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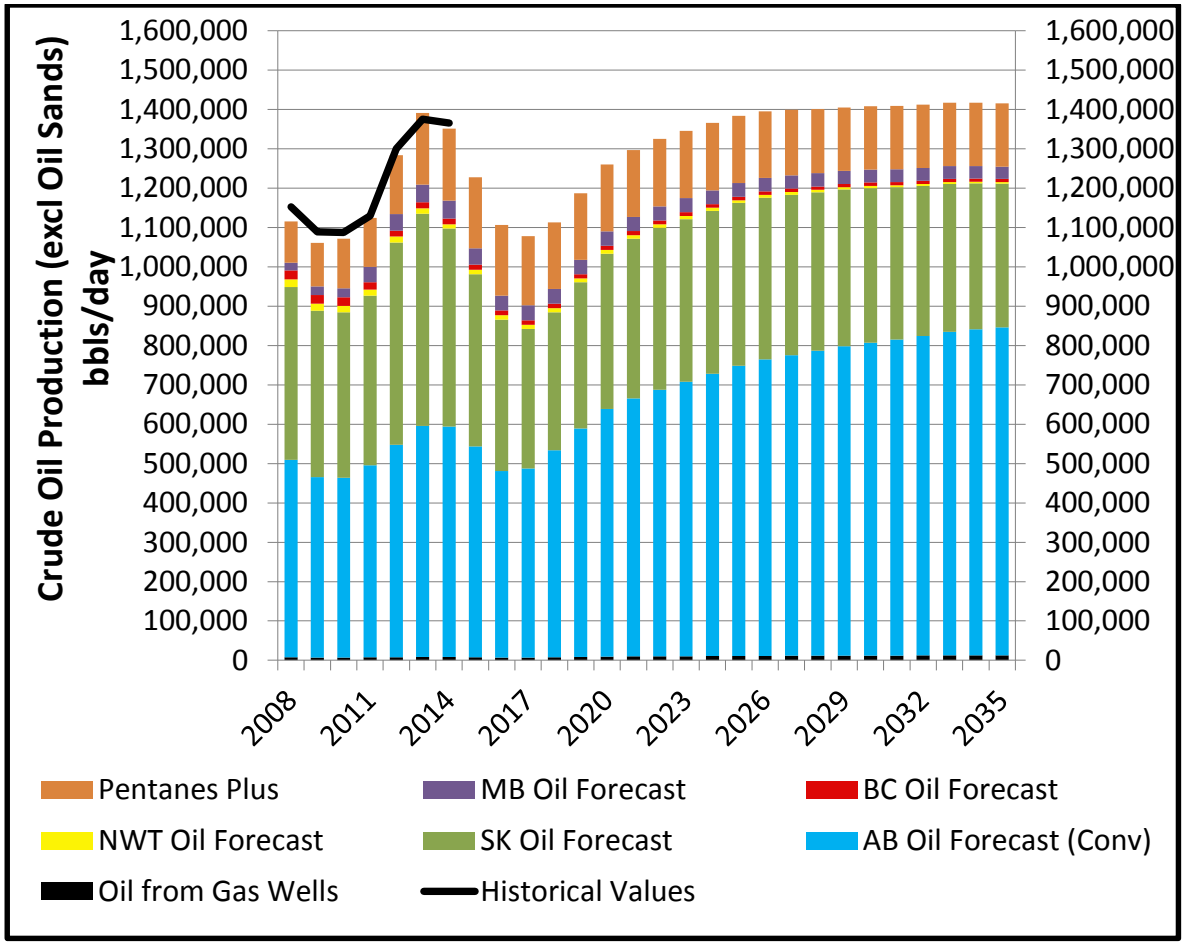
WESTERN CANADA CRUDE OIL FORECASTS AND IMPACTS (2015-2035)



WESTERN CANADA CRUDE OIL FORECASTS AND IMPACTS (2015-2035)

Western Canada Crude Oil Forecasts and Impacts (2015-2035)

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ISBN 1-927037-35-5

July 2015
Printed in Canada

Acknowledgements:
The author of this report would like to extend his thanks and sincere gratitude to all CERI staff involved in the production and editing of the material, including but not limited to Megan Murphy.

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Executive Summary

In 2008, the oil and gas industry in Western Canada brought on stream 4,483 new crude oil wells. This included for Alberta (1,870), British Columbia (19) and Saskatchewan (2,594). The average annual WTI market price at Cushing, Oklahoma was US$99.8/bbl. The following year, 2009, was the low point for oil well activity in western Canada with under 2,500 new crude oil wells drilled because of the global recession. The average annual WTI market price dropped to US$62/bbl. However, in the following year oil developments moved up quickly following the upswing in the oil price that reached a WTI market price of US$105/bbl in July 2014. For the remaining five months of 2014 and continuing into the first half of 2015, WTI oil prices fell to a low point of US$40/bbl before settling in on a range of US$50 to US$60/bbl.

In July 2014, the Canadian Energy Research Institute (CERI) published a study that forecasted the future of the North American oil market as played out in four plausible narratives.[1] That report, which investigated the productive capacity of all major oil plays in North America, with detailed attention to the merging shale oil plays, established a reference case forecast for the United States. That analysis was undertaken by ICF International and was the basis for CERI establishing a western Canadian crude oil forecast by taking into account market basis differentials, pipeline and rail transportation and upstream supply cost estimates. Figure 1.3 illustrates the results of that study with respect to the western Canadian conventional crude oil forecast. Also included on Figure 1.3 is the June 2013 conventional oil forecast from the Canadian Association of Petroleum Producers (CAPP).

The purpose of this report is to extend the work done by the 2014 report by investigating the downside potential of oil well activity in Western Canada as a direct result of declining oil prices and reduced producers capital budgets. As a secondary task, this report is intended to report on the economic impacts associated with this forecast of drilling and future production in terms of Gross Domestic Product (GDP), taxes paid to the provincial and federal governments and future employment for the industry.

Analysis of the provincial regulator licensing files for the first 6 months of 2015 and extrapolating out to the end of the year suggests that new oil well licenses for 2015 will be reduced by 45-55 percent from 2014 levels. With regard to determining a well activity forecast for western Canada, CERI has adopted the extrapolated new well license estimate for 2015 and has also assumed that this reduced level of activity will continue into 2016. CERI has assumed that WTI oil prices will start moving upwards in 2017 as demonstrated in Figure 1.5. New well activity is assumed to follow the upward trend in market prices.

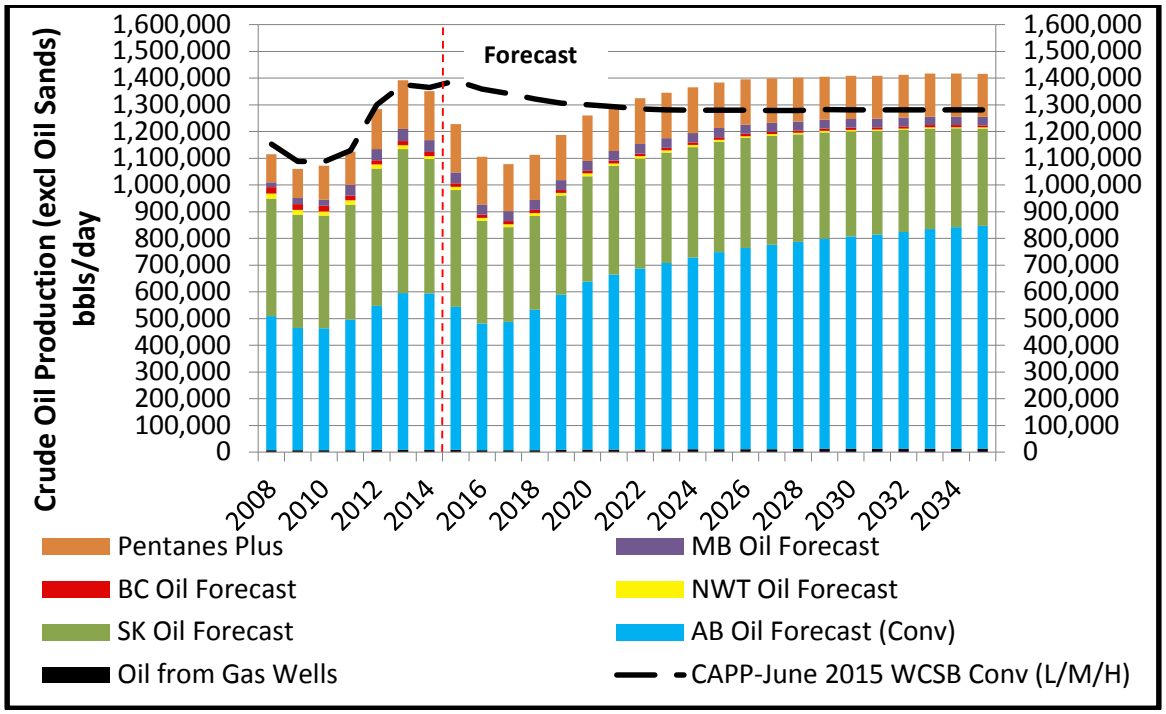
Figure E.1 demonstrates the resulting oil forecast by province while Table E.1 details the economic impacts of those oil developments. The Canadian Association of Petroleum Producers (CAPP) June 2015 forecast (light, medium and heavy crude oil) is also presented on Figure E.1 for

[1] CERI Study 144, Canadian Oil Pathways, July 2014

comparative purposes. In order to compare directly against the CAPP forecast, Figure E.1 has included a forecast for Pentanes Plus. CERI's analysis of the fallout from reduced drilling in western Canada suggests that by 2017 conventional crude oil production will be 350,000 barrels below CERI's 2014 forecast. This is a direct result of drilling and connecting fewer wells in 2014, 2015 and 2016. The fallout from this reduced activity over the next 3 years will be played out in reduced field employment, provincial and federal taxes, royalties and activity in various indirect and induced industries.

Table E.1 details the economic impacts of the reduced forecast expressed in terms of capital investment, producer revenues, gross domestic product, and taxes paid to provincial and federal governments.

