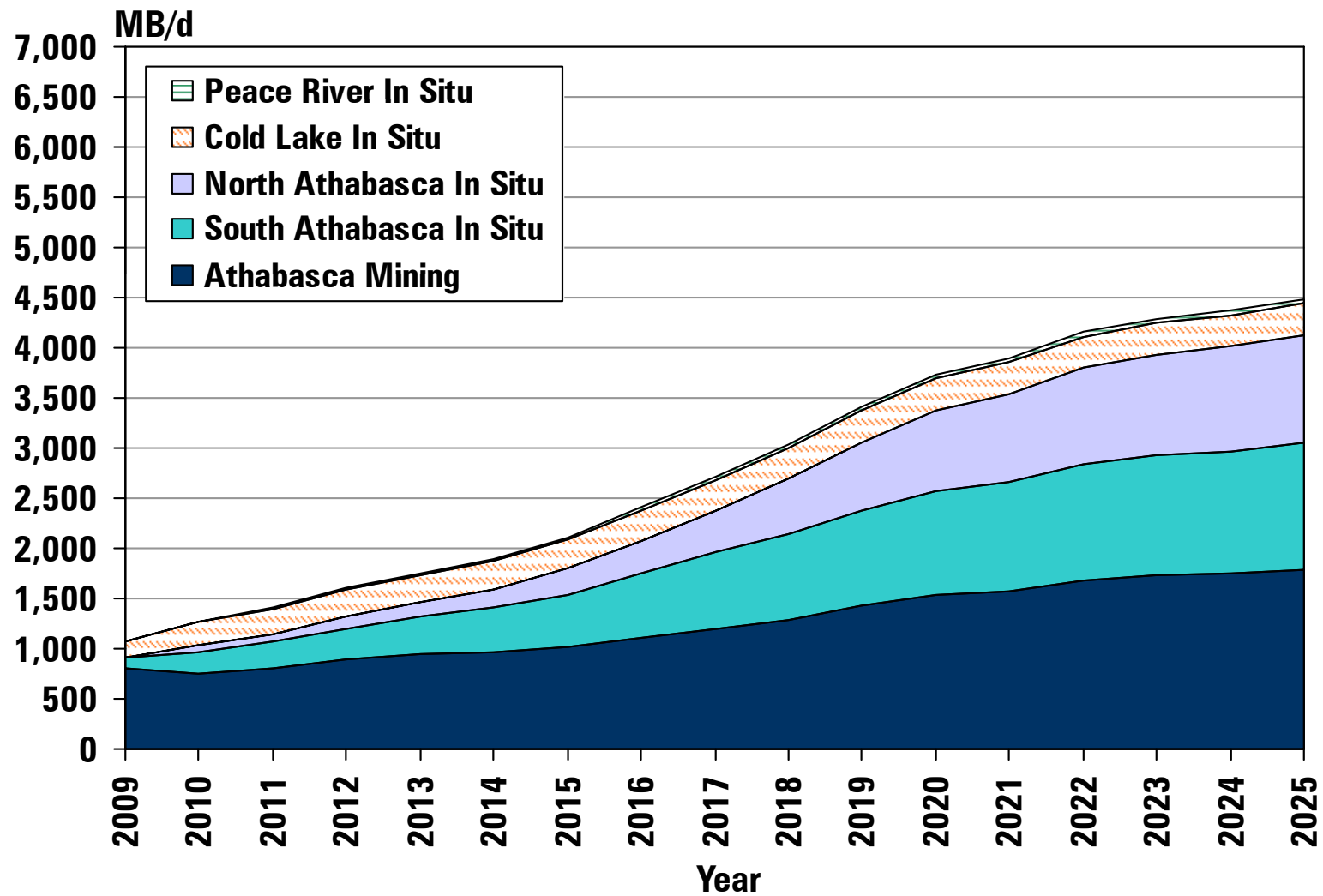
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Source: Peters & Co. Limited estimates.

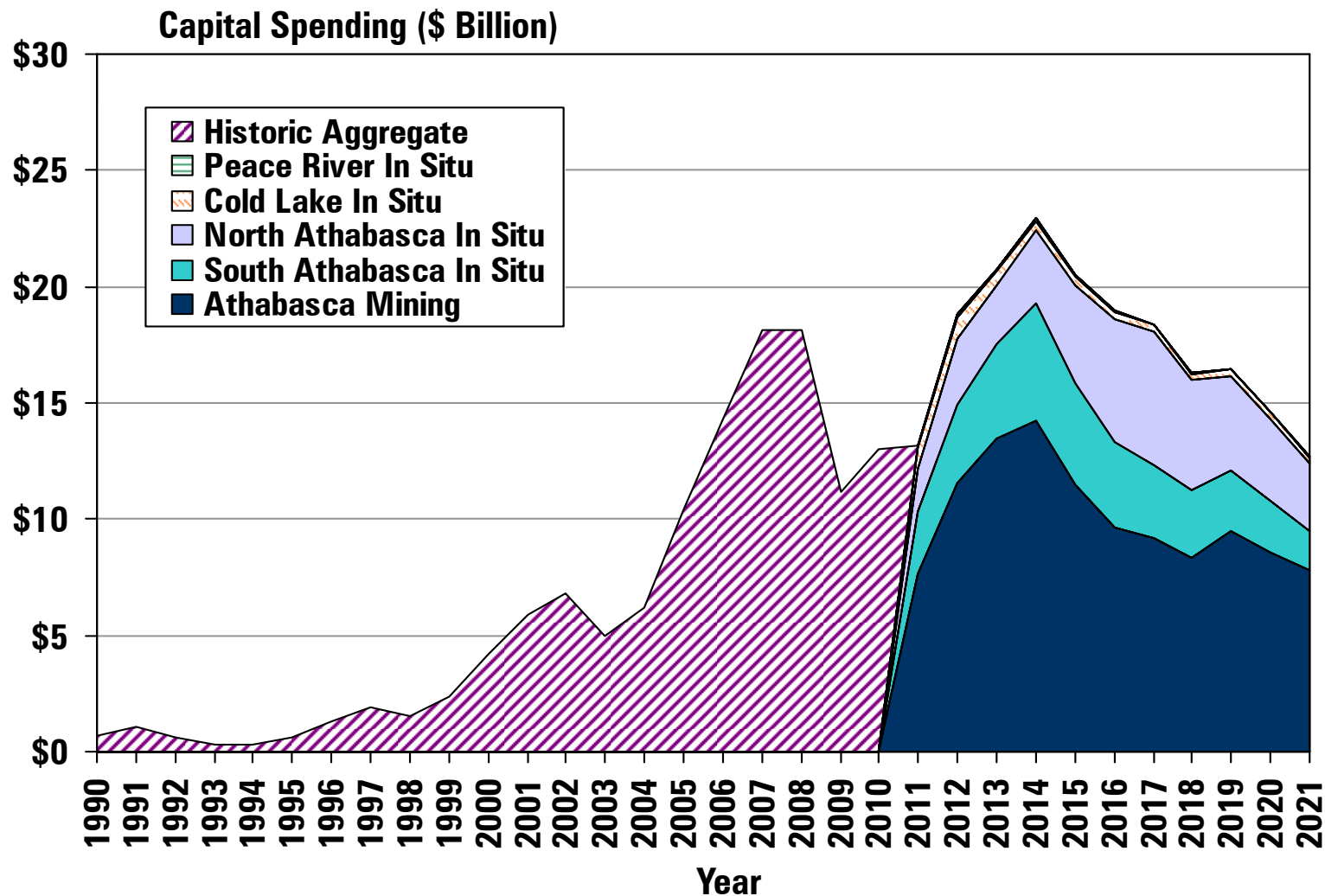
# Oil Sands Production Forecast – Risked Bitumen and Upgraded Crude Oil

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Source: Peters & Co. Limited estimates.

# Potential Annual Capital Spending on New Project Development and Maintenance (Risky)



Source: Forecast based on Peters & Co. Limited estimates, historic based on CAPP data.

# Crude Bitumen Initial In-place Volumes

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Area	Deposit	Initial Volume In-place (MMB)	Area (Acres 000's)	Average Pay Thickness (m)	Average Bitumen Saturation		Average Porosity (%)
					Mass (%)	Pore Volume (%)	
<b>Athabasca</b>							
1	Grand Rapids	54,585	1,302	9.6	6.5%	57%	30%
2	Wabiskaw-McMurray (mineable)	130,977	926	25.9	10.1%	76%	28%
3	Wabiskaw-McMurray (in situ)	827,821	11,594	13.1	10.2%	73%	29%
4	Nisku	64,976	1,233	8.0	5.7%	63%	21%
5	Grosmont	405,938	4,362	23.8	6.6%	79%	20%
		<b>1,484,295</b>	<b>19,417</b>				
<b>Cold Lake</b>							
6	Upper Grand Rapids	33,821	1,512	4.8	9.0%	65%	28%
7	Lower Grand Rapids	62,925	1,625	7.8	9.2%	65%	30%
8	Clearwater	59,264	1,070	11.8	8.9%	59%	31%
9	Wabiskaw-McMurray	26,965	1,198	5.1	8.1%	62%	28%
		<b>182,976</b>	<b>5,404</b>				
<b>Peace River</b>							
10	Bluesky-Gething	68,989	2,510	6.1	8.1%	68%	26%
11	Belloy	1,774	64	8.0	7.8%	64%	27%
12	Debolt	49,062	637	25.3	5.1%	66%	18%
13	Shunda	15,788	353	14.0	5.3%	52%	23%
		<b>135,612</b>	<b>3,564</b>				
<b>Total</b>		<b>1,802,884</b>	<b>28,385</b>				

Source: ERCB ST98-2010 (Table 2.3).

Notes: Estimates are as of December 31, 2009. Within the Grosmont units, initial volume in-place estimates are 53 billion barrels for the A (13%), 28 billion barrels for the B (7%), 118 billion barrels for the C (29%), and 207 billion barrels for the D (51%).

# Reserves of Mineable Crude Bitumen



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Development	Initial Mineable Volume In-place (MMB)	Initial Established Reserves (MMB)	Cumulative Production (MMB)	Remaining Established Reserves (MMB)
<b>ACTIVE MINING PROJECTS</b>				
Shell Albion Sands	4,227	2,636	359	2,277
Fort Hills	4,397	2,290	-	2,290
Horizon	5,246	3,378	25	3,353
Kearl	8,328	5,485	-	5,485
Jackpine	2,271	1,396	-	1,396
Suncor	6,227	4,321	1,679	2,642
Syncrude	13,027	8,215	2,453	5,762
<b>Total Active</b>	<b>43,722</b>	<b>27,720</b>	<b>4,516</b>	<b>23,204</b>
<b>NON-ACTIVE MINING PROJECTS (ALL OTHER)</b>				
	87,110	11,033	-	11,014
<b>Total</b>	<b>130,832</b>	<b>38,753</b>	<b>4,516</b>	<b>34,218</b>

Source: ERCB ST98-2010 (Table 2.4).

Notes: Estimates are as of December 31, 2009.

# Reserves of In-Situ Crude Bitumen

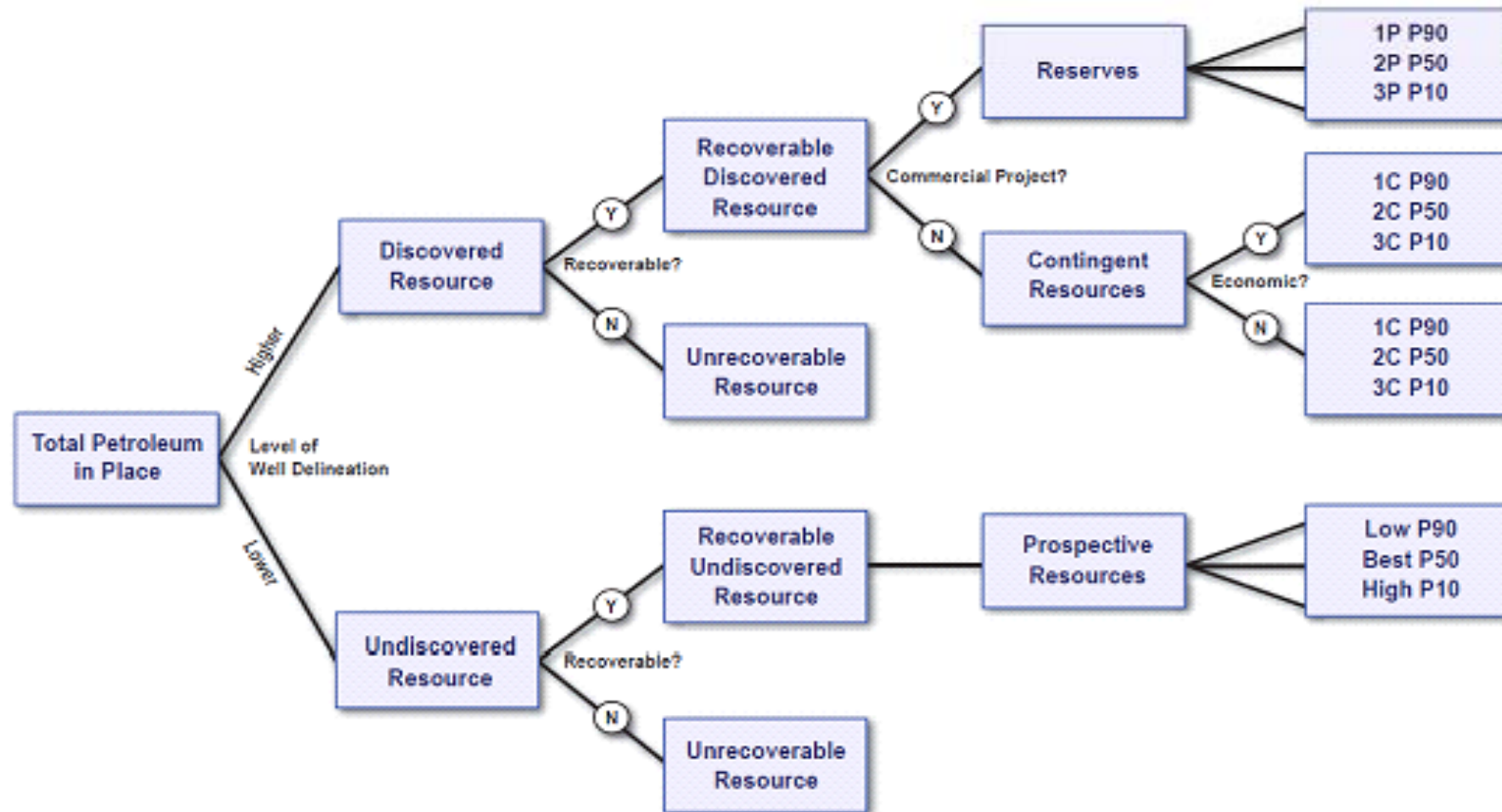
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Development	Initial In Situ Volume In-place (MMB)	Initial Established Reserves (MMB)	Cumulative Production (MMB)	Remaining Established Reserves (MMB)
<b>ACTIVE IN SITU PROJECTS</b>				
<b>Peace River Oil Sands Area</b>				
Thermal commercial projects	351	140	65	75
Primary recovery schemes	1,011	101	52	49
	<b>1,362</b>	<b>242</b>	<b>118</b>	<b>124</b>
<b>Athabasca Oil Sands Area</b>				
Thermal commercial projects	1,973	987	315	672
Primary recovery schemes	6,455	323	138	185
Enhanced recovery schemes (poly/waterflood)		182	82	100
	<b>8,428</b>	<b>1,491</b>	<b>534</b>	<b>957</b>
<b>Cold Lake Oil Sands Area</b>				
Thermal commercial (CSS)	7,629	1,907	1,244	664
Thermal commercial (SAGD)	213	106	9	97
Primary production within projects	3,781	189	86	103
Primary recovery schemes	27,343	1,367	360	1,007
Lindbergh primary production	8,235	412	48	364
	<b>47,201</b>	<b>3,982</b>	<b>1,748</b>	<b>2,234</b>
<b>NON-ACTIVE IN SITU PROJECTS (ALL OTHER)</b>	<b>1,614,888</b>	<b>132,285</b>	<b>-</b>	<b>132,235</b>
<b>Total</b>	<b>1,671,879</b>	<b>138,000</b>	<b>2,400</b>	<b>135,550</b>

Source: ERCB ST98-2010 (Table 2.5).

Notes: Estimates are as of December 31, 2009.

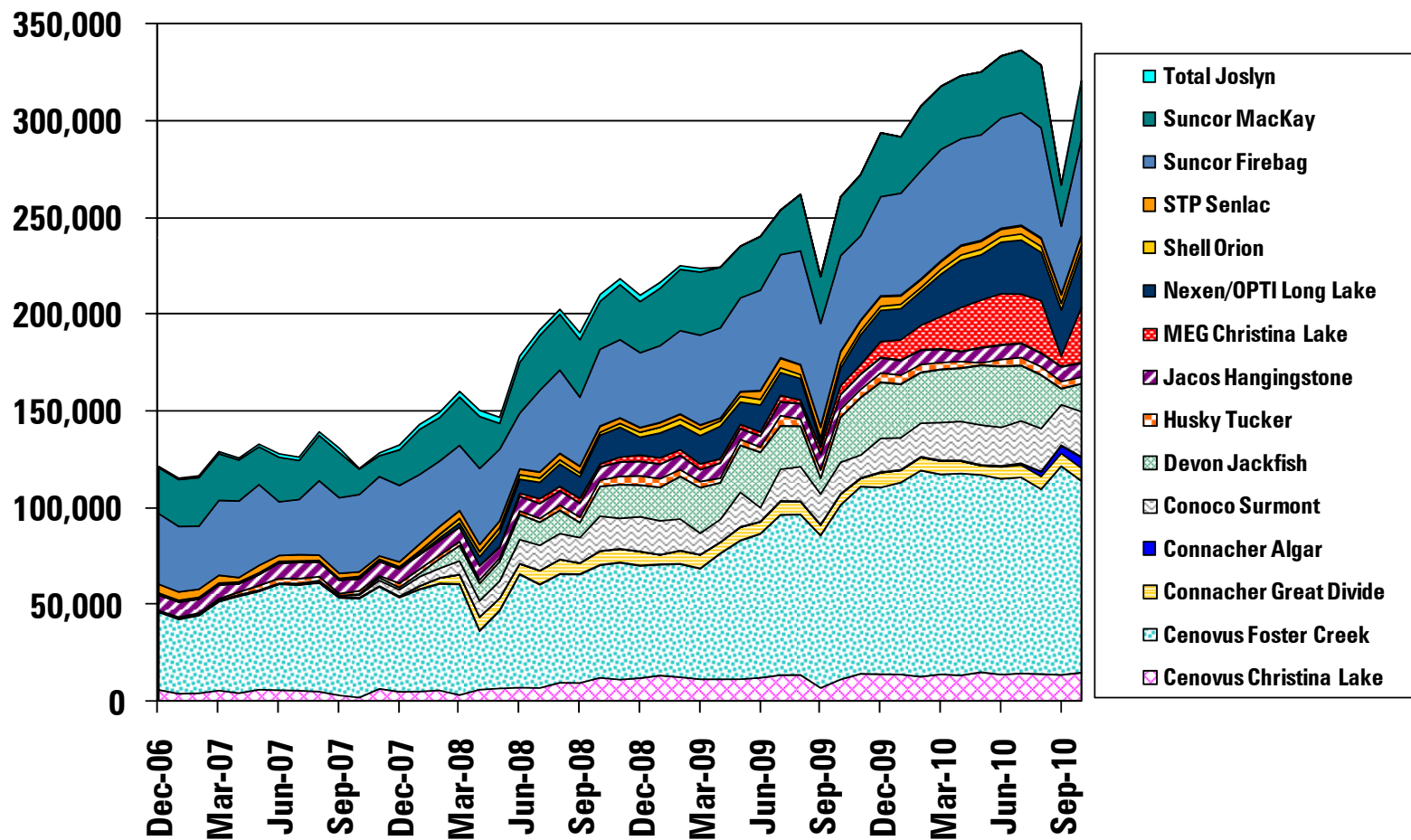
# Oil Sands Resource Classifications



# SAGD Historical Production Performance

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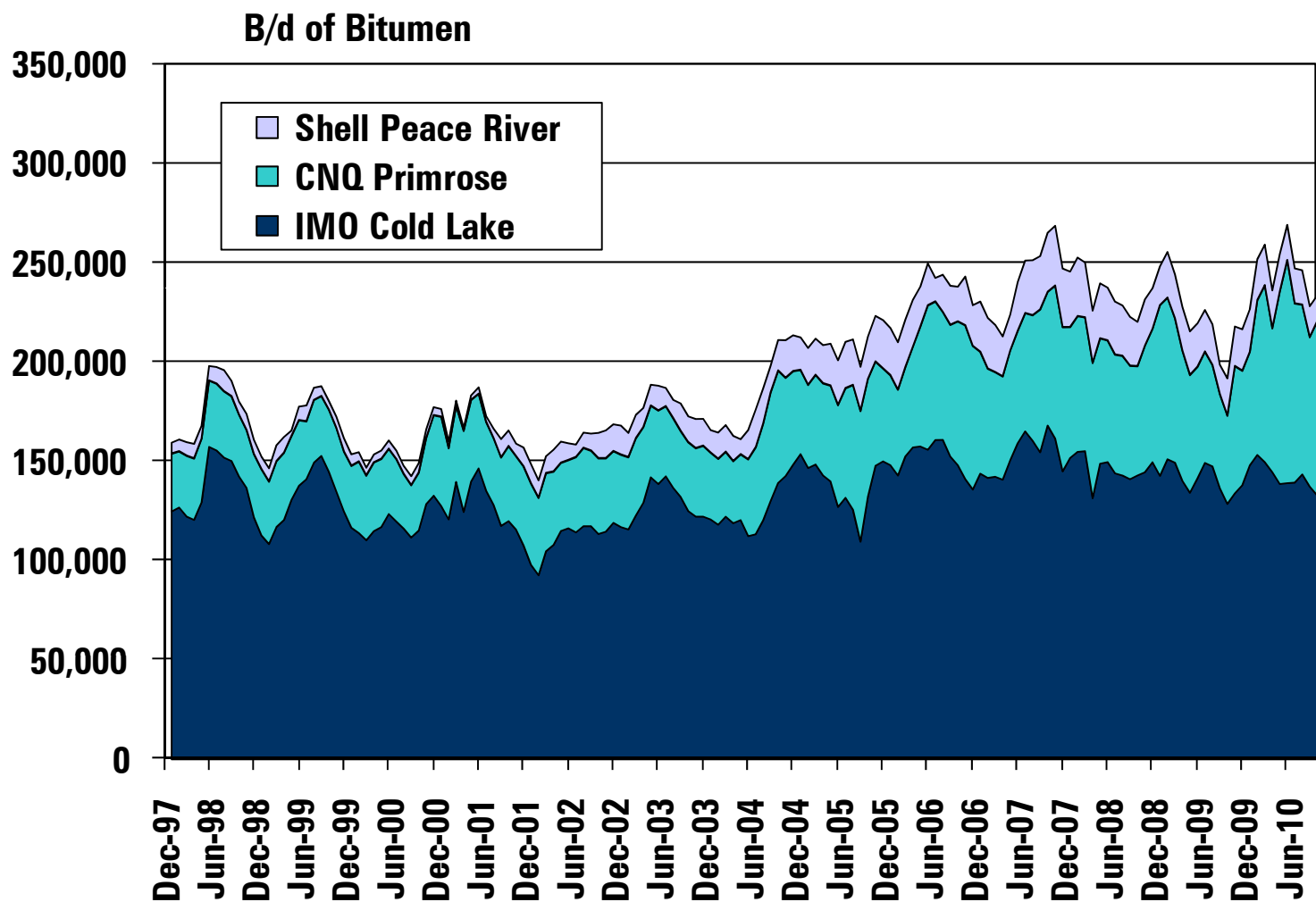
B/d of Bitumen



Source: geoSCOUT, Peters & Co. Limited estimates.

# CSS Historical Production Performance

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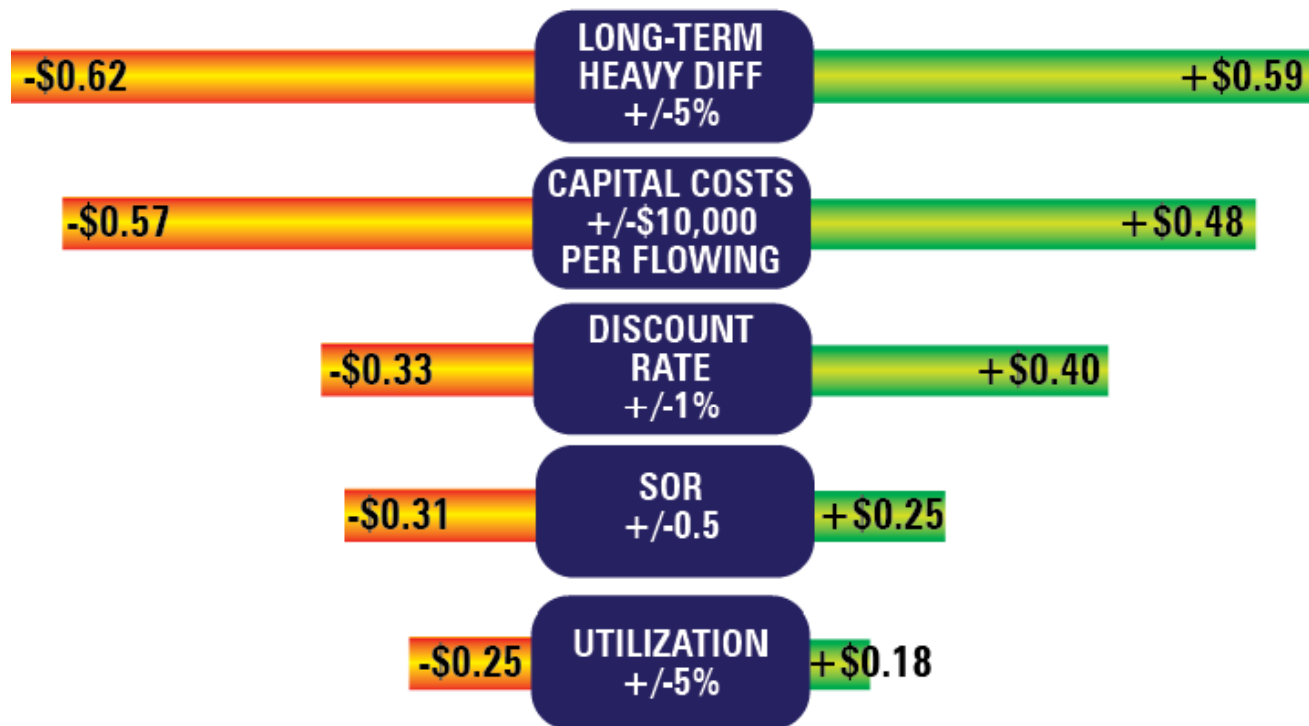


Source: geoSCOUT, Peters & Co. Limited estimates.

# Standard SAGD Model NPV Sensitivity at US\$80/B WTI

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## BASE CASE NPV \$1.10 PER BARREL



### Base Case Assumptions:

SOR	3.5	Capital Costs	\$37,500
Utilization	85%	Discount Rate	10%
Long-term Heavy Diff.	22%		

# In Situ Project Summary (October 2010)



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## In Situ Project Summary (October 2010)

Project	Production (B/d)	Utilization	ISOR	CSOR
<b>SAGD Projects</b>				
Southern Pacific - Senlac [1]	4,700	57%	2.1	2.1
Cenovus - Christina Lake	15,400	82%	1.9	2.2
Cenovus - Foster Creek	98,700	79%	2.2	2.5
Suncor - MacKay River	30,600	98%	2.6	2.5
Devon - Jackfish	14,300	81%	2.6	2.6
MEG - Christina Lake	28,400	108%	2.3	2.8
ConocoPhillips - Surmont	23,600	90%	2.4	3.0
Suncor - Firebag	49,600	63%	3.3	3.3
JACOS - Hangingstone	7,100	62%	4.0	3.5
Connacher - Great Divide	7,000	69%	3.7	3.8
Total - Joslyn [2]	2,900	29%	4.5	4.0
Shell - Orion	3,700	35%	5.7	5.1
Nexen/OPTI - Long Lake	29,000	35%	5.0	5.8
Connacher - Algar [3]	5,400	14%	4.2	8.6
Husky - Tucker Lake	3,500	23%	7.9	10.0
<b>Median</b>		<b>66%</b>	<b>3.3</b>	<b>3.3</b>
<b>Weighted Average</b>		<b>75%</b>	<b>3.0</b>	<b>3.3</b>
<b>CSS Projects</b>				
Shell - Peace River	14,800	58%	2.2	3.0
Imperial - Cold Lake	133,200	95%	4.0	3.4
Canadian Natural - Primrose	87,700	69%	5.0	4.9
<b>Median</b>		<b>69%</b>	<b>4.0</b>	<b>3.4</b>
<b>Weighted Average</b>		<b>83%</b>	<b>3.5</b>	<b>3.9</b>

[1] CSOR is from beginning of 2008.