Figure E.1: Western Canada Crude Oil and Oil Equivalent Forecast (2015-2035)



Source: CERI

Table E.1: Summary of Economic Impacts from Oil Well Developments in Western Canada, 2015-2035 (Billion CDN$)

	AB	BC	SK	Total
Capital investment in the drilling, completing and connection of crude oil wells	261.0	1.0	133.0	395.0
Revenues from crude oil domestic sales and export sales	481.0	9.8	209.0	699.8
Total Canadian GDP impacts	949.0	12.0	347.0	1,308.0
Federal Government tax revenues	108.0	1.1	30.0	139.1
Provincial Government tax revenues	66.0	0.7	26.0	92.7

Source: CERI

Chapter 1: Introduction

In July 2014, the Canadian Energy Research Institute (CERI) undertook a study to research and forecast the future of the North American oil market as played out in four equally plausible narratives. The four narratives depicted the influence of high/low market access and high/low social license. These four narratives were the subject matter for a CERI report titled "Canadian Oil Pathways" published in July 2014.2 Although the title of the report refers to Canadian oil, the focus of the research was to detail and estimate the productive potential of the United States oil basins and by difference (demand minus supply) suggest the annual level of US required imports leading to an estimation of Canadian supply potential directed to the United States market. That report also addressed the implications that a status quo market access would have on the basis differential and the risk of higher costs because of obtaining a social license.

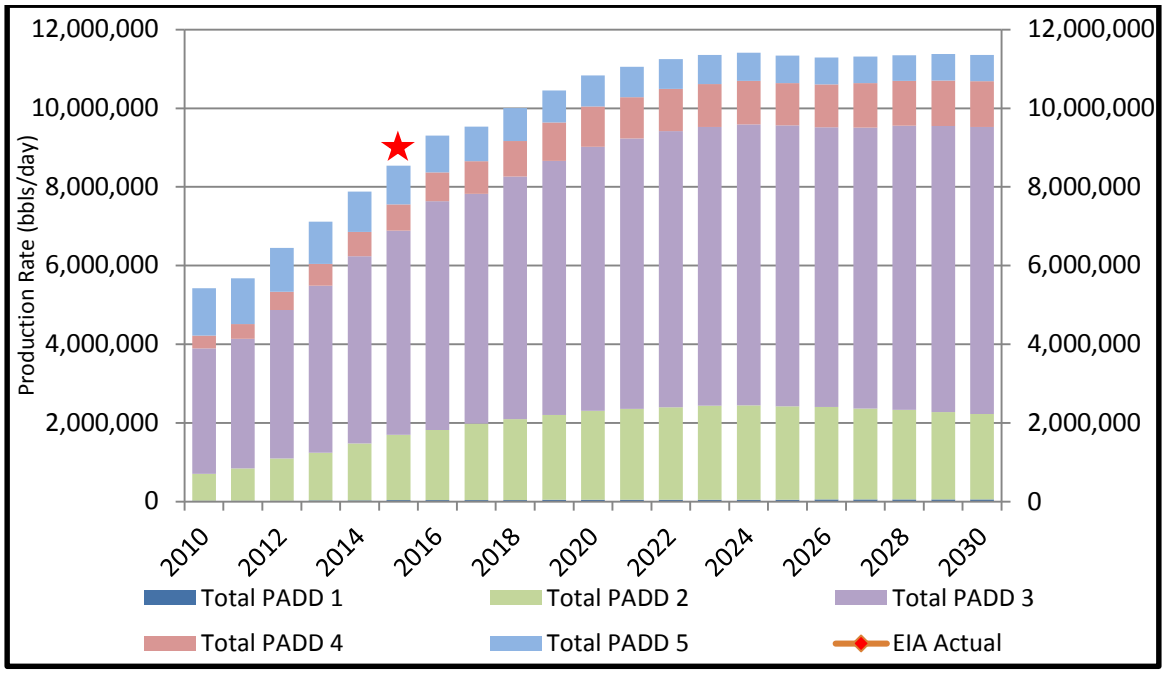
The purpose of this report is to ascertain the implications of the recent oil price decline coupled with Canadian oil producers reducing capital budgets for 2015, 2016 and possibly further into the future. This analysis will be expressed in a crude oil drilling forecast, capital requirements for new wells, producer production revenues, and economic impacts in terms of GDP growth, employment and industry taxation (excluding royalties) for the period 2015 to 2035.

For the North American analysis, the ICF International Detailed Oil Production report was used to establish a reference case for North America. This model uses historical data as sourced from the individual state regulators and is used to estimate the trend in initial production rates, the forecast of future production and ultimate production for each current well along with establishing a decline curve and other parameters for forecasting production from future wells. The model structure for the new tight/shale resources incorporates per well trends due to technology and depletion and evaluates productivity through time as a function of declining estimated ultimate recovery (EUR) and oil and gas prices. Figure 1.1 illustrates the reference case from the Canadian Oil Pathways report. The Energy Information Administration (EIA) of the United States shows actual production for the first four months in 2015 averaging nine million barrels per day or approximately 300,000 barrels per day higher than the reference case.

At the time of the 2014 report, CERI's forecast for future crude, tight and shale oil developments was predicated on the assumption that oil well activity for western Canada would continue at the 2013 drilling level for the years 2014 to 2016 followed by a 1 percent decline out to 2020 and a 5 percent decline per year for the remainder of the forecast. This view was considered conservative about future events and did not reflect the size of the remaining resource basin. Figure 1.2 details the forecast for new crude oil well connections broken down by province and type of well.

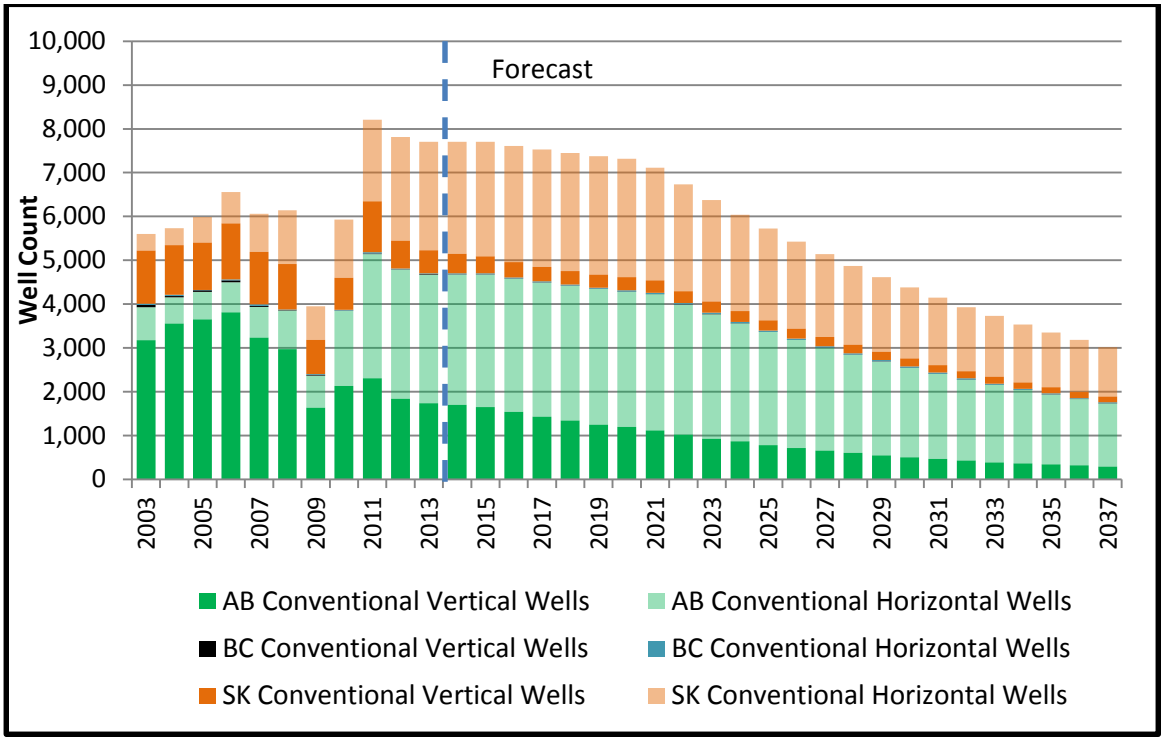
[2] CERI Study 144, Canadian Oil Pathways, July 2014

Figure 1.1: United States Crude Oil Supply (Reference Case)



Source: CERI Study 144, Canadian Oil Pathways, July 2014, Figure E.3

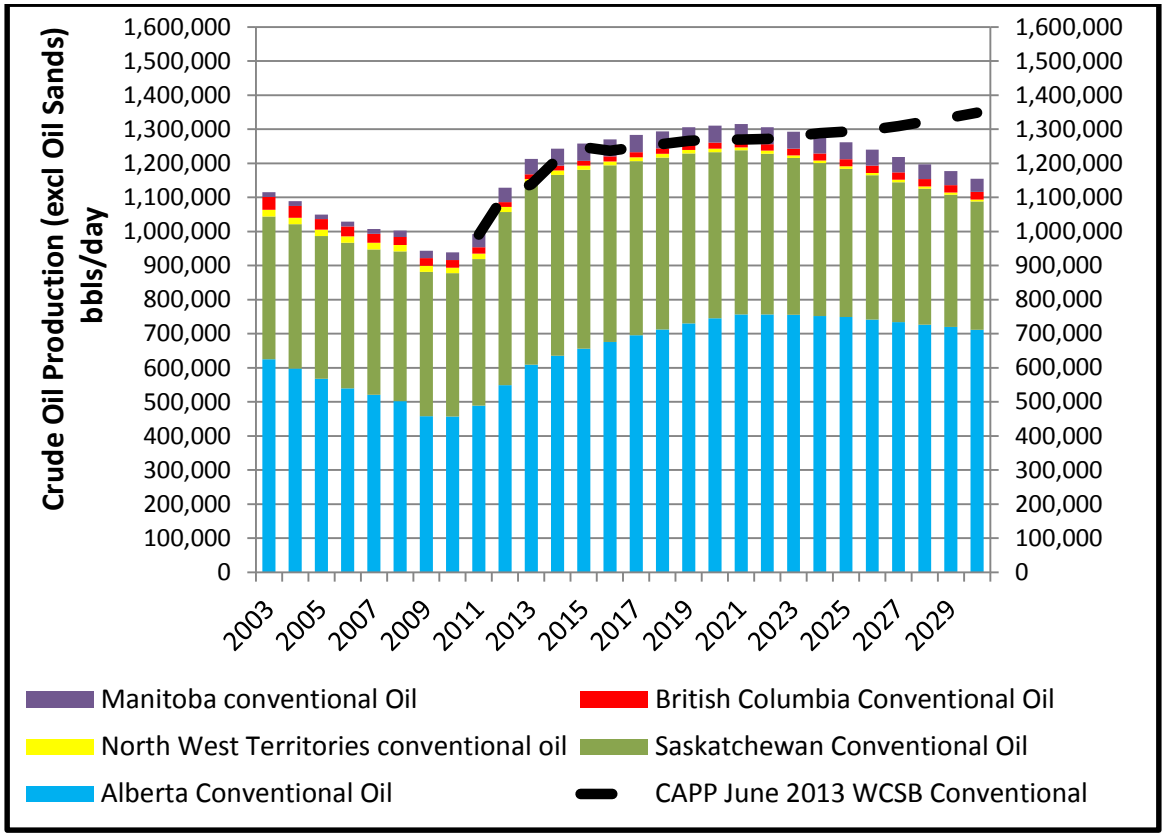
Figure 1.2: Western Canada Oil (Light/Heavy) New Well Connection Forecast



Source: CERI Study 144, Canadian Oil Pathways, July 2013, Figure 2.1

CERI's Canadian oil forecast model, as described in Appendix A, takes into account the new well connections from Figure 1.2 and applies initial production rates, decline type curves and other modeling parameters to determine a western Canada crude oil production forecast as detailed in Figure 1.3. CAPP's June 2013 WCSB forecast[3] is included on the chart for comparative purposes.

Figure 1.3: WCSB Crude Oil Forecast (Q2 2014)

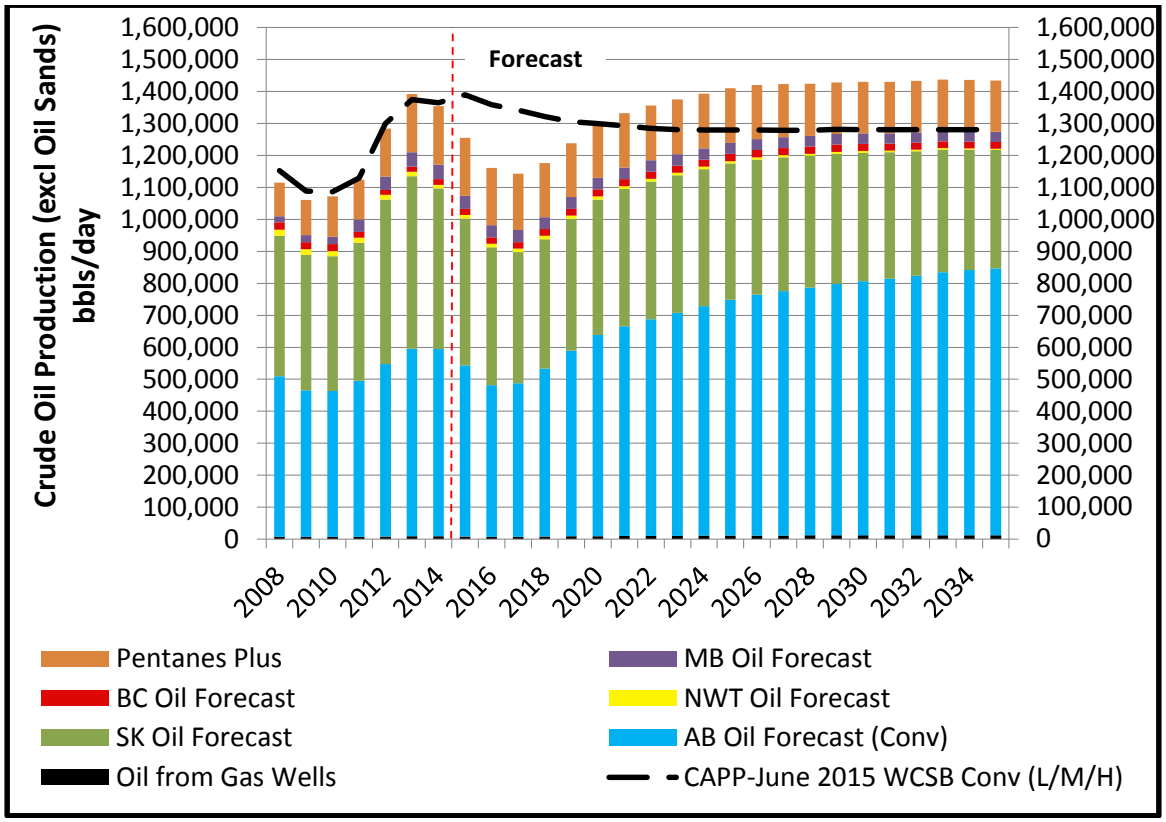


Source: CERI Study 144, Canadian Oil Pathways, July 2013, Figure 2.2

Starting with Figure 1.3, CERI utilized the historical oil well licensing files from the Alberta Energy Regulator (AER), the British Columbia Oil and Gas Commission and Saskatchewan Energy and Mines to estimate the decline in new oil well drilling based on actual recorded oil well licenses up to June 2015 and extrapolating to the end of the year. That analysis determined that Alberta would license 1,344 new oil well connections for the year 2015; Saskatchewan is assumed to bring on 1,900 new oil well connections for 2015. This reduced level of drilling is assumed to be repeated for 2016 followed by an upward trend in 2017 mimicking the movement in the oil price forecast as suggested by the EIA and illustrated in Figure 1.5. Refer to Chapters 2-4 for the individual provincial forecasts and impacts. Applying these reductions to the new well connection forecast (Figure 1.2) results in a pullback in production levels as demonstrated in Figure 1.4.

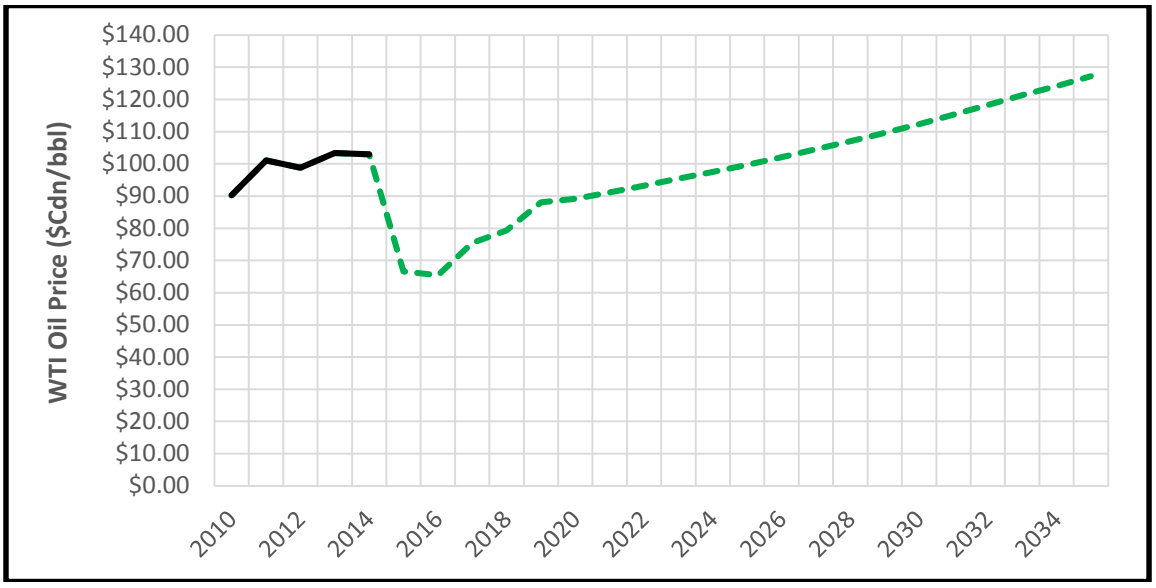
[3] CAPP, Crude Oil Forecast, Markets & Trends, June 2013, Appendix B.1

Figure 1.4: WCSB Crude Oil Forecast (2015-2035)



Source: CERI, CAPP

Figure 1.5: Alberta AECO-C/NIT Market Price Forecast (2015-2035)



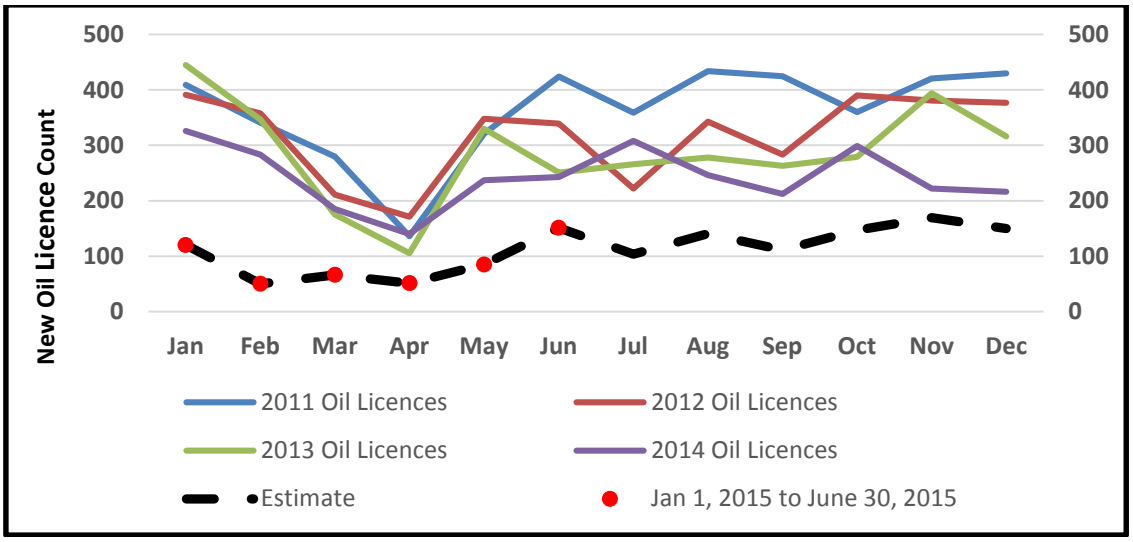
Source: EIA, Modified by CERI: 2016, 2017 values

Chapter 2: Economic Impacts of Crude Oil Developments – Alberta

This chapter examines the crude oil forecast and associated economic impacts of crude oil developments, including both existing and future drilling activity within the province of Alberta over the period 2015 to 2035. This analysis covers crude, shale and tight oil activity, using vertical and horizontal wells.