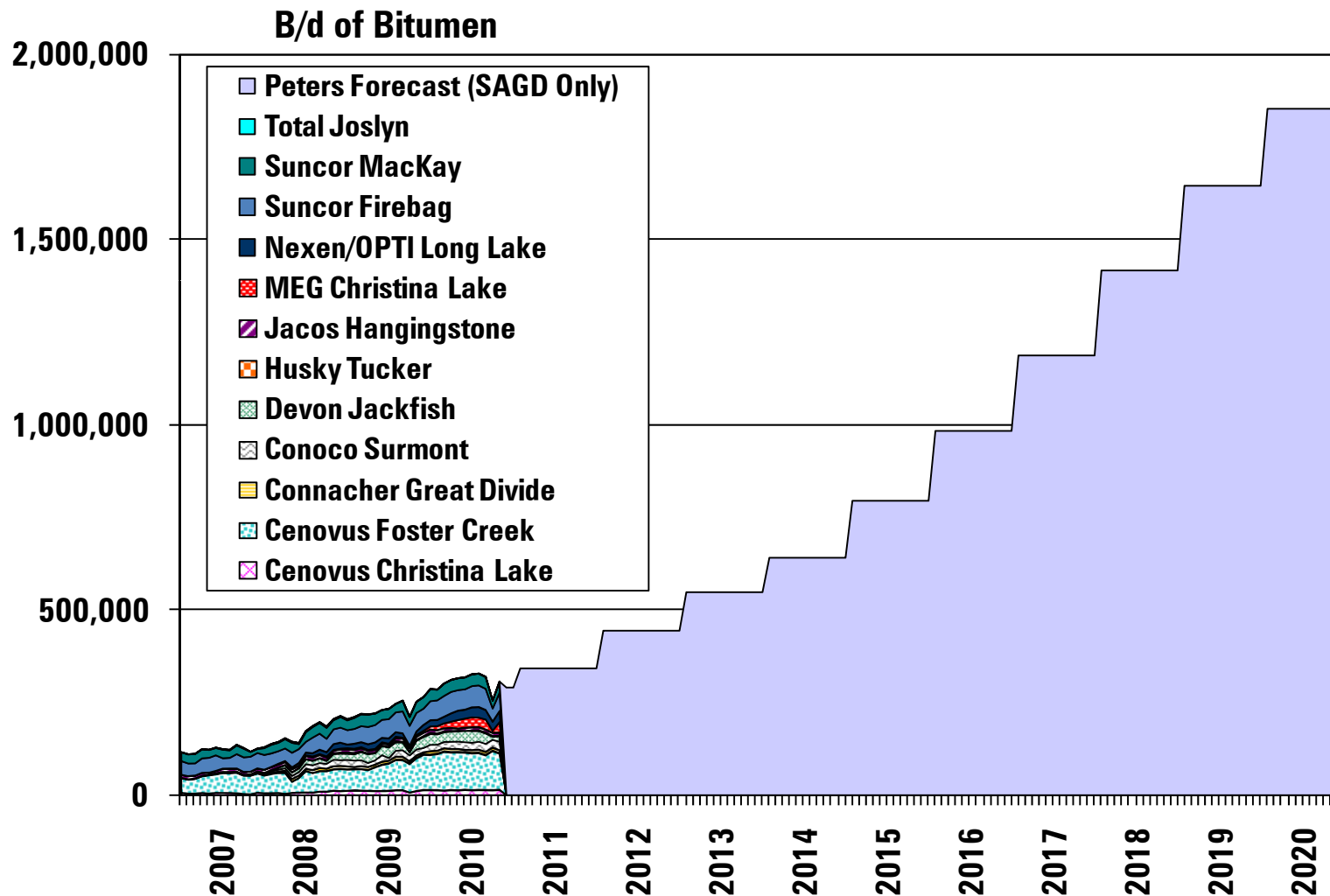
[2] Data is for the last twelve months the project was operating to March 2009.

[3] Project is in initial ramp-up stage, with first bitumen production in June 2010.

Source: Peters & Co. Limited estimates, geoSCOUT.

# SAGD Production Forecast by Project to 2020

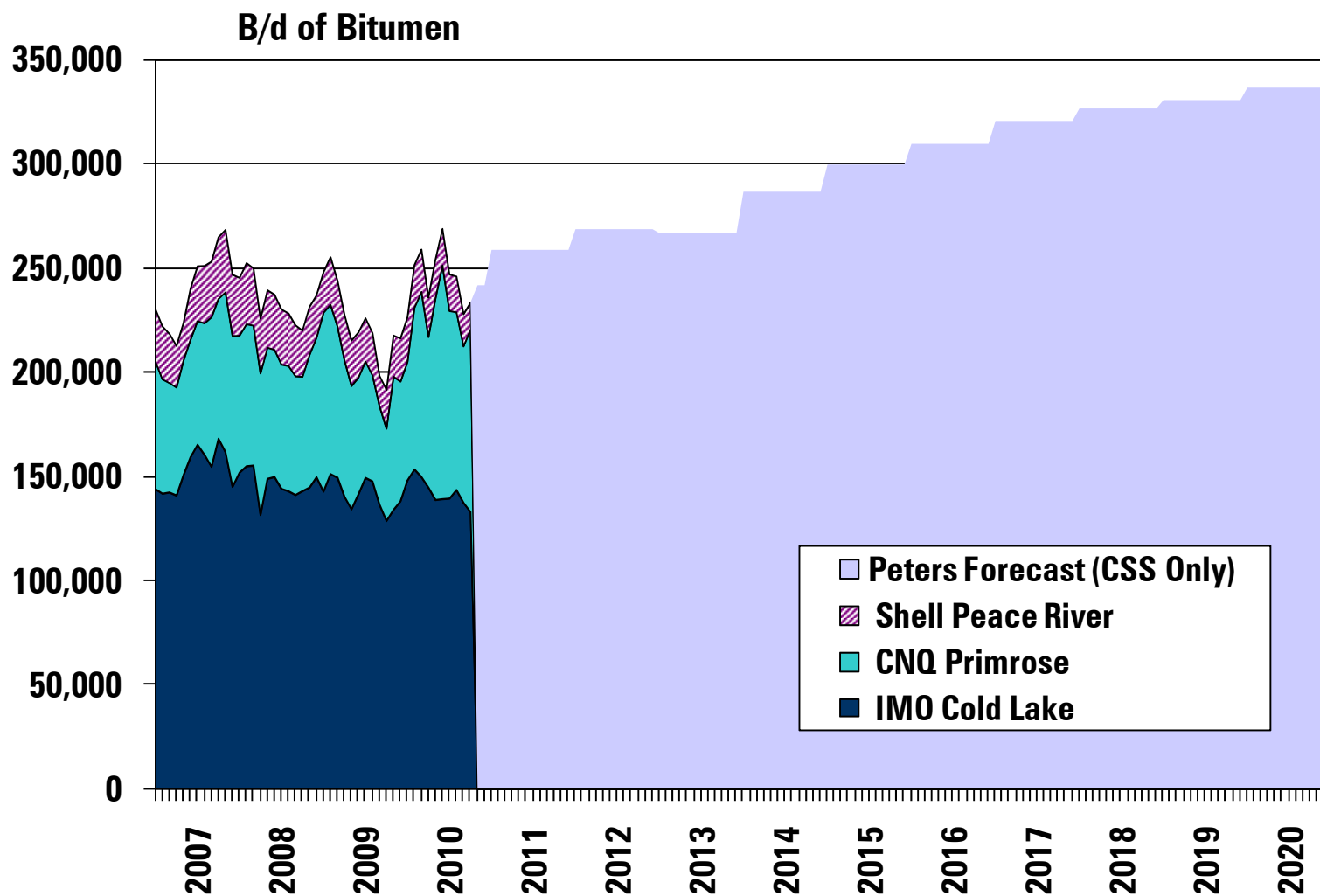
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Source: geoSCOUT, Peters & Co. Limited estimates.

# CSS Production Forecast by Project to 2020

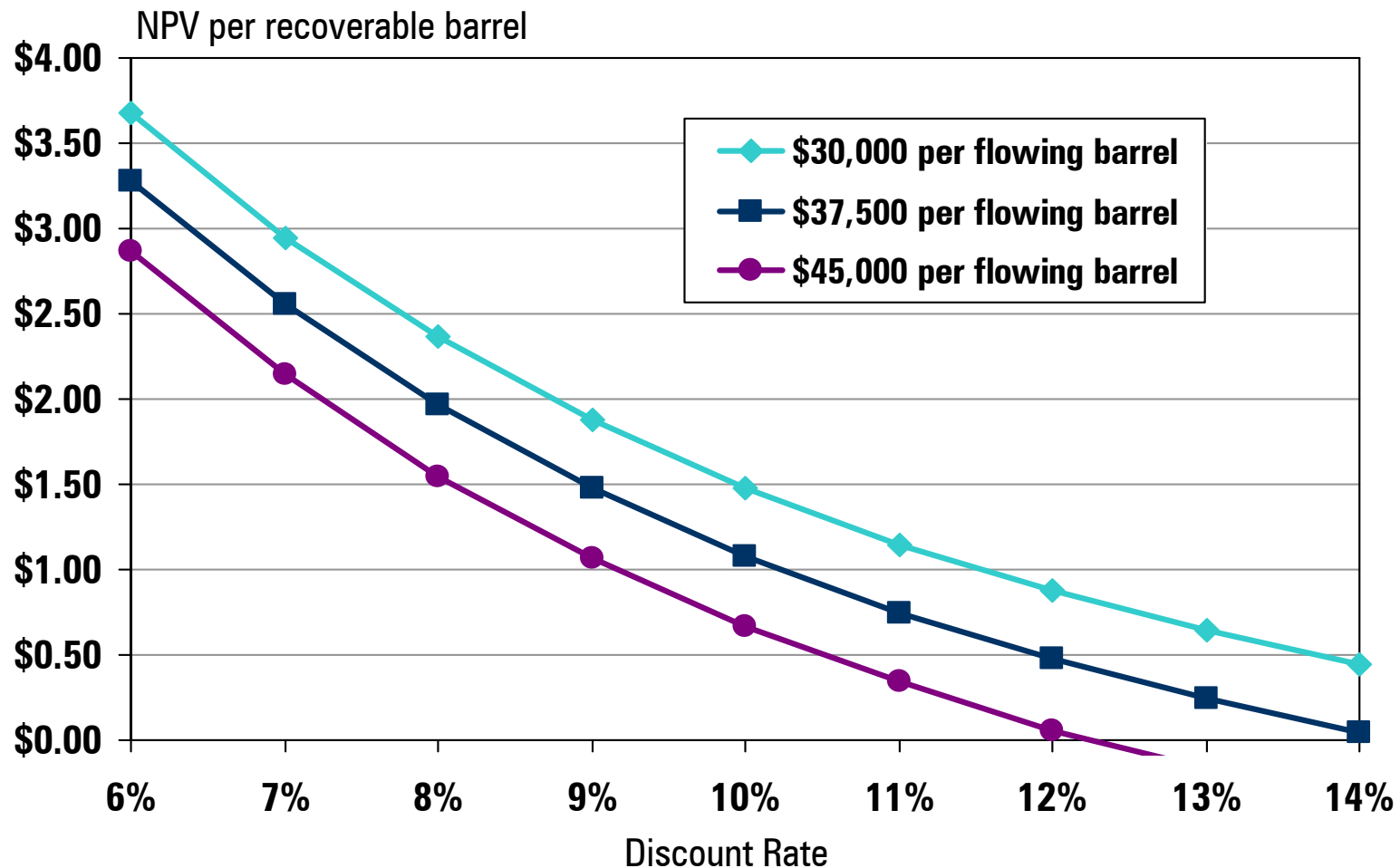
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Source: geoSCOUT, Peters & Co. Limited estimates.

# NPV per Recoverable Barrel vs. Capital Costs and Discount Rates at US\$80/B WTI

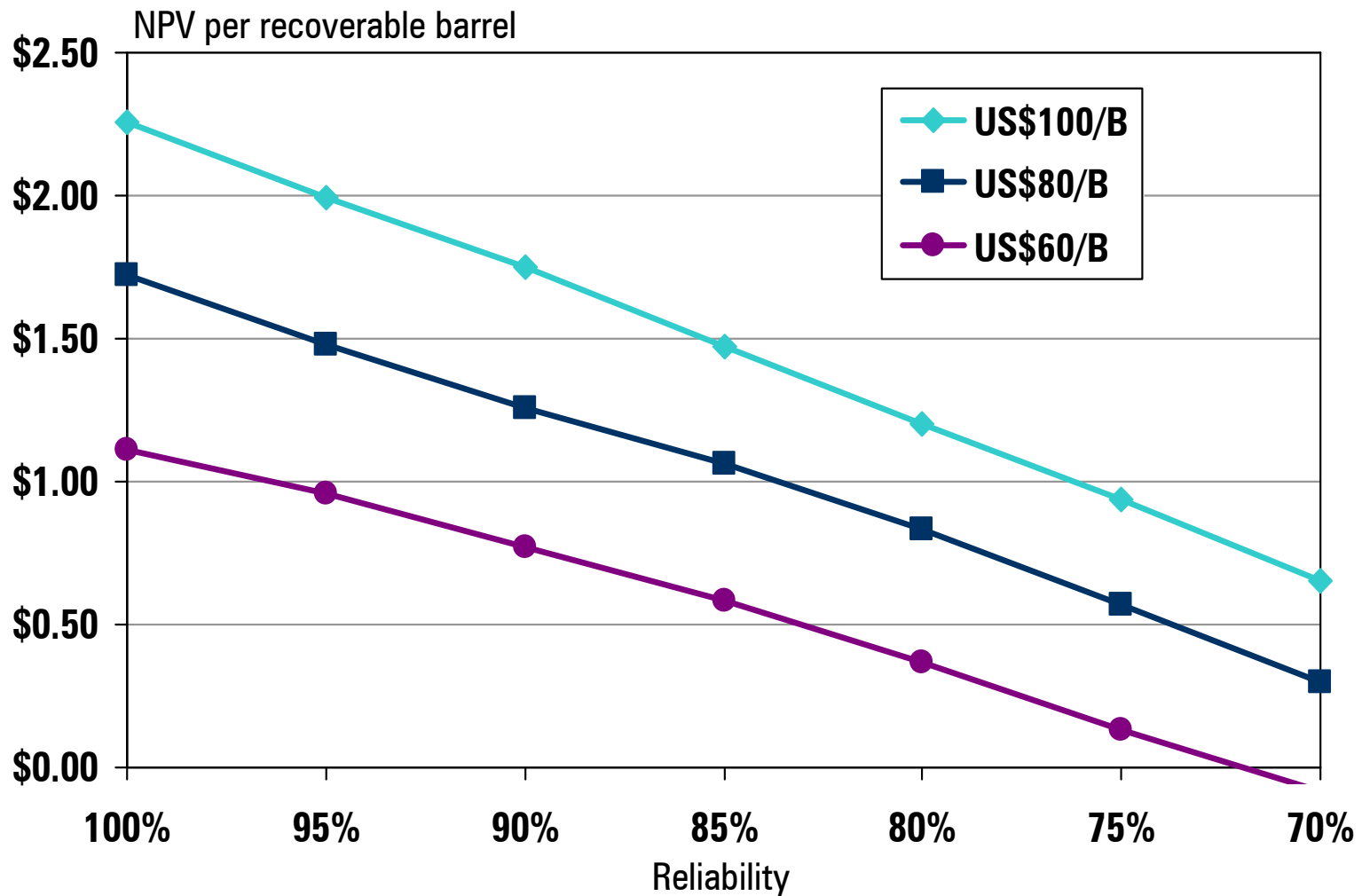
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Source: Peters & Co. Limited estimates using base case assumptions, with a 2014 start date and a 22% long-term heavy differential.