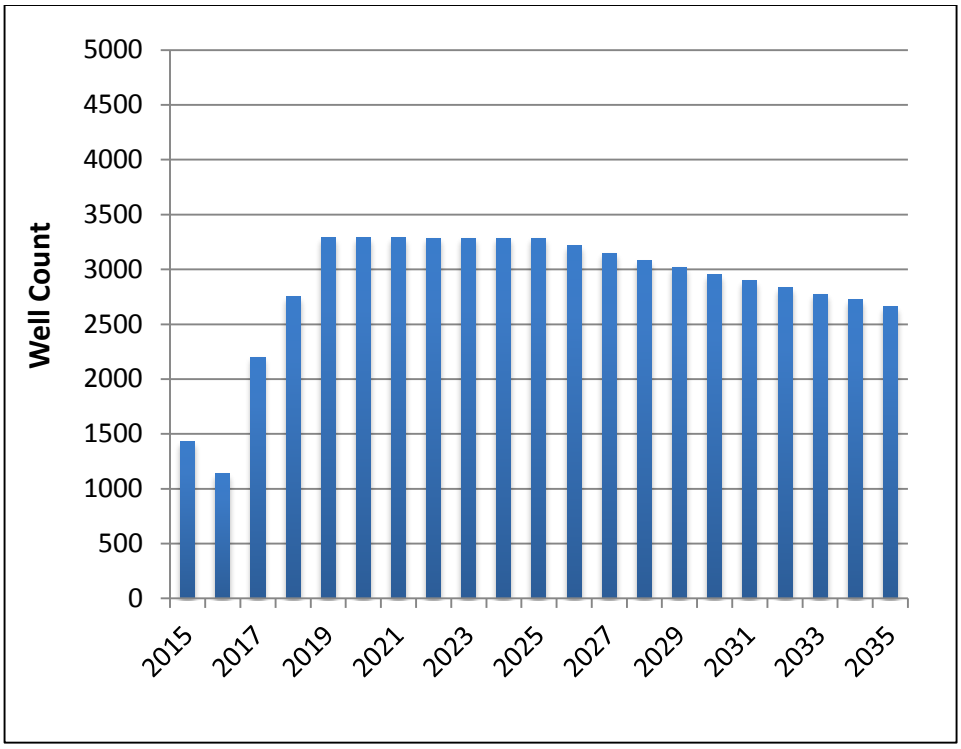
Figure 2.1 shows the historical monthly new oil well licenses issued by the Alberta Energy Regulator (AER) for the years 2011 to 2014. The first 6 months of 2015 oil licenses are shown as red dots and the dashed line is a curve fit and extrapolation to the end of the year using an average historical trend. These licenses are for crude oil wells (vertical and horizontal) and do not include cold bitumen production (CBP) wells or in-situ thermal producing wells (Steam Assisted Gravity Drainage, [SAGD]), producing wells. This extrapolation suggests that the oil industry will license 1,350 oil wells in 2015. This level of drilling activity is assumed to continue in 2016 before allowing the drilling trend to follow the growth trajectory of the oil price forecast displayed in Figure 1.5. Figure 2.2 details the resulting annual new well forecast for Alberta.

Figure 2.1: Alberta New Oil Well Licenses (2011-2014)



Source: AER, CERI

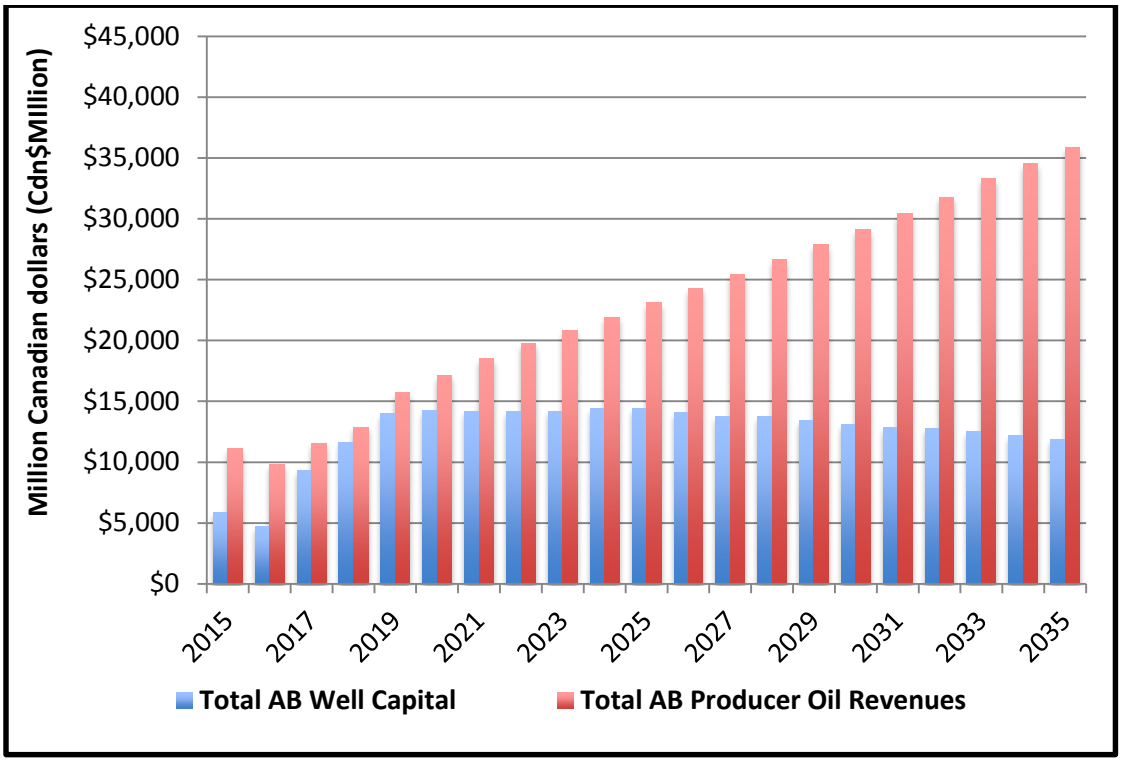
Figure 2.2: Alberta New Well Forecast (2015-2035)



Source: CERI

In order to determine the cost of the drilling activity outlined in Figure 2.2, CERI makes use of the information contained in the 2015 Well Cost Study (winter 2015 costs) from the Petroleum Services Association of Canada (PSAC). Reference wells are assigned to each area and formation under study and the well cost is calibrated to the average drill depth using true vertical depth for a vertical well and total drill depth for a horizontal well. A provision for connection infrastructure costs plus geological and geophysical costs are added to the well cost as represented by the blue bars in Figure 2.3. The red bars represent the forecast of producer revenues from all future crude oil production (existing wells plus future new well additions) based on the oil price forecast reflected in Figure 1.5 calibrated back to a gross field gate price by taking into account market differentials, currency exchange rates and transportation costs. This revenue stream will cover operating costs, taxes, royalties, etc. This oil price forecast from the EIA has been modified by CERI for the years 2016 and 2017 to reflect a continuing low market situation allowing time for global demand to catch up with global supply.

Figure 2.3: Alberta New Well Capital Cost and Producer Revenues (2015-2035)



Source: CERI

Tables 2.1 and 2.2 and Figures 2.4 and 2.5 demonstrate the economic impacts derived from crude oil developments.

- Capital investments in the development of new oil wells in Alberta will total CDN$261 billion or average CDN$12.5 billion per year.
- Revenues from crude oil domestic sales and export sales will total CDN$481 billion or average CDN$23.2 billion per year.
- Total Canadian GDP impacts are estimated at CDN$949 billion, 89 percent within the province of Alberta and 11 percent across the other provinces and territories (Table 2.1).
- Taxes directed to the Federal government will total CDN$108 billion and CDN$66 billion to the Provincial governments (Table 2.2).
- Employment (direct, indirect and induced) will grow from 100,000 jobs in 2015 to 285,000 by 2035 (Figure 2.4, Figure 2.5).

Table 2.1: Economic Impacts of Crude Oil Developments in Alberta (2015-2035)

Investment and Operations	$CAD Million		Thousand Person Years
	GDP	Compensation of Employees	Employment
Alberta	845,156	357,950	3,619
British Columbia	23,759	14,594	215
Manitoba	4,035	2,317	40
New Brunswick	1,217	683	12
Newfoundland/Labrador	559	256	4
Nova Scotia	958	594	10
Nunavut	86	62	1
Northwest Territories	192	119	2
Ontario	50,731	30,686	375
Prince Edward Island	83	48	1
Quebec	15,928	9,011	150
Saskatchewan	6,480	2,865	47
Yukon Territory	87	54	1
Total Canada	**949,271**	**419,238**	**4,477**

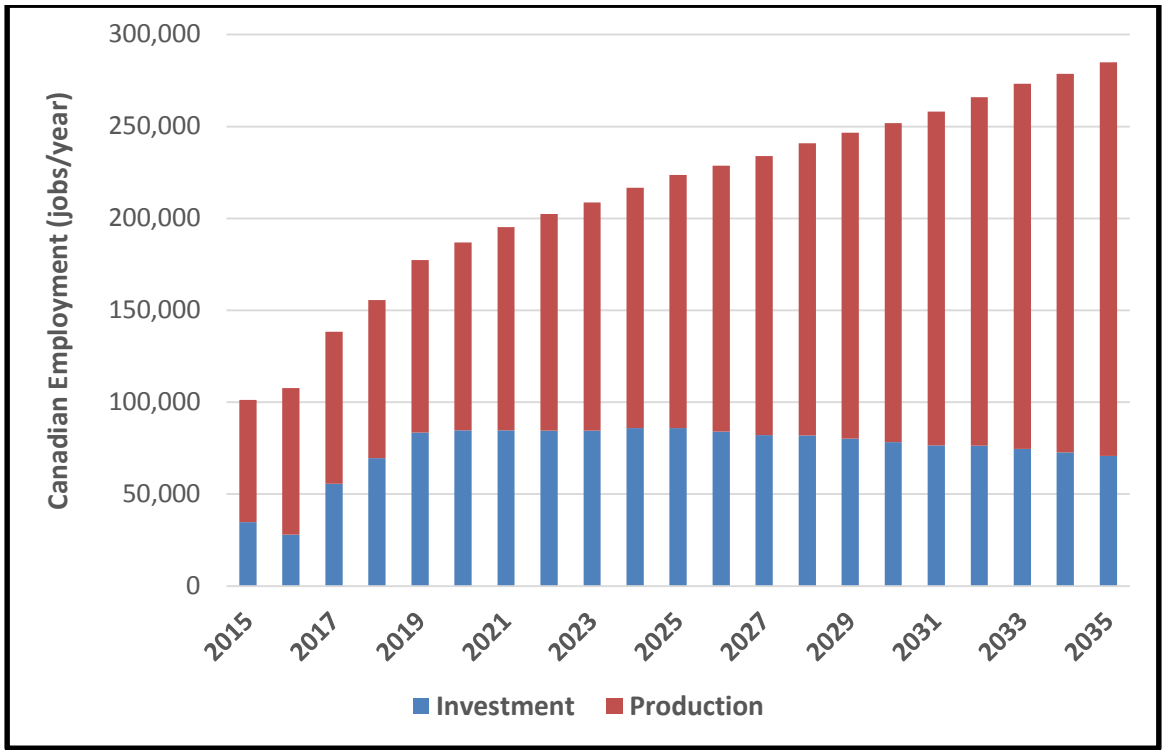
Source: CERI

Table 2.2: Tax Receipts Derived from Crude Oil Developments in Alberta (2015-2035)

Investment and Operations	Federal Corporate $CAD Million	Federal Indirect $CAD Million	Federal Personal $CAD Million	Provincial Corporate $CAD Million	Provincial Indirect $CAD Million	Provincial Personal $CAD Million
Alberta	29,992	10,050	57,664	15,190	10,985	31,109
British Columbia	469	410	1,599	172	865	694
Manitoba	63	70	237	22	165	189
New Brunswick	18	17	72	8	41	55
Newfoundland/Labrador	11	7	28	15	14	20
Nova Scotia	17	16	62	9	30	52
Nunavut	1	1	5	0	1	1
Northwest Territories	4	4	8	3	5	4
Ontario	925	945	3,596	486	1,853	2,155
Prince Edward Island	1	2	5	1	4	4
Quebec	290	282	1,046	203	743	969
Saskatchewan	145	93	319	98	227	192
Yukon Territory	1	2	4	0	2	2
Total Canada	31,936	11,899	64,645	16,208	14,933	35,446

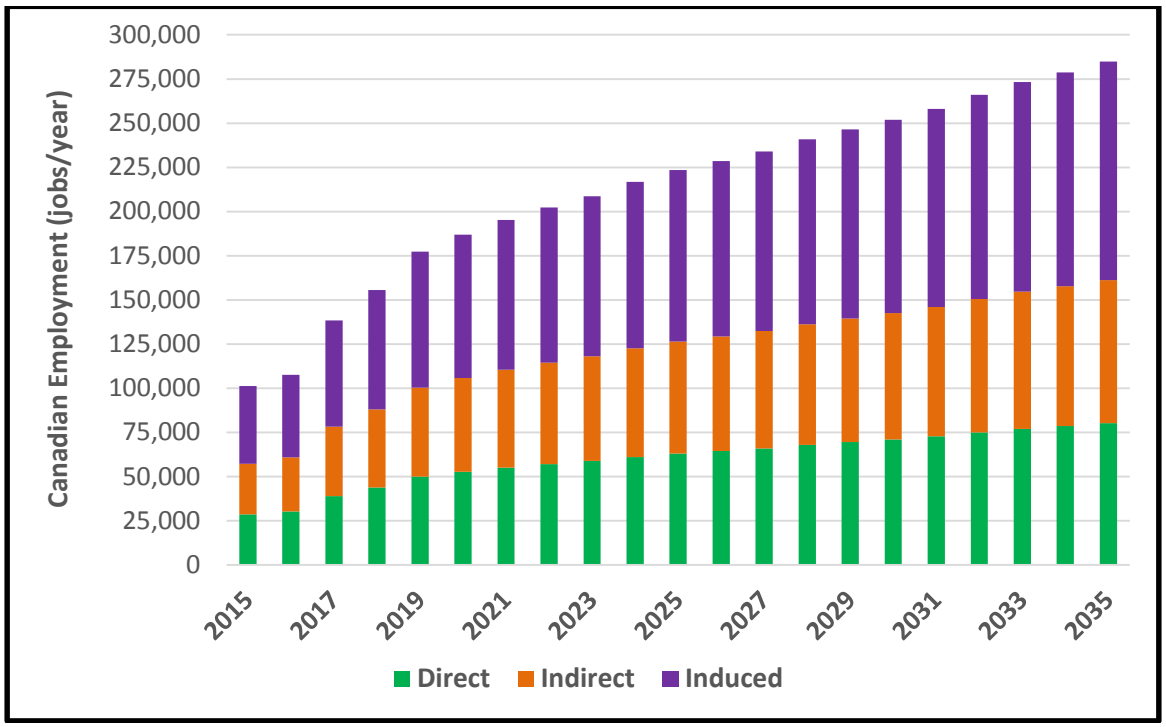
Source: CERI

Figure 2.4: Alberta Employment Impacts: Investment and Production (2015-2035)



Source: CERI

Figure 2.5: Alberta Employment Impacts: Direct, Indirect and Induced (2015-2035)



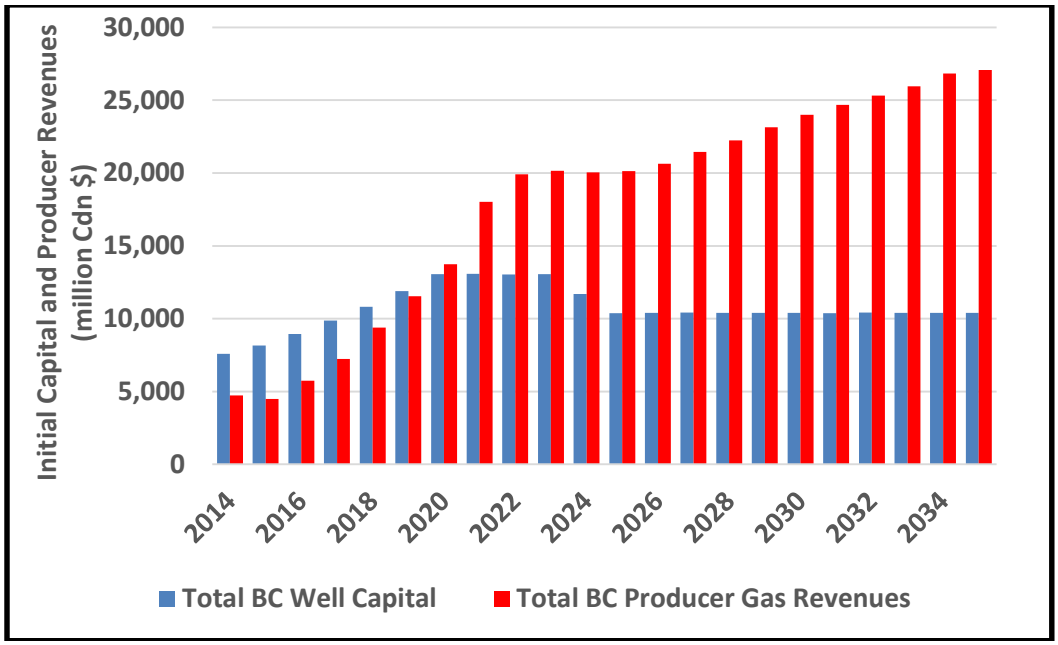
Source: CERI

Chapter 3: Economic Impacts of Crude Oil Developments – British Columbia

This chapter discusses the crude oil forecast and associated economic impacts of crude oil developments, including both existing and future within the province of British Columbia over the period 2015 to 2035. This analysis covers crude, shale and tight oil activity, using vertical and horizontal wells.

Annual capital cost for drilling and connection of new crude oil wells including infrastructure costs plus geological and geophysical costs are represented by the blue bars in Figure 3.1. The red bars represent the forecast of producer revenues from all crude oil production (existing wells plus future new well additions) based on the oil price forecast reflected in Figure 1.5 calibrated back to a gross field gate price by taking into account market differentials, currency exchange rates and transportation costs. This revenue stream will cover operating costs, taxes, royalties, etc. This oil price forecast from the EIA has been modified by CERI for the years 2016 and 2017 to reflect a continuing low market situation allowing time for global demand to catch up with global supply.

Figure 3.1: New Well Capital Cost and Annual Producer Revenues (2014-2035)



Source: CERI

Tables 3.1 and 3.2 and Figures 3.2 and 3.3 demonstrate the economic impacts derived from crude oil developments.

- Capital investments in the development of new oil wells in British Columbia will total CDN$1.0 billion.
- Revenues from crude oil domestic sales and export sales will total CDN$9.8 billion or average CDN$0.5 billion per year.
- Total Canadian GDP impacts are estimated at CDN$11.6 billion, 90 percent within the province of British Columbia and 10 percent across the other provinces and territories (Table 3.1).
- Taxes directed to the Federal government will total CDN$1.1 billion and CDN$0.7 billion to the Provincial governments (Table 3.2).
- Employment (direct, indirect and induced) will grow from 2,100 jobs in 2015 to 2,450 by 2035 (Figure 3.2 and Figure 3.3).