# NPV per Recoverable Barrel vs. Reliability Factor

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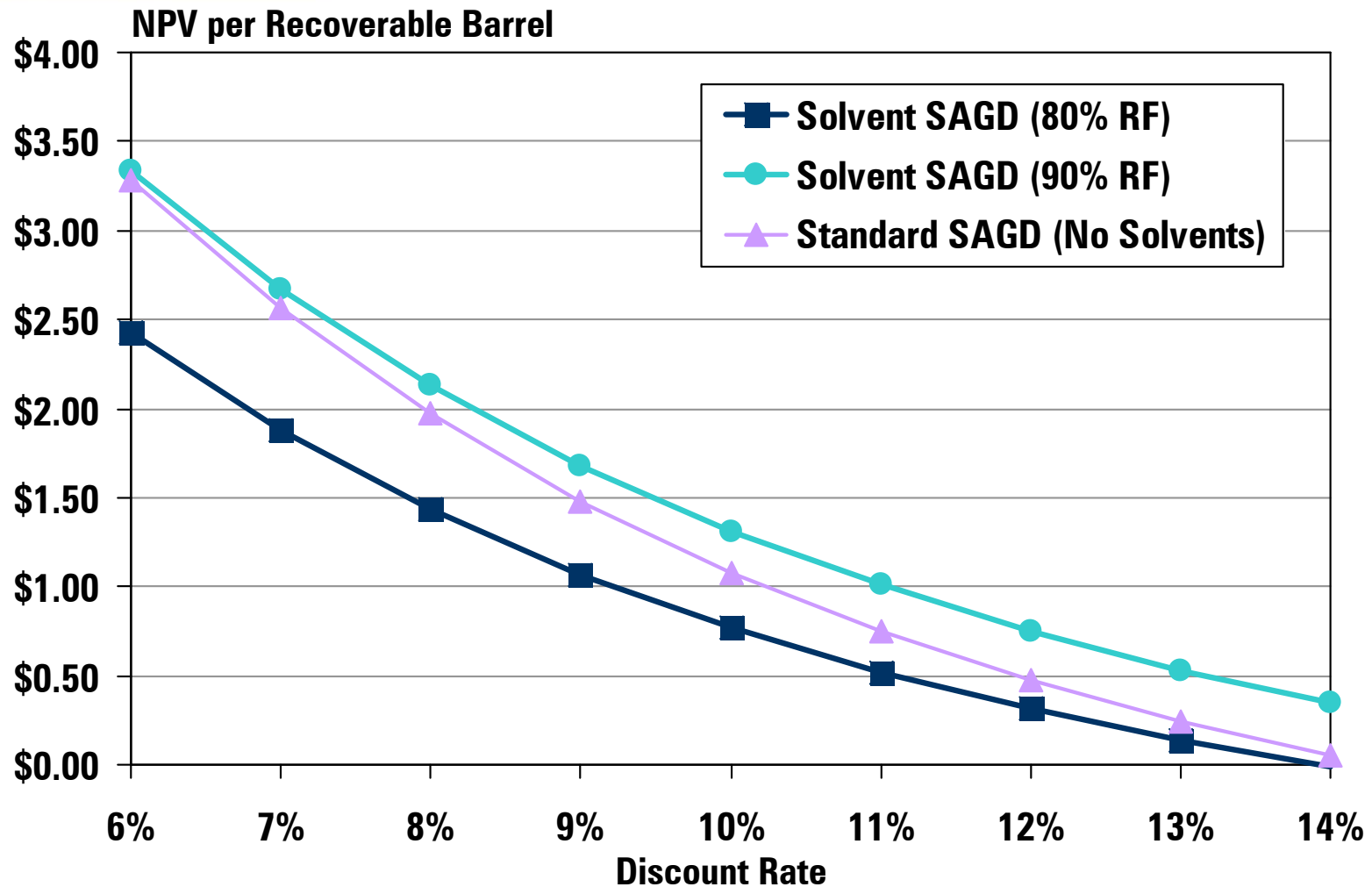
Source: Peters & Co. Limited estimates using base case assumptions, with a 2014 start date and a 22% long-term heavy differential.

## New Technologies

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- Solvents
- Electrical Heating
- Low Temperature Heating
- THAI™

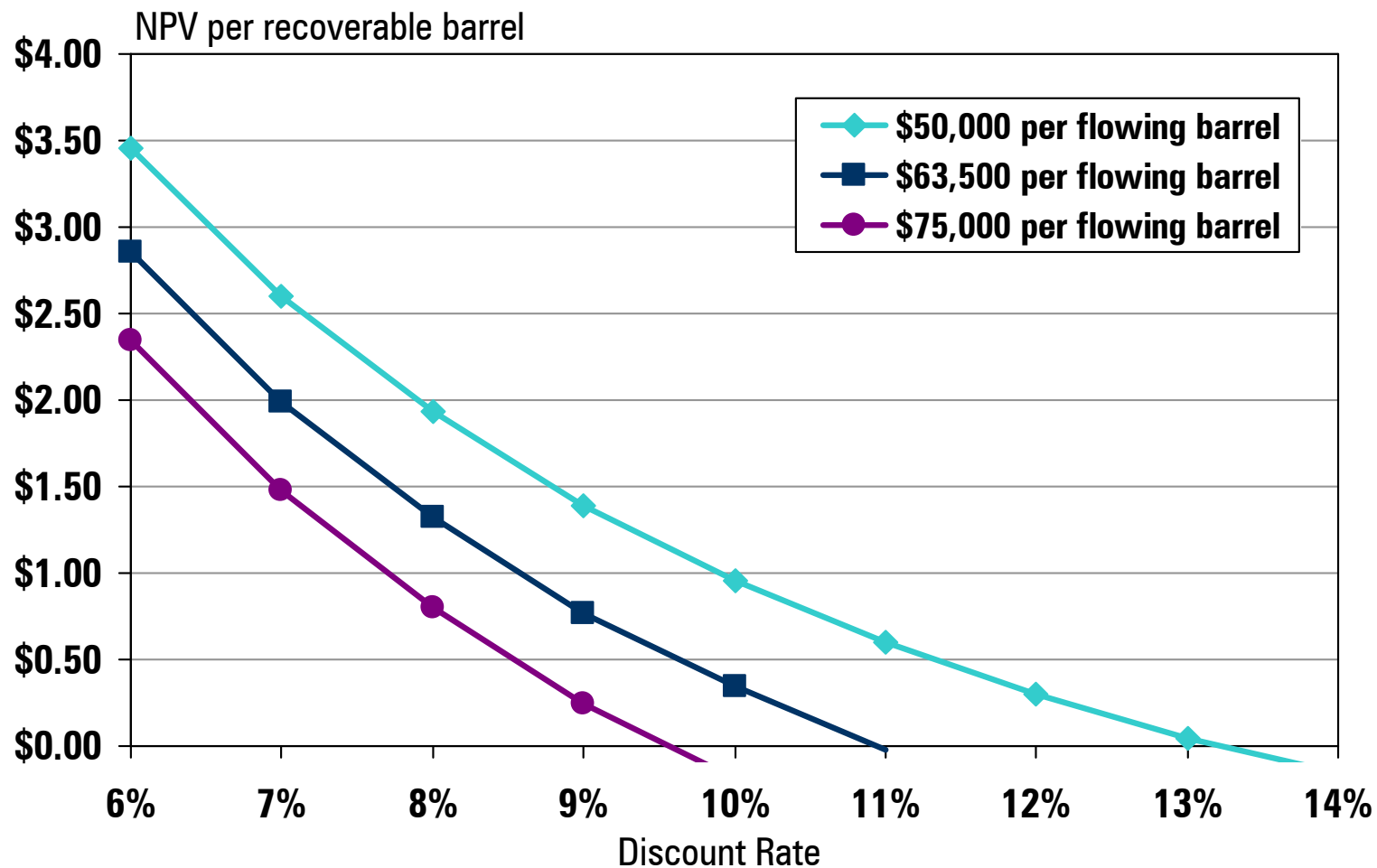
# Capital Cost Sensitivity Cenovus SAP Economics at US\$80/B WTI



Source: Peters & Co. Limited estimates using base case assumptions, with a 2014 start date and 22% long-term heavy differential.

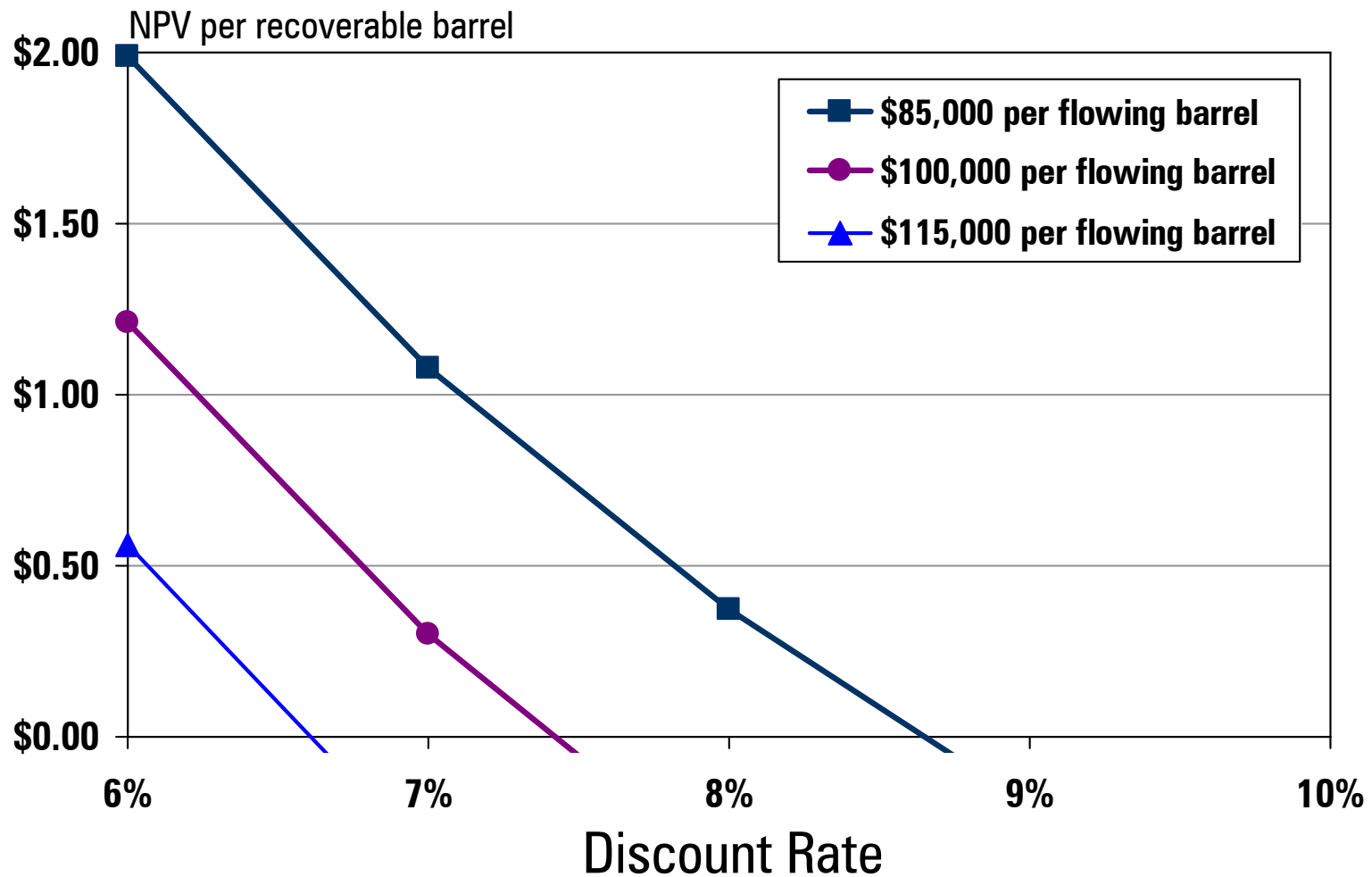
# Mining Excluding Upgrading NPV per Recoverable Barrel vs. Capital Costs and Discount Rates at US\$80/B WTI

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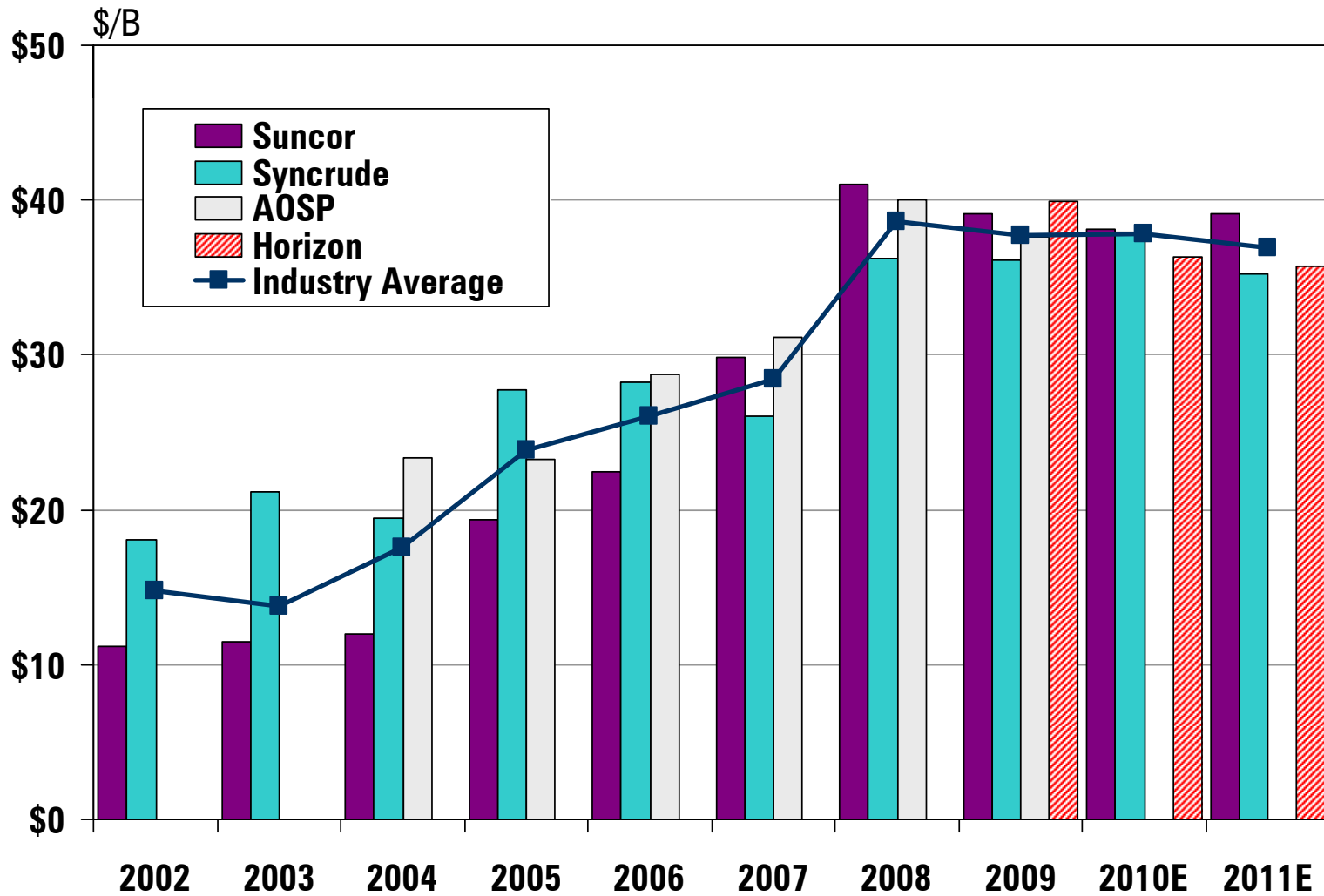
Source: Peters & Co. Limited estimates using base case assumptions, with a 2014 start date and 22% long-term heavy differential.

# Mining Including Upgrading NPV per Recoverable Barrel vs. Capital Costs and Discount Rates US\$80/B WTI



Source: Peters & Co. Limited estimates using base case assumptions, with a 2014 start date.

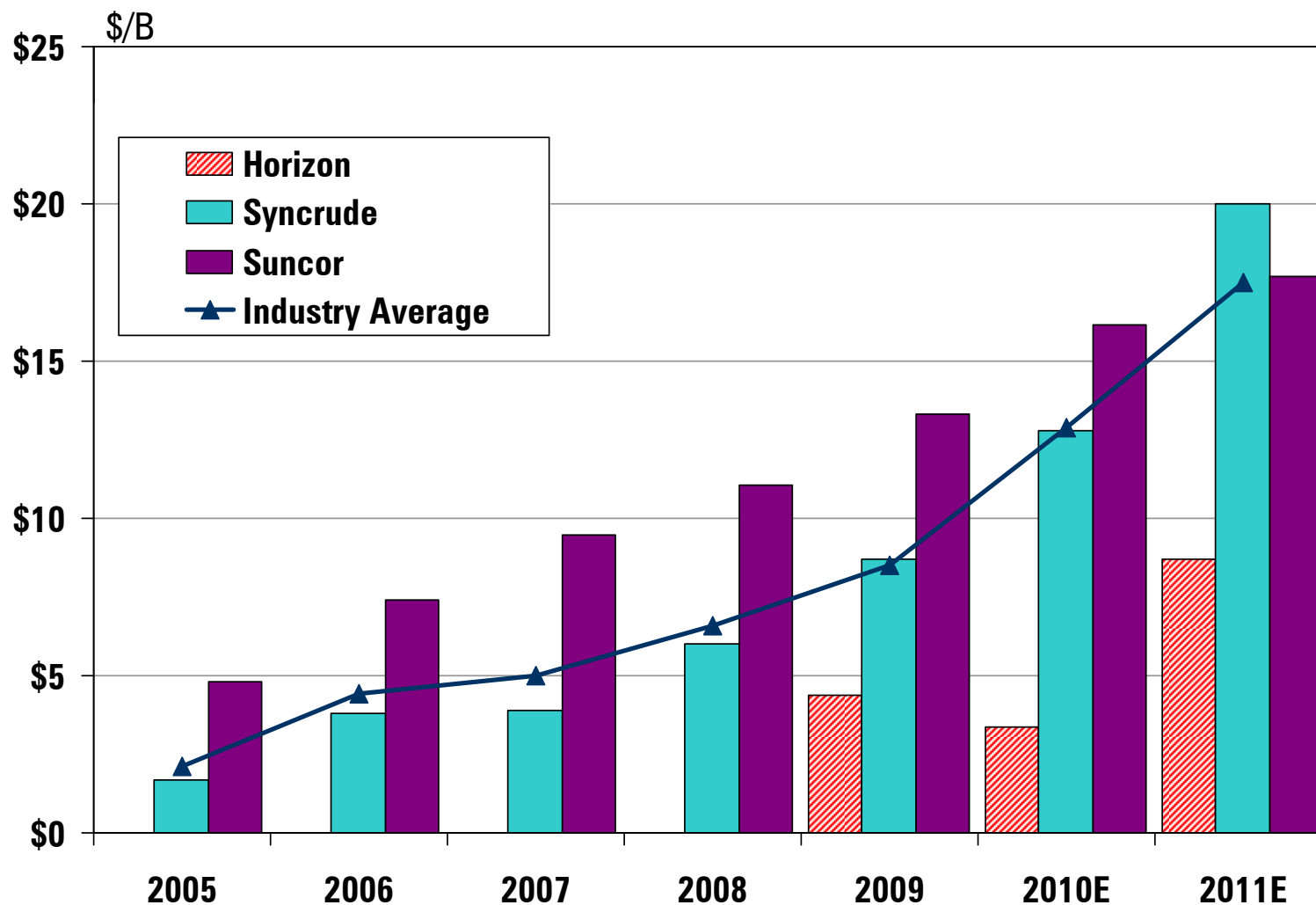
# Cash Operating Costs by Project



Note: AOSP operating cost data for 2010 and 2011 is not yet available.

# Maintenance Capital by Project

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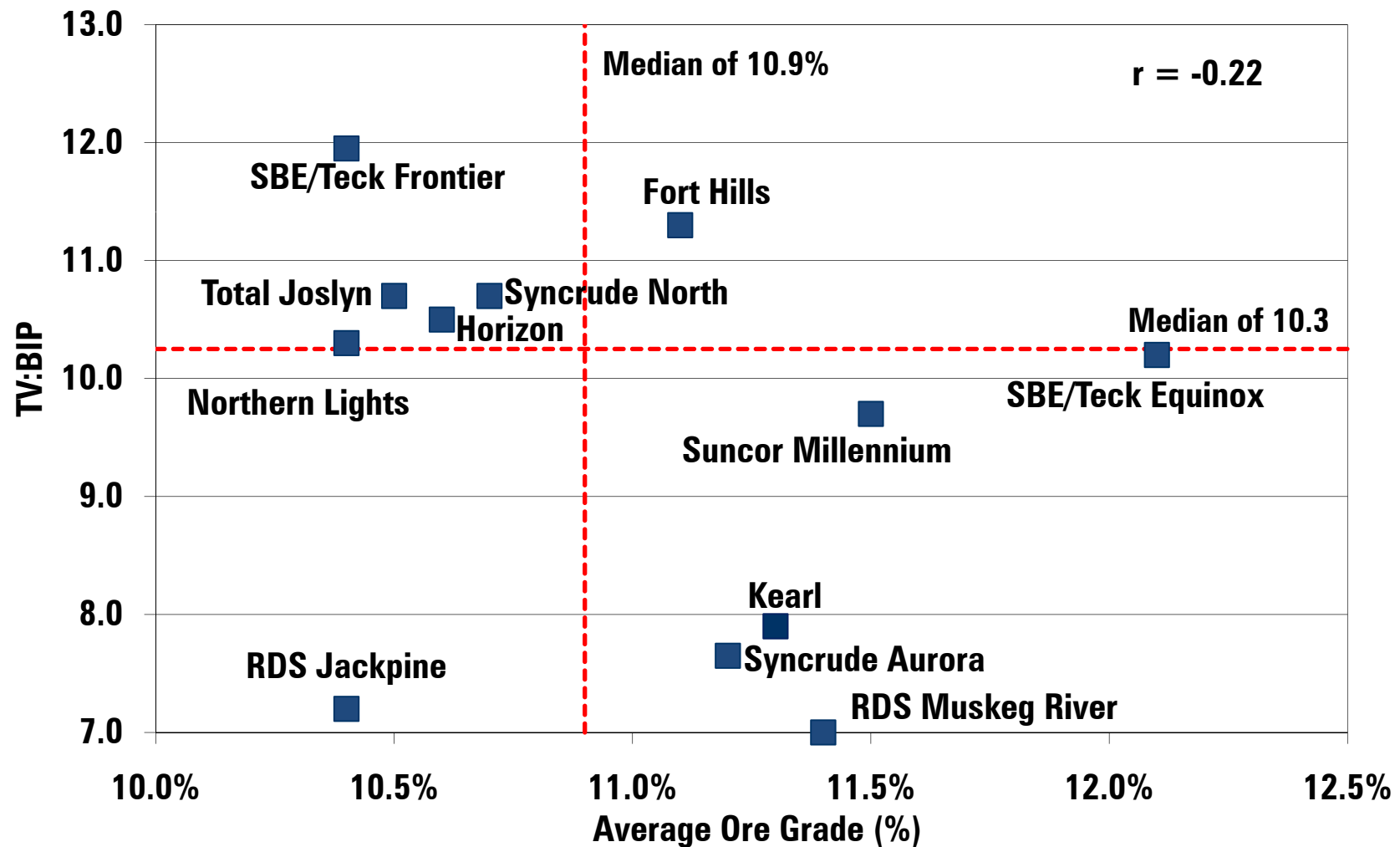


Note: Cost per barrel based on design capacity.

# Oil Sands Mining Projects Average Ore Grade vs. TV:BIP

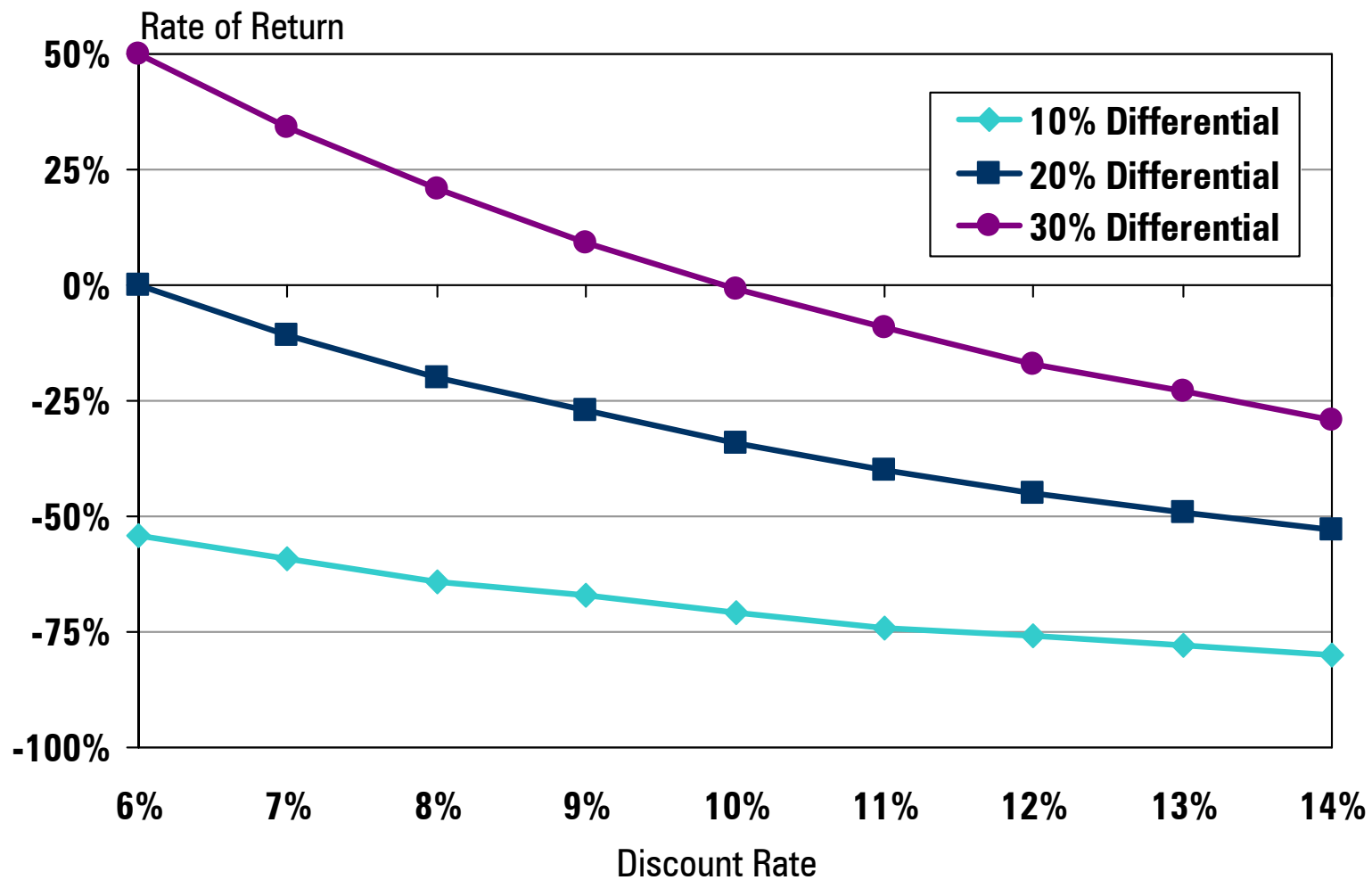
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## Oil Sands Mining Projects



# Standalone Upgrading Sensitivity to Light-Heavy Differential at US\$80/B WTI

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Source: Peters & Co. Limited estimates using base case assumptions with capital costs of \$55,000 per flowing barrel.