Table 3.1: Economic Impacts of Crude Oil Developments in British Columbia (2015-2035)

Investment and Operations	$CAD Million		Thousand Person Years
	GDP	Compensation of Employees	Employment
Alberta	373	197	2
British Columbia	10,475	3,749	39
Manitoba	39	23	0
New Brunswick	9	5	0
Newfoundland/Labrador	4	2	0
Nova Scotia	10	6	0
Nunavut	0	0	0
Northwest Territories	4	2	0
Ontario	496	302	4
Prince Edward Island	1	0	0
Quebec	163	93	2
Saskatchewan	31	14	0
Yukon Territory	7	3	0
Total Canada	**11,612**	**4,397**	**48**

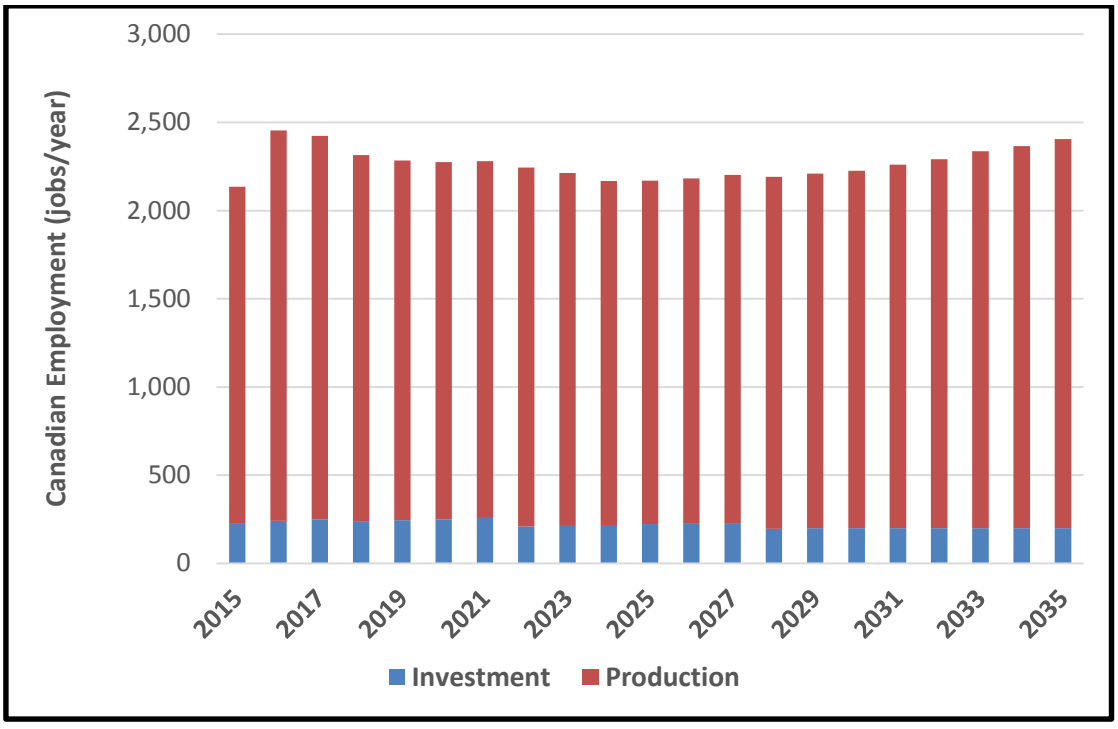
Source: ICF, CERI

Table 3.2: Tax Receipts Derived from Crude Oil Developments in British Columbia (2015-2035)

Investment and Operations	Federal Corporate $CAD Million	Federal Indirect $CAD Million	Federal Personal $CAD Million	Provincial Corporate $CAD Million	Provincial Indirect $CAD Million	Provincial Personal $CAD Million
Alberta	13	6	25	7	6	14
British Columbia	207	118	705	76	249	306
Manitoba	1	1	2	0	2	2
New Brunswick	0	0	1	0	0	0
Newfoundland/Labrador	0	0	0	0	0	0
Nova Scotia	0	0	1	0	0	1
Nunavut	0	0	0	0	0	0
Northwest Territories	0	0	0	0	0	0
Ontario	9	9	35	5	18	21
Prince Edward Island	0	0	0	0	0	0
Quebec	3	3	11	2	7	10
Saskatchewan	1	0	2	0	1	1
Yukon Territory	0	0	0	0	0	0
Total Canada	234	137	782	91	283	355

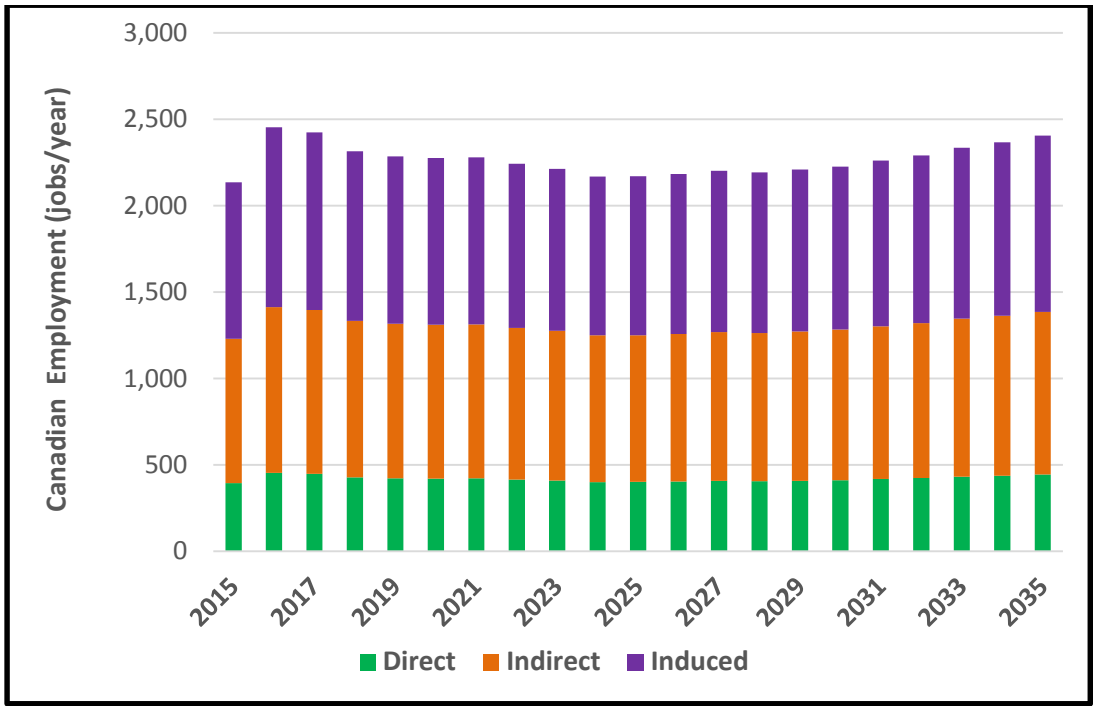
Source: CERI

Figure 3.2: British Columbia Employment Impacts: Investment and Production (2015-2035)



Source: CERI

Figure 3.3: British Columbia Employment Impacts: Direct, Indirect and Induced (2015-2035)



Source: CERI

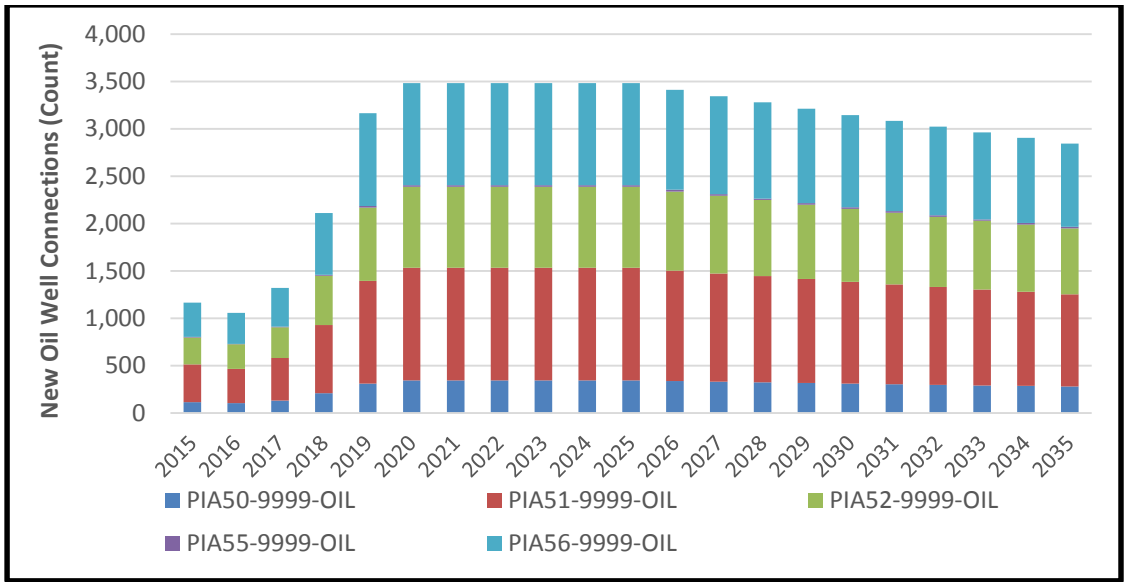
Chapter 4: Economic Impacts of Crude Oil Developments – Saskatchewan

This chapter discusses the crude oil forecast and associated economic impacts of crude oil developments, including both existing and future within the province of Saskatchewan over the period 2015 to 2035. This analysis covers crude, shale and tight oil activity, using vertical and horizontal wells.

CERI assumes that new oil well connections for 2015 will drop by 45 percent from 2014 levels following the same path as described in Chapter 2 for Alberta. This assumption is because budget cuts by producers will be felt across the industry and across corporate oil plays. CERI has also assumed that these cuts in new well activity will continue through 2016 before starting to recover because of the forecasted recovery in the WTI oil price as described in Figure 1.5. This oil price forecast from the EIA has been modified by CERI for the years 2016 and 2017 to reflect a continuing low market situation allowing time for global demand to catch up with global supply.

Figure 4.1 demonstrates the resulting new oil well forecast for Saskatchewan. Illustrated in this chart are the regional breakdowns; refer to Figure A.3 for a geographical representation of the Saskatchewan forecast areas.