## Environmental Issues

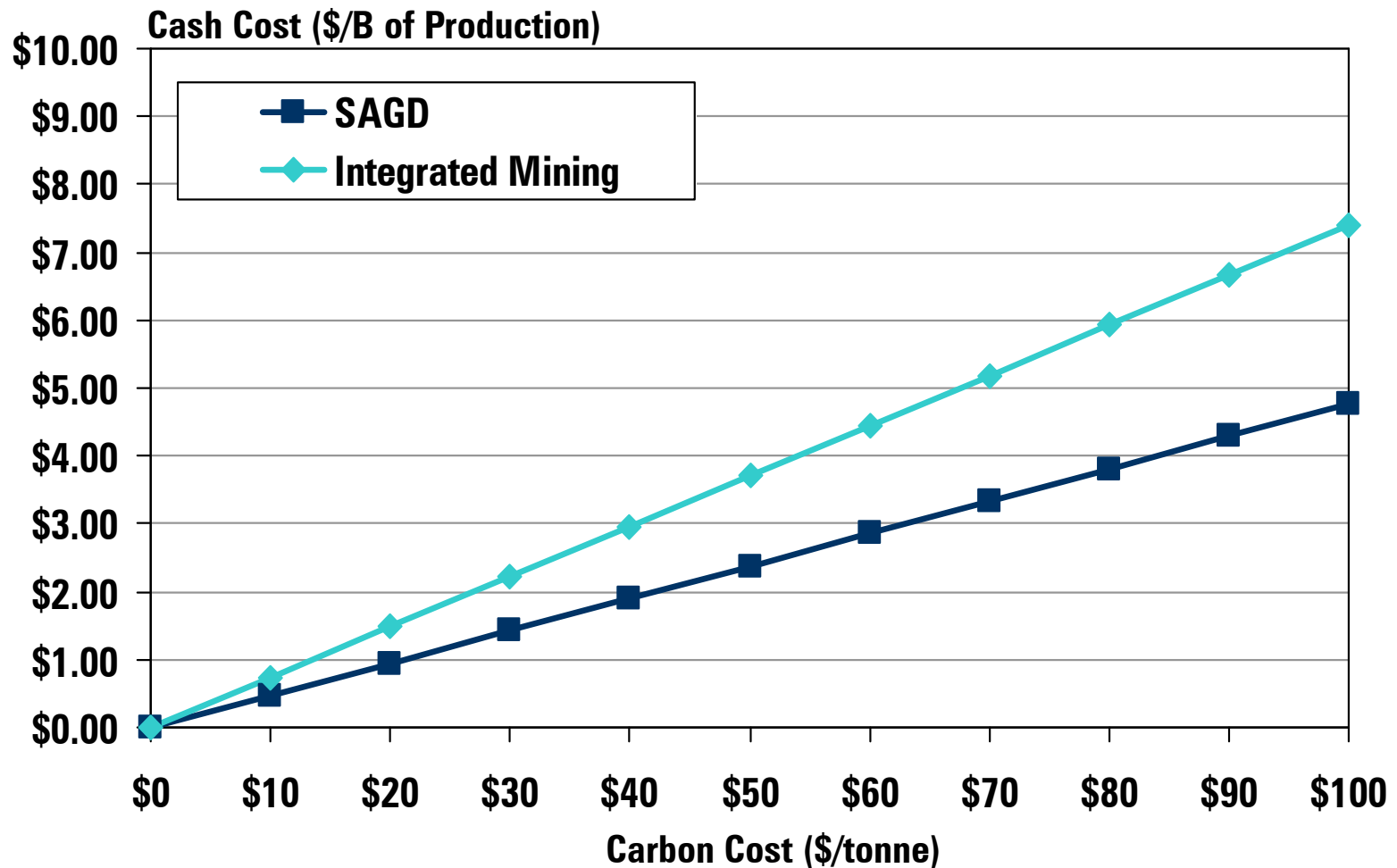


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- Tailings Management
- Water Usage
- Carbon Emissions

# Carbon Compliance Cost Per Barrel of Production in 2018 – Standard SAGD and Integrated Mining Models at US\$80/B WTI

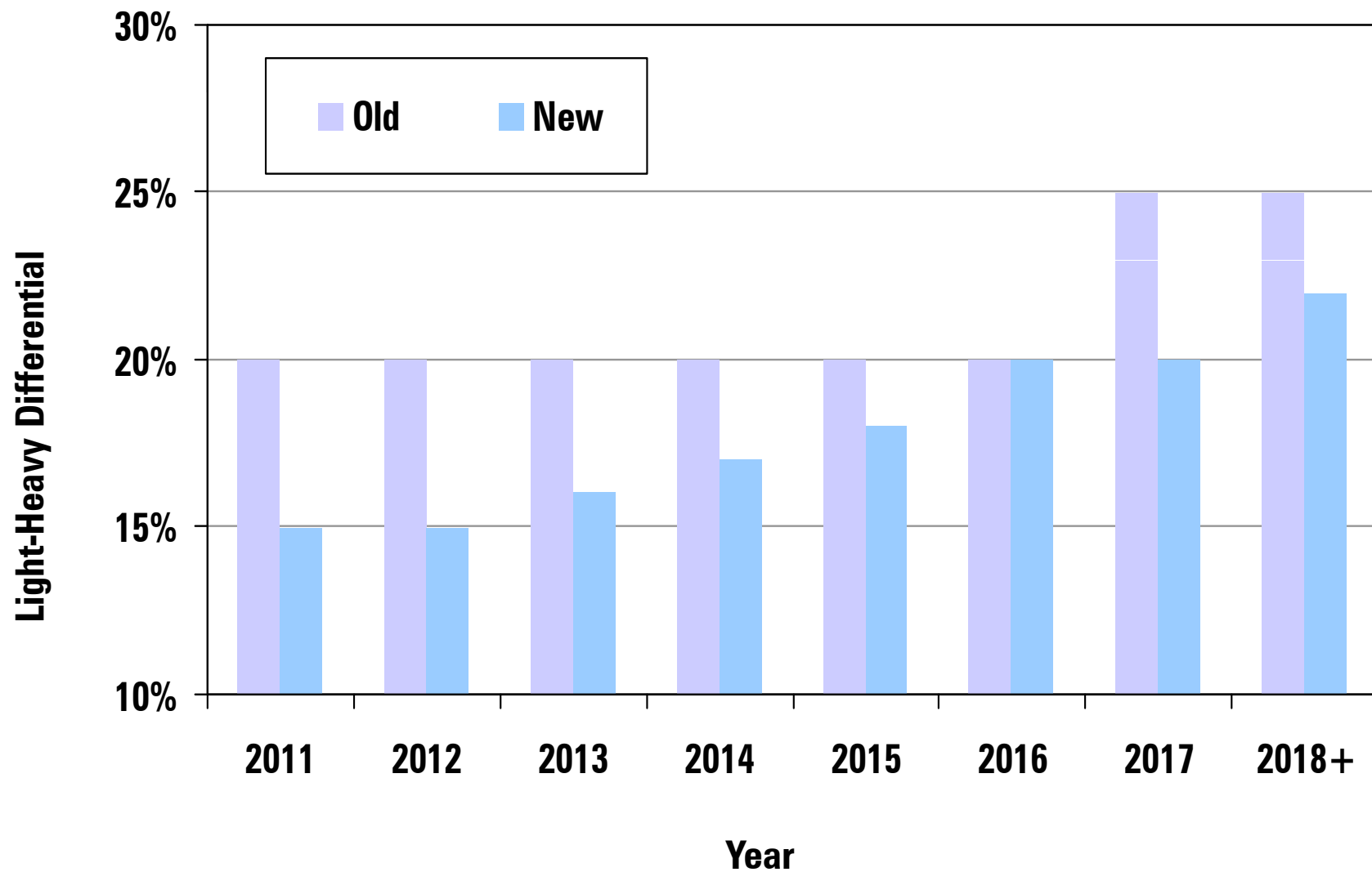
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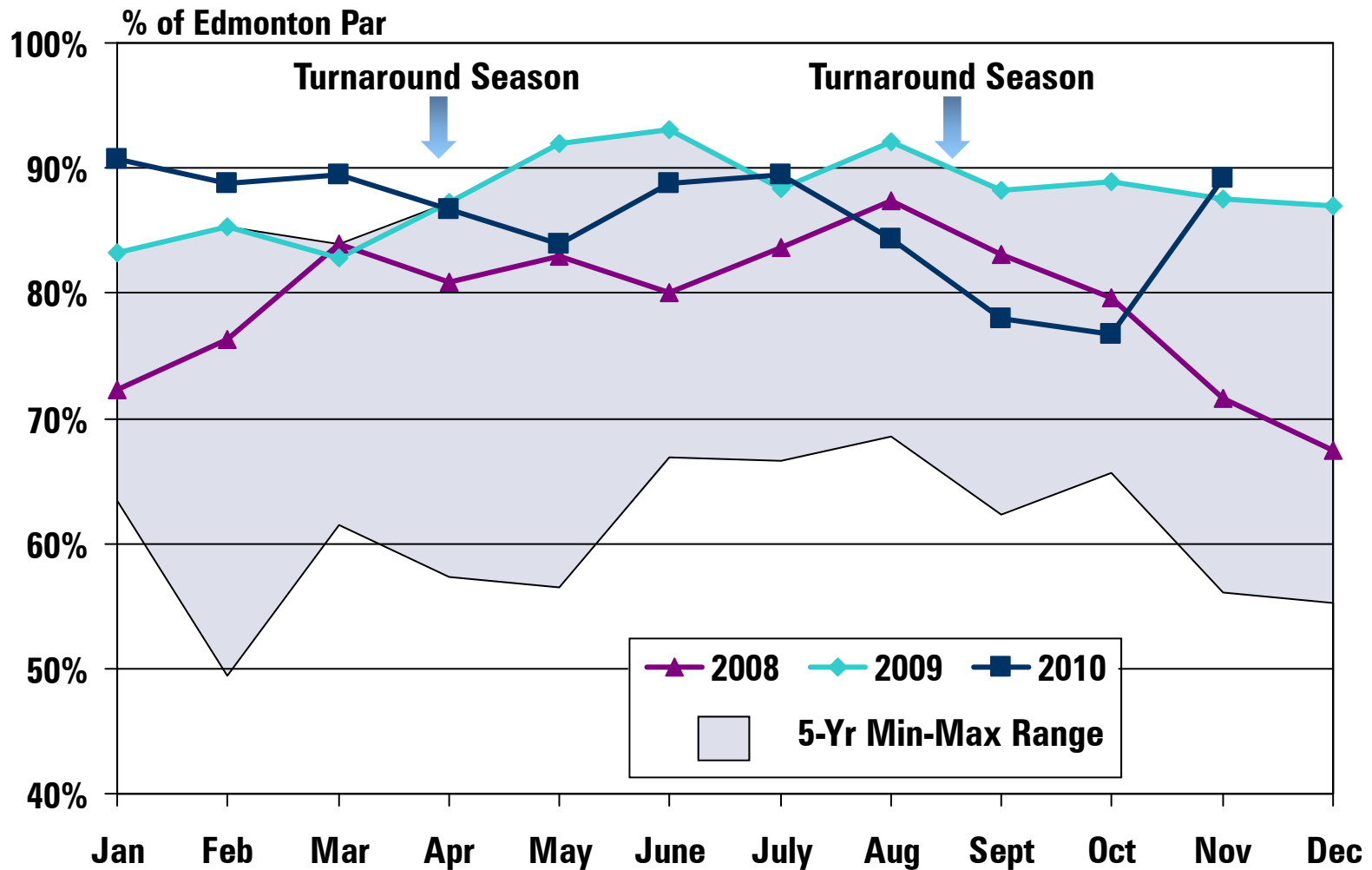
Source: Peters & Co. Limited estimates using base case assumptions, with a 2014 start date and 22% long-term heavy differential.

# Changes to our Light-Heavy Differential Assumption

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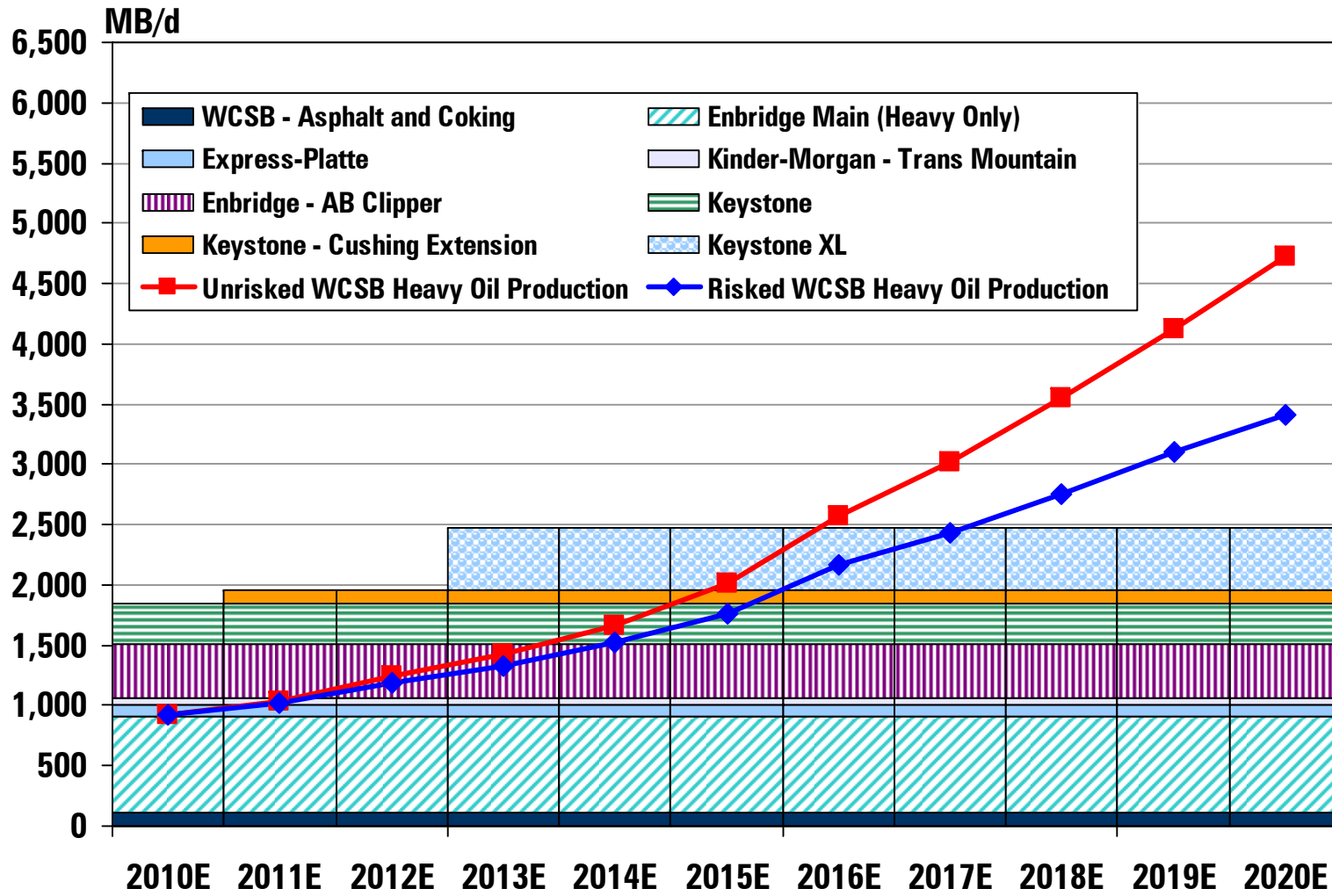


# Light-Heavy Differential Edmonton Par – Western Canadian Select



Source: Bloomberg, Cenovus, Imperial Oil.

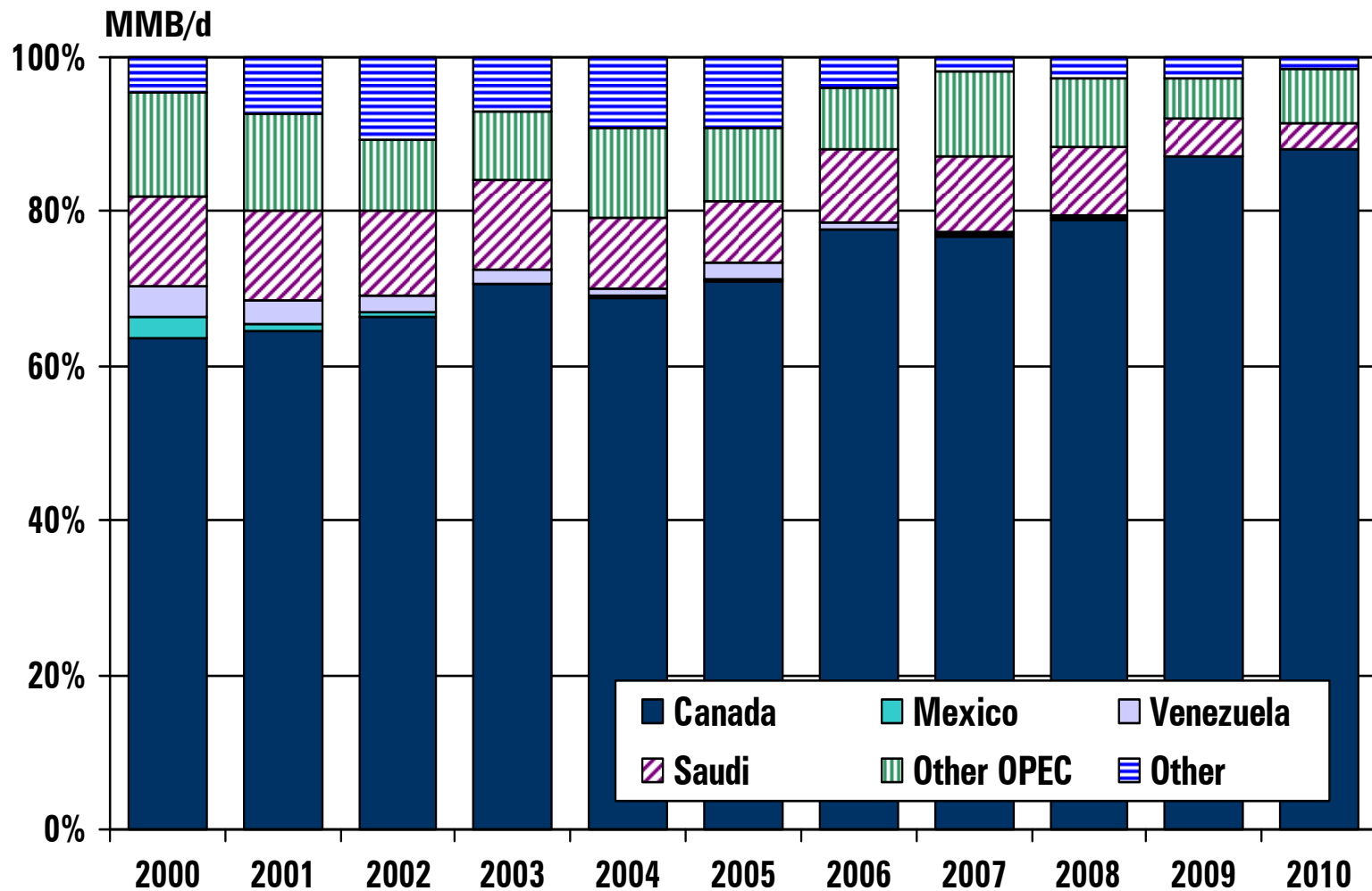
# Western Canadian Oil Sands (Dilbit) Forecast vs. Heavy Oil Takeaway Capacity 2010E – 2020E



Source: CAPP Forecast, Company reports, EIA Data, Peters & Co. Limited estimates.

# PADD II - Crude Oil Imports by Country of Origin

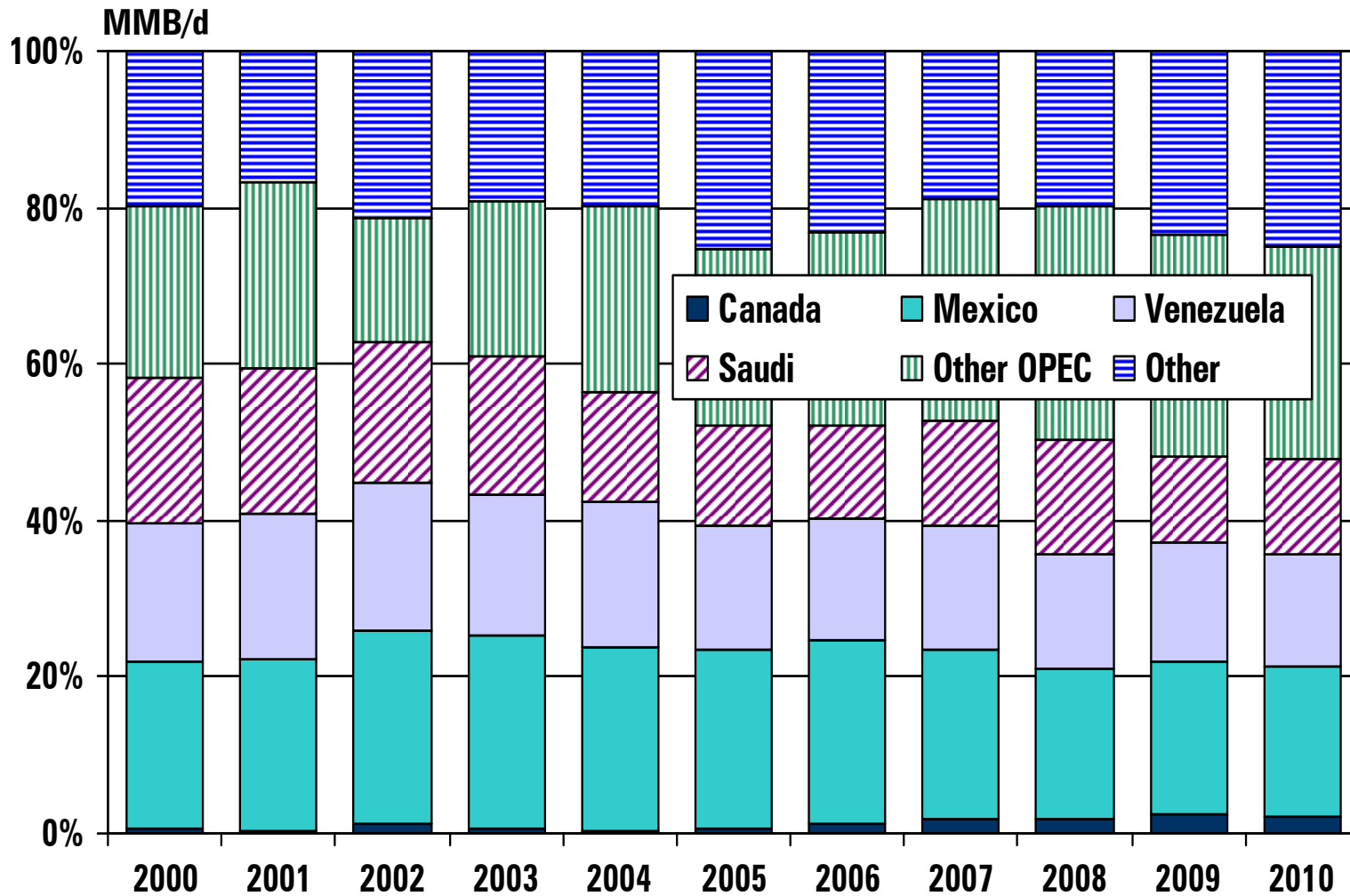
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Source: Energy Information Administration.

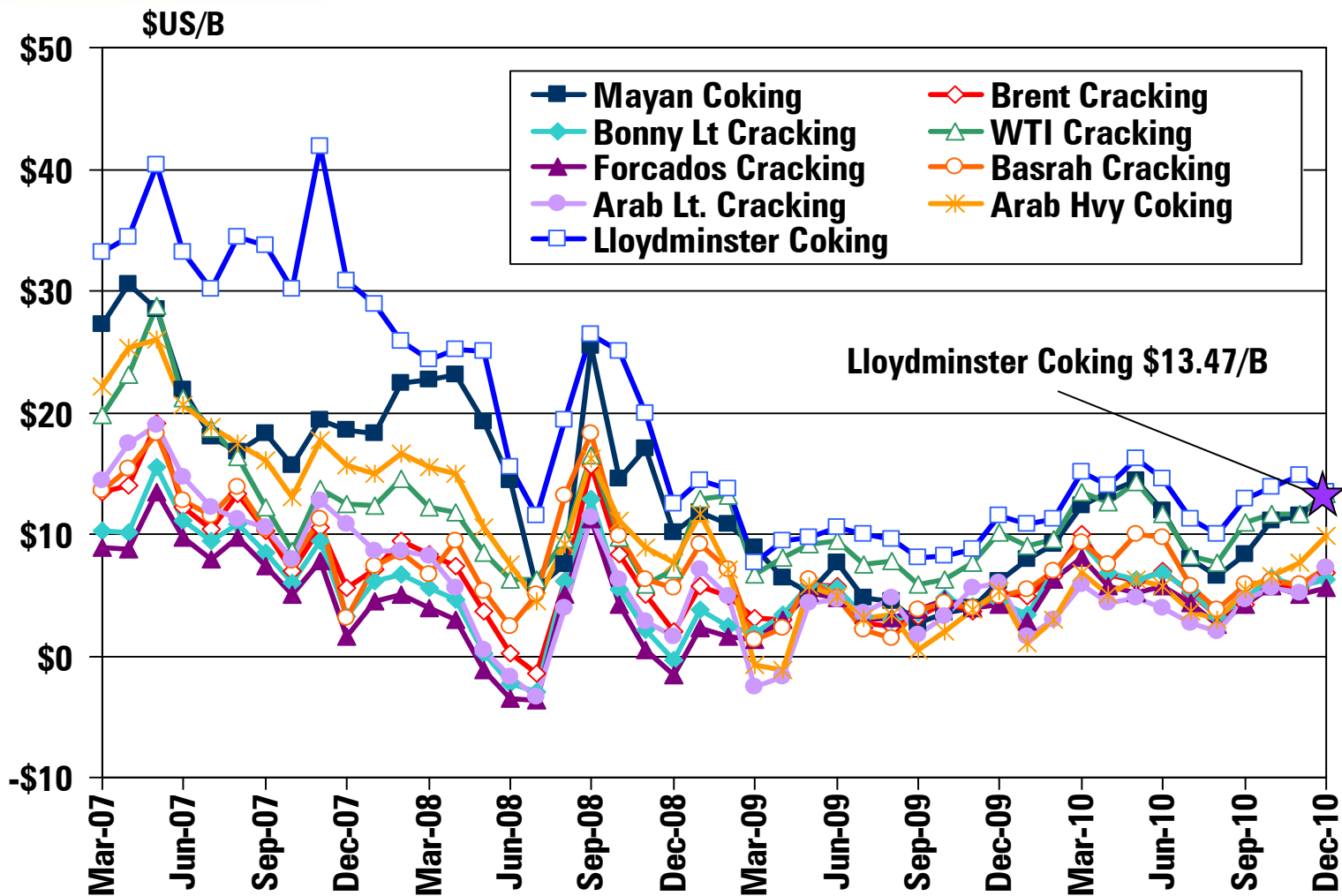
# PADD III - Crude Oil Imports by Country of Origin

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Source: Energy Information Administration.