Figure 4.1: Saskatchewan New Oil Well Connection Forecast (2015-2035)

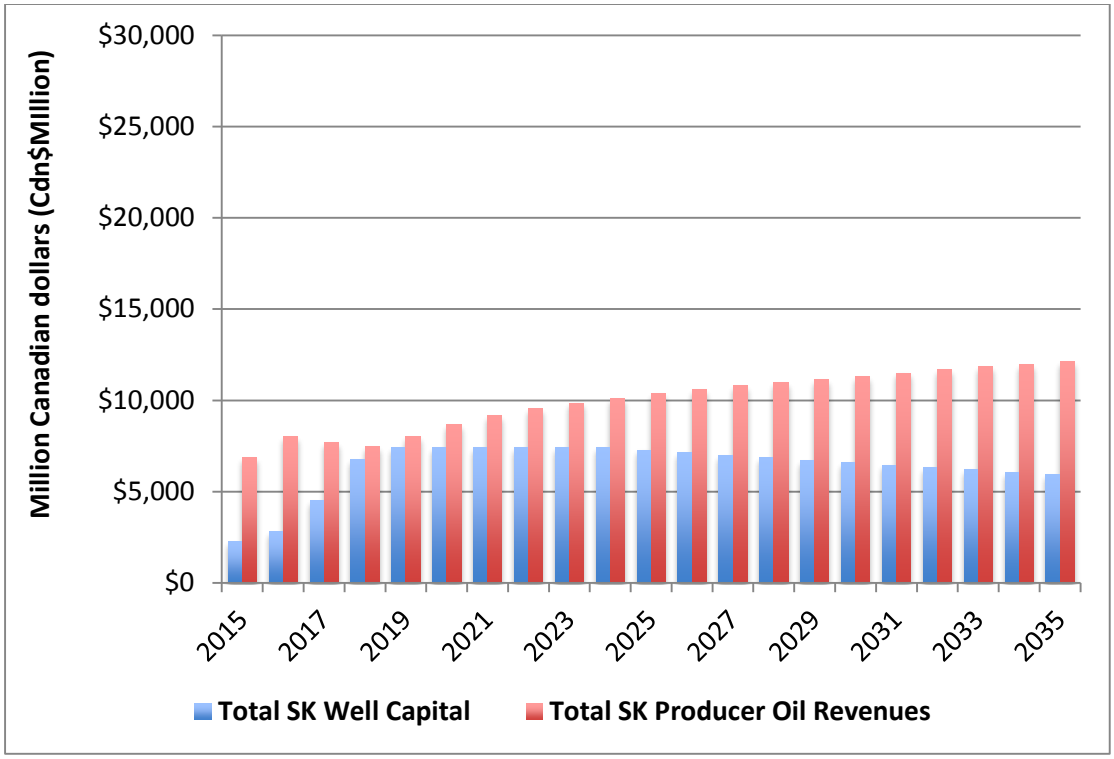


Source: CERI

Figure 4.2 details annual capital requirements for drilling and connecting new oil wells along with the estimated producer revenues from existing and future production. The capital requirements is determined by using the drilling profile (Figure 4.1) converted to investment dollars by means

of the PSAC well cost study and including estimates for infrastructure and other development costs (blue bars). Revenues are determined by taking the WTI oil price forecast (Figure 1.5) and after accounting for basis differentials, currency exchange and transportation from field to pipe and pipe to market, represents the field gate price on a per barrel basis (expressed in Canadian dollars). Producer gross revenues are represented by the red bars in Figure 4.2. With respect to Figure 1.5, this oil price forecast from the EIA has been modified by CERI for the years 2016 and 2017 to reflect a continuing low market situation allowing time for global demand to catch up with global supply.

Figure 4.2: New Well Capital Cost and Annual Producer Revenues (2015-2035)



Source: CERI

Tables 4.1 and 4.2 and Figures 4.3 and 4.4 demonstrate the economic impacts derived from crude oil developments for the forecast period 2015-2035.

- Capital investments in the development of new oil wells in Saskatchewan will total CDN$133 billion.
- Revenues from crude oil domestic sales and export sales will total CDN$209 billion.
- Total Canadian GDP impacts are estimated at CDN$347 billion, 89 percent within the province of Saskatchewan and 11 percent across the other provinces and territories (Table 4.1).
- Taxes directed to the Federal government will total CDN$30 billion and CDN$26 billion to the Provincial governments (Table 4.2).

- Employment (direct, indirect and induced) will grow from 29,000 jobs in 2015 to 59,000 by 2035 (Figure 4.3 and Figure 4.4).

Table 4.1: Economic Impacts of Crude Oil Developments in Saskatchewan (2015-2035)

Investment and Operations	$CAD Million		Thousand Person Years
	GDP	Compensation of Employees	Employment
Alberta	17,876	8,833	98
British Columbia	2,870	1,806	26
Manitoba	1,699	1,018	18
New Brunswick	161	88	2
Newfoundland/Labrador	103	46	1
Nova Scotia	218	135	2
Nunavut	9	6	0
Northwest Territories	35	21	0
Ontario	10,475	6,184	73
Prince Edward Island	23	13	0
Quebec	2,979	1,637	27
Saskatchewan	310,973	61,621	874
Yukon Territory	14	9	0
Total Canada	**347,434**	**81,418**	**1,121**

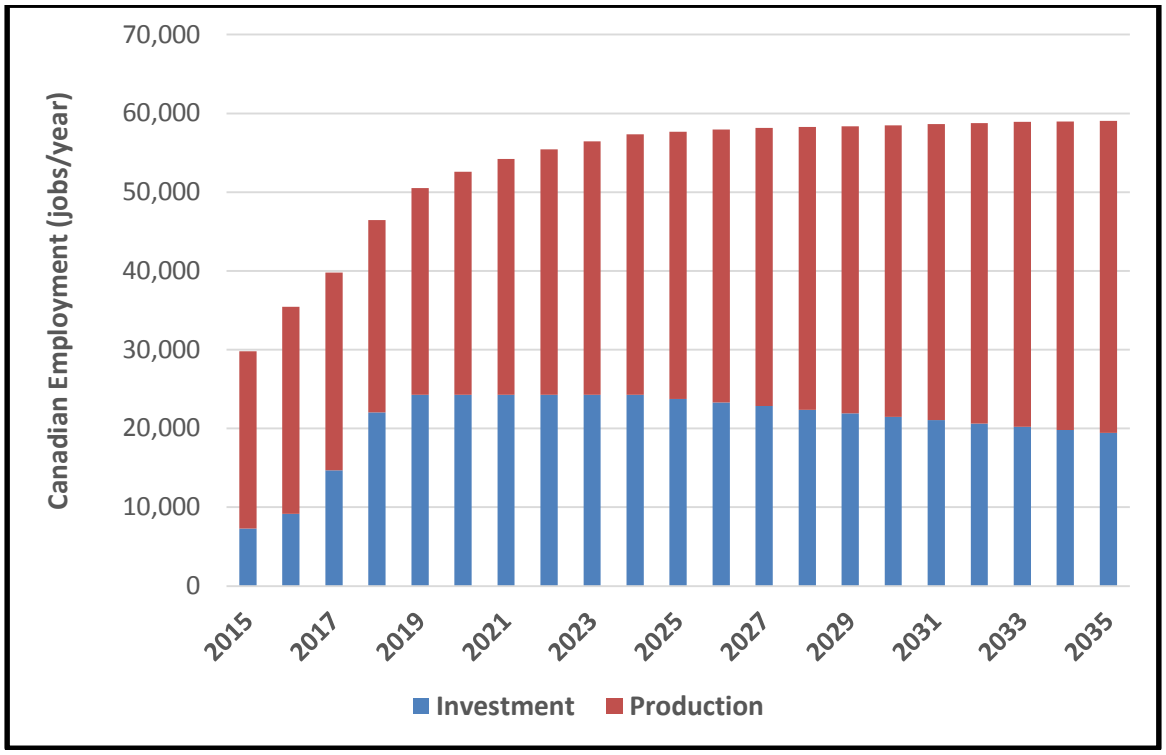
Source: CERI

Table 4.2: Tax Receipts Derived from Crude Oil Developments in Saskatchewan (2015-2035)

Investment and Operations	Federal Corporate $CAD Million	Federal Indirect $CAD Million	Federal Personal $CAD Million	Provincial Corporate $CAD Million	Provincial Indirect $CAD Million	Provincial Personal $CAD Million
Alberta	634	239	1,220	321	262	658
British Columbia	57	50	193	21	105	84
Manitoba	27	27	100	9	63	80
New Brunswick	2	2	10	1	5	7
Newfoundland/Labrador	2	1	5	3	2	4
Nova Scotia	4	4	14	2	7	12
Nunavut	0	0	0	0	0	0
Northwest Territories	1	1	2	0	1	1
Ontario	191	194	743	100	380	445
Prince Edward Island	0	0	1	0	1	1
Quebec	54	47	196	38	124	181
Saskatchewan	6,949	3,943	15,310	4,694	9,576	9,237
Yukon Territory	0	0	1	0	0	0
Total Canada	7,921	4,509	17,793	5,191	10,527	10,710

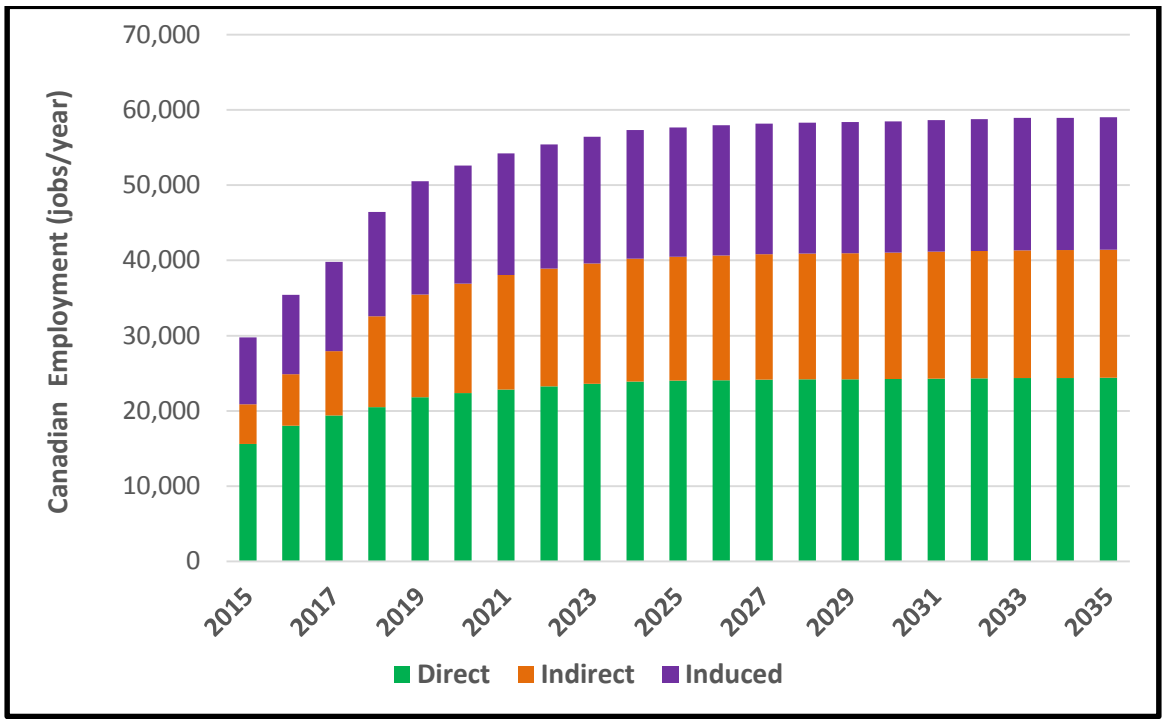
Source: CERI

Figure 4.3: Saskatchewan Employment Impacts: Investment and Production (2015-2035)



Source: CERI

Figure 4.4: Saskatchewan Employment Impacts: Direct, Indirect and Induced (2015-2035)



Source: CERI

Appendix A: WCSB Crude Oil Production Forecast

Methodology

This section is intended to describe the methodology used by CERI in determining a future forecast for oil production from the Western Canada Sedimentary Basin (WCSB).