# Historical Mid-Continent Refining Margins

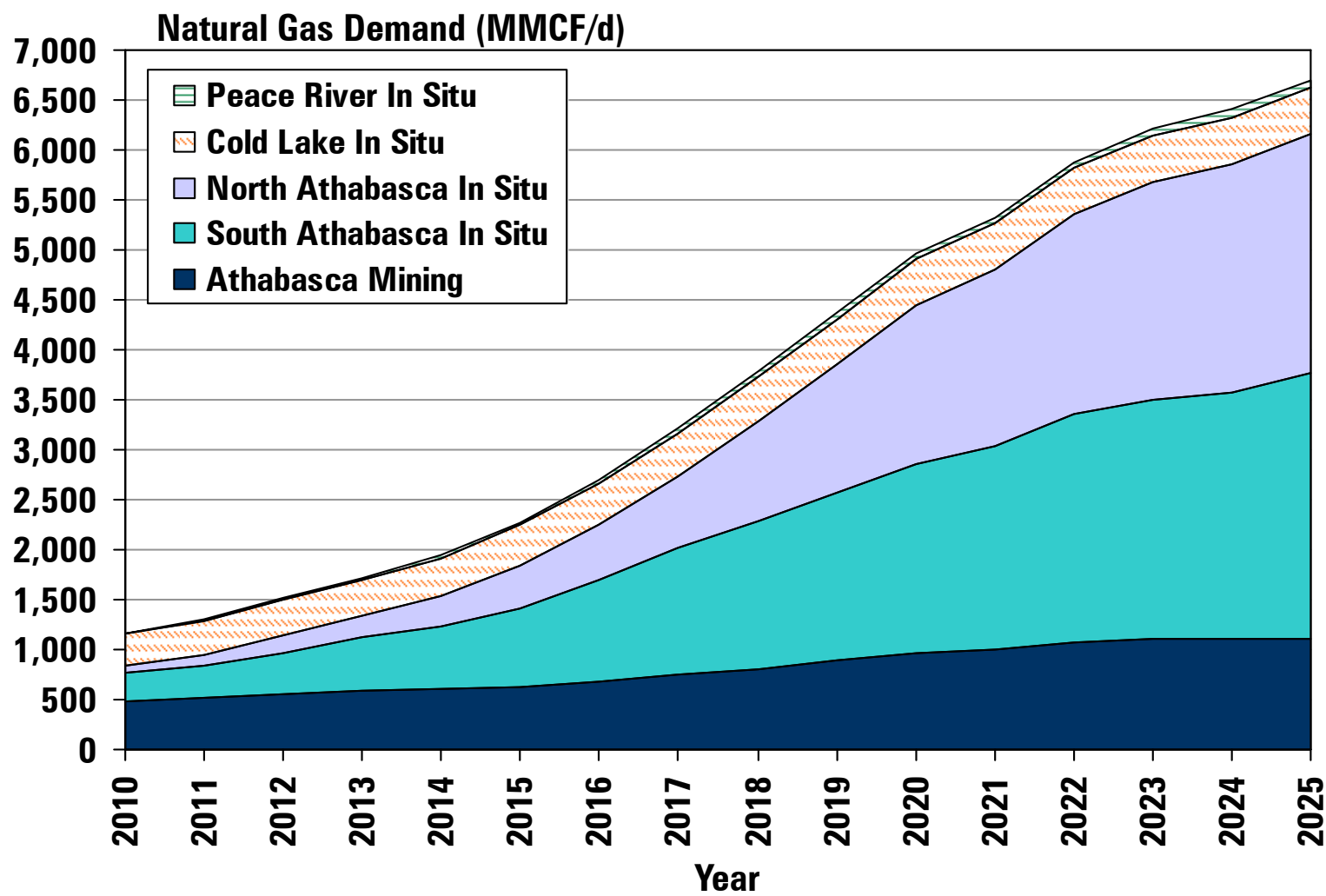


Source: Bloomberg.

Note: Mayan Coking margins are presented for the U.S. Gulf Coast.

# Oil Sands Natural Gas Demand Based on Unrisked Production Forecast

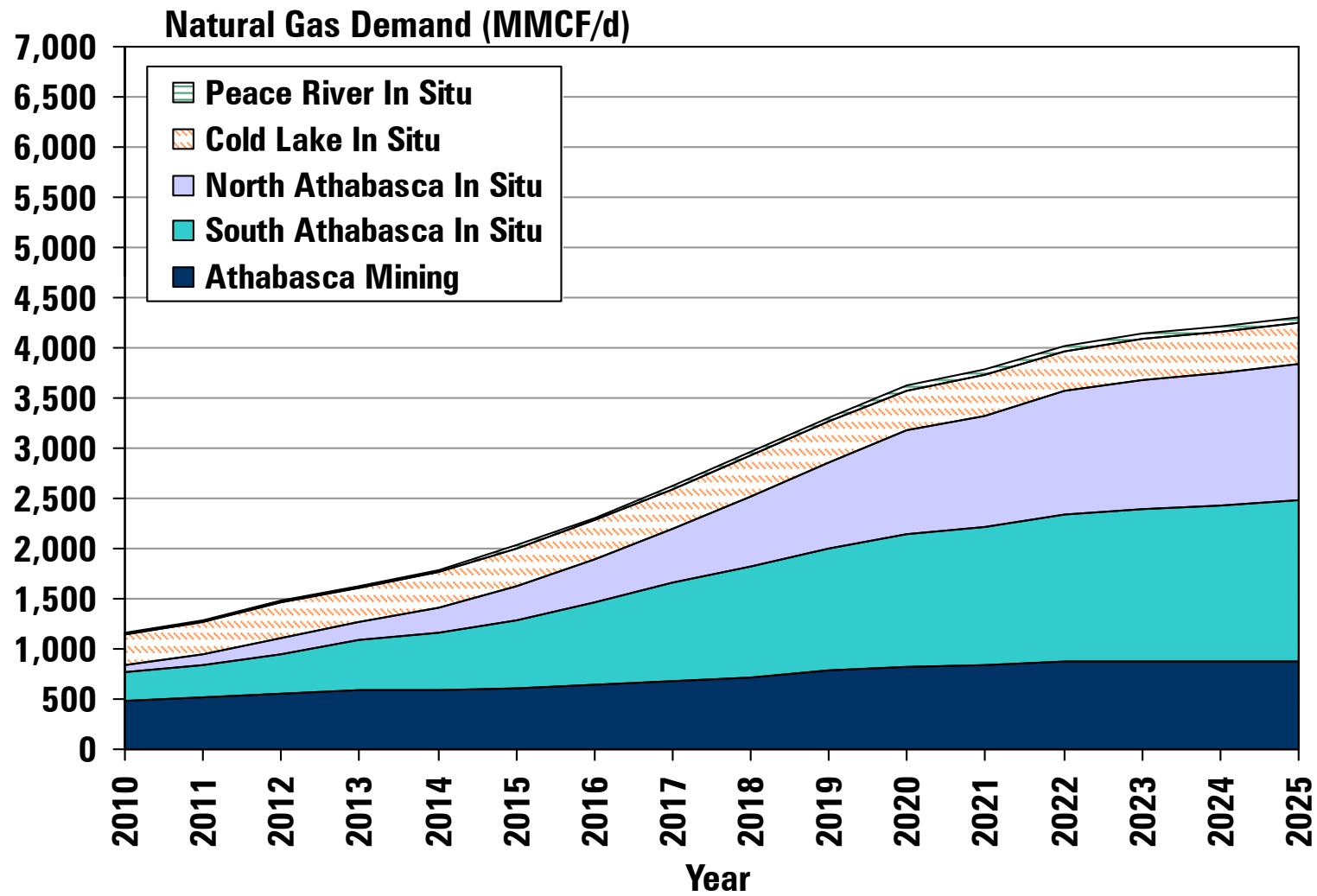
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Source: Peters & Co. Limited estimates.

# Oil Sands Natural Gas Demand Based on Risked Production Forecast

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Source: Peters & Co. Limited estimates.

# Oil Sands Transactions – In-Situ Exploration

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## Oil Sands Transactions

Date	Buyer	Seller	Project Name/Area	Type of Lease	Total Deal Value (\$MM)	Project Interest Aquired	Total Project Resource (MMB)	Acquired Resource MMB	Value Per Barrel	
<b>In Situ - Exploration</b>										
Nov-10	Athabasca Oil Sands Corp.	Bounty Developments Ltd.	Hangingstone	In-Situ	\$25	25.0%	228	57	\$0.44	
Nov-10	PTTEP	Statoil	Kai Kos Dehseh	In-Situ	\$2,327	40.0%	4300	1,720	\$1.35	
Sep-10	Southern Pacific Resource Corp.	North Peace Energy Corp.	Corporate	In-Situ	\$15	100.0%	105	105	\$0.14	
Sep-10	Canadian Natural	Enerplus	Kirby	In-Situ	\$405	100.0%	497	497	\$0.81	
Sep-10	Athabasca Oil Sands Corp.	Excelsior Energy	Corporate	In-Situ	\$85	100.0%	183	183	\$0.46	
Aug-10	Harvest	Korean National Oil Corporation	BlackGold	In-Situ	\$374	100.0%	289	289	\$1.29	
Mar-10	BlackPearl Resources	Serrano Energy Ltd.	Blackrod	In-Situ	\$21	20.0%	274	55	\$0.38	
Mar-10	Southern Pacific	Bounty Developments Ltd.	McKay / Ells	In-Situ	\$33	20.0%	246	49	\$0.67	
Mar-10	Devon Energy	BP plc	Kirby	In-Situ	\$670	50.0%	1,250	625	\$1.07	
Feb-10	BP	Value Creation Inc.	Terre De Grace	In-Situ	\$950	75.0%	2,687	2,015	\$0.47	
Aug-09	PetroChina	Athabasca Oil Sands Corp.	MacKay River / Dover	In-Situ	\$1,900	60.0%	5,000	3,000	\$0.63	
Dec-08	Nexen	OPTI Canada Inc.	Long Lake	In-Situ	\$735	15.0%	5,704	856	\$0.86	
May-08	Ivanhoe Energy	Talisman Energy Inc.	Leases 10, 50 and 6	In-Situ	\$105	95.7%	294	282	\$0.37	
Jun-07	Enerplus	Kirby Oil Sands Partnership	Kirby	In-Situ	\$20	10.0%	244	24	\$0.83	
May-07	MEG Energy	Paramount Resources Ltd.	Surmont	In-Situ	\$302	100.0%	450	450	\$0.67	
Apr-07	Statoil	North American Oil Sands Co.	Corporate	In-Situ	\$2,200	n/a	2,200	2,200	\$1.00	
Mar-07	Enerplus	Kirby Oil Sands Partnership	Kirby	In-Situ	\$183	90.0%	244	220	\$0.83	
Oct-06	ConocoPhillips	EnCana Corporation	Christina Lake & Foster Creek	In-Situ	\$4,423	50.0%	6,500	3,250	\$1.36	
Jul-06	Korean National Oil Corporation	Newmont Mining Corporation	BlackGold	In-Situ	\$310	100.0%	306	306	\$1.01	
					<b>Median</b>	<b>\$310</b>			<b>Min</b>	<b>\$0.14</b>
					<b>Total</b>	<b>\$15,083</b>			<b>Average</b>	<b>\$0.77</b>
									<b>Median</b>	<b>\$0.81</b>
									<b>Max</b>	<b>\$1.36</b>

# Oil Sands Transactions – Mining Exploration

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## Oil Sands Transactions

Date	Announce Buyer	Seller	Project Name/Area	Type of Lease	Total Deal Value (\$MM)	Project Interest Aquired	Total Project Resource (MMB)	Acquired Resource MMB	Value Per Barrel
<b>Mining - Exploration</b>									
Jul-10	Total S.A.	UTS Energy	Corporate	Mining	\$441	100.0%	678	678	\$0.65
Nov-09	IMO / ExxonMobil	UTS Energy Corporation	Lease 421 Area	Mining	\$250	50.0%	2,000	1,000	\$0.25
Jun-08	Occidental Petroleum Corporation	Enerplus Resources Fund	Joslyn	Mining	\$510	15.0%	2,103	316	\$1.62
Apr-08	Total S.A.	Synenco Energy Inc.	Corporate	Mining	\$337	60.0%	1,349	809	\$0.42
Sep-07	Teck Cominco / Petro-Canada	UTS Energy Corporation	Fort Hills	Mining	\$750	10.0%	4,000	400	\$1.88
Jul-07	Marathon Oil Corporation	Western Oil Sands Inc.	Corporate	Mining/In-Situ	\$6,584	n/a	2,600	2,600	\$2.53
Apr-07	Teck Cominco	UTS	Lease 14	Mining	\$200	50.0%	400	200	\$1.00
Feb-06	Laracina Energy Ltd.	Enerplus Resources Fund	Joslyn	Mining	\$20	1.0%	2,313	23	\$0.85
Sep-05	Teck Cominco	UTS Energy Corporation	Fort Hills	Mining	\$225	5.0%	2,800	140	\$1.61
Sep-05	Teck Cominco	UTS Energy Corporation/Petro-Canada	Fort Hills	Mining	\$250	10.0%	2,800	280	\$0.89
Sep-05	Total S.A.	Deer Creek Energy Limited	Joslyn	Mining	\$1,527	84.0%	2,193	1,842	\$0.83
May-05	Sinopec	Synenco Energy Inc.	Northern Lights	Mining	\$105	40.0%	1,300	520	\$0.20
Mar-05	Petro-Canada	UTS Energy Coporation	Fort Hills	Mining	\$300	60.0%	2,800	1,680	\$0.18
Apr-04	UTS Energy Corporation	TrueNorth Energy L.P. / TrueNorth Energy Corp.	Fort Hills	Mining	\$125	78.0%	2,800	2,184	\$0.06
Aug-02	Enerplus Resources Fund	Deer Creek Energy Limited	Joslyn	Mining	\$19	16.0%	2,064	330	\$0.06
					<b>Median</b>	<b>\$250</b>		<b>Min</b>	<b>\$0.06</b>
					<b>Total</b>	<b>\$11,643</b>		<b>Median</b>	<b>\$0.83</b>
								<b>Average</b>	<b>\$0.87</b>
								<b>Max</b>	<b>\$2.53</b>

# Oil Sands Transactions – Producing Assets

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## Oil Sands Transactions

Date	Buyer	Seller	Project Name/Area	Type of Lease	Total Deal Value (\$MM)	Project Interest Aquired	Total Project Resource (MMB)	Acquired Resource MMB	Value Per Barrel
<b>In Situ &amp; Mining - Producing</b>									
Apr-10	Sinopec	ConocoPhillips	Syncrude	Mining	\$4,660	9.0%	9,960	899	\$5.18
Oct-09	Southern Pacific	EnCana Corporation	Senlac	In-Situ	\$90	100.0%	9	9	\$9.88
Jan-07	Royal Dutch Shell	Shell Canada	Corporate	Mining/In-Situ	\$8,700	n/a	6,681	1,470	\$5.92
Nov-06	Canadian Oil Sands Trust	Talisman	Syncrude	Mining	\$475	1.3%	8,480	106	\$4.48
May-06	Shell Canada Limited	BlackRock Ventures Inc.	Seal/Orion	In-Situ	\$2,302	100.0%	604	603	\$3.82
Jun-03	Canadian Oil Sands Trust	EnCana Corporation	Syncrude	Mining	\$417	3.8%	8,300	311	\$1.34
Feb-03	Canadian Oil Sands Trust	EnCana Corporation	Syncrude	Mining	\$1,070	10.0%	8,300	830	\$1.29
				<b>Median</b>	<b>\$1,070</b>			<b>Min</b>	<b>\$1.29</b>
				<b>Total</b>	<b>\$17,714</b>			<b>Median</b>	<b>\$4.48</b>
								<b>Average</b>	<b>\$4.56</b>
								<b>Max</b>	<b>\$9.88</b>

Source: Peters & Co. Limited estimates.

## Conclusions

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- Economics remain strong at current oil prices
- Oil sands will drive Canadian oil production growth for the near future
- Service companies levered to oil sands will benefit
- Emerging technologies could further enhance recoveries and economics, specifically for in-situ developments