CERI utilizes historical information supplied by Canadian provincial energy regulators in order to establish trends and parameters that are used in the forecasting algorithms. Specifically, the historical data is sourced from the following:

- British Columbia: British Columbia Oil and Gas Commission
- Alberta: Energy Resources Conservation Board (now the Alberta Energy Regulator)
- Saskatchewan: Saskatchewan Energy and Mines
- Manitoba: Manitoba Department of Energy

The historical information required is on a well by well basis and includes a description of each well drilled and/or completed and includes the geographic location, well type (vertical, horizontal), finish drilling date, initial production date, and the monthly production records (hours on production and all fluids recovered) from the well bore.

For the purpose of modeling conventional and shale oil developments, the WCSB is sub-divided along geographical and geological boundaries. The well by well information is sorted and grouped first on a regional basis (Pipeline Influence Areas, “PIA”) followed by a further disaggregation on a geological play basis (PIA-Regional play or formation, “PIA-Form”). This area/play basis grouping is intended to further refine the decline analysis for plays that are currently experiencing significant attention from exploration companies in the form of land acquisitions and exploratory and development drilling.

Alberta is sub-divided into 23 areas and 7 geological plays named below:

- Cardium formation
- Viking formation
- Slave Point formation
- Swan Hills formation
- Lloydminster formation
- Montney formation
- Pekisko formation

In addition, within two areas of the province, exploration companies are developing cold bitumen production (CBP) which is modeled separately from the conventional oil areas/plays.

British Columbia is sub-divided into 14 areas but drilling for oil is contained within two areas and is currently not attracting attention from exploration companies.

Saskatchewan is sub-divided into six areas with the southeast part of the province attracting the majority of the development drilling in the Bakken shale oil formation. The southwest part of the province is displaying renewed exploration activity as well as the border area between Alberta and Saskatchewan.

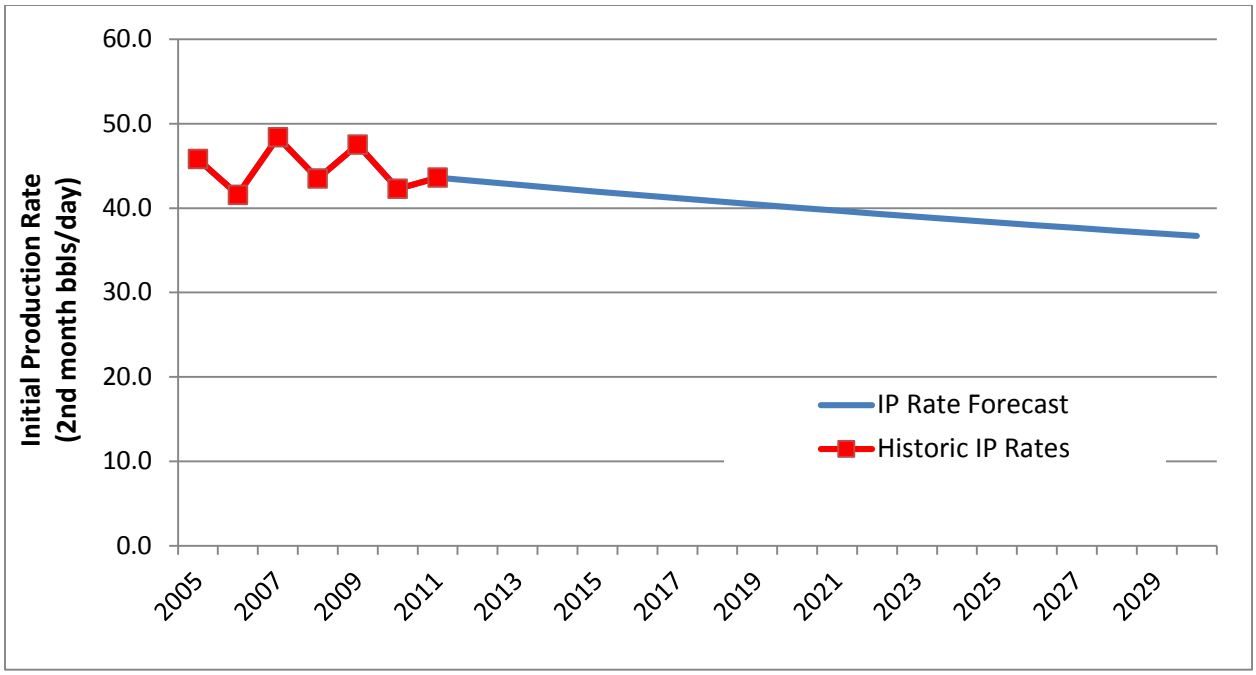
Historical production data for wells within each of the PIA areas/PIA-Form groupings is processed to determine the initial production rate for each well based on the type of well and calendar year of the second month of production. The second month of production is used to define the initial production month to eliminate the first month variability in production rates because of a new well coming on stream. The historical trend of initial production rates is used to estimate initial production rates into the future (refer to Figure A.1). The data is further processed to determine the historical virtual production curve based on the first year of production and the subsequent months of recorded production. The virtual curves are placed on the same axis from month 0 (zero) to the most recent month of recorded production. This curve representation is used to establish a "type curve" for the PIA areas/PIA-Form groupings. The type curve is a mathematical formula (harmonic, exponential, hyperbolic curves) that approximates the historical decline for all wells within the PIA areas/PIA-Form grouping. The fitting of mathematical equations to actual production decline data is a visual analysis performed by CERI and updated annually. This type curve is used first to forecast the future production from the wells that are currently on production and second, to establish the forecast of future production from new wells that will be drilled and connected in the future.

The number of new wells that are connected for production, along with wells that are drilled and abandoned are tabulated and used as a starting point for the CERI estimated drilling forecast for each area/play. CERI's oil supply cost model is used to confirm why certain areas/plays are currently attracting the attention of oil developers as it relates to drilling activity. Each area/play is assigned a weighting factor, based on the results of the supply cost calculation, which drives the level of drilling activity within an area/play on a yearly basis and based on the provincial forecast of future drilling.

The future forecast of provincial drilling is based on the historical drilling (including drilled and completed and drilled and abandoned) as a starting point and CERI's view of the future number of wells to be drilled per year of the forecast. This view is based on opinions from industry association groups (CAPP, PSAC, etc.), corporate annual reports and reviews of other independent forecasts.

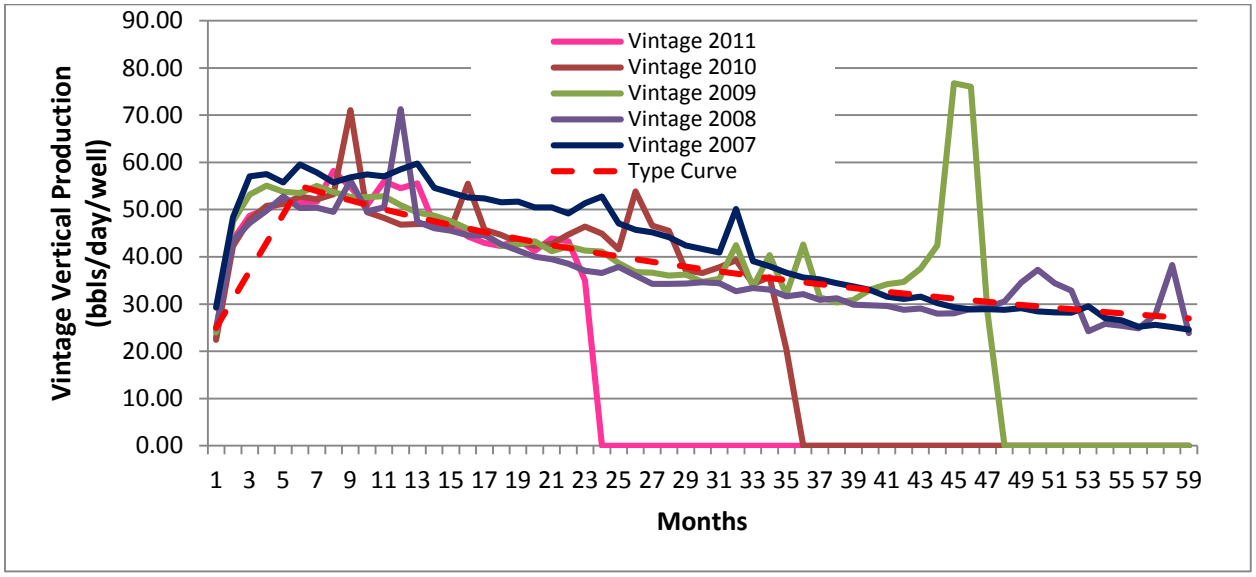
Figure A.1 is an example of the historical and forecast trend of initial production rates for a sample area/play. Figure A.2 is an example of the type curve determination for a sample area/play.

Figure A.1 Example Area: Historical and Forecast of Initial Production Rates



Source: CERI

Figure A.2 Example Area: Historical and Forecast of Type Curve



Source: CERI

At the completion of the iterative procedure, the model generates information, which describes the number of wells drilled by PIA area or PIA-Form group, and the annual wellhead production.

Figures A.3 to A.5 show geographical representations of the Pipeline Influence Areas for Alberta, British Columbia and Saskatchewan, respectively.

Figure A.3: Pipeline Influence Area: Alberta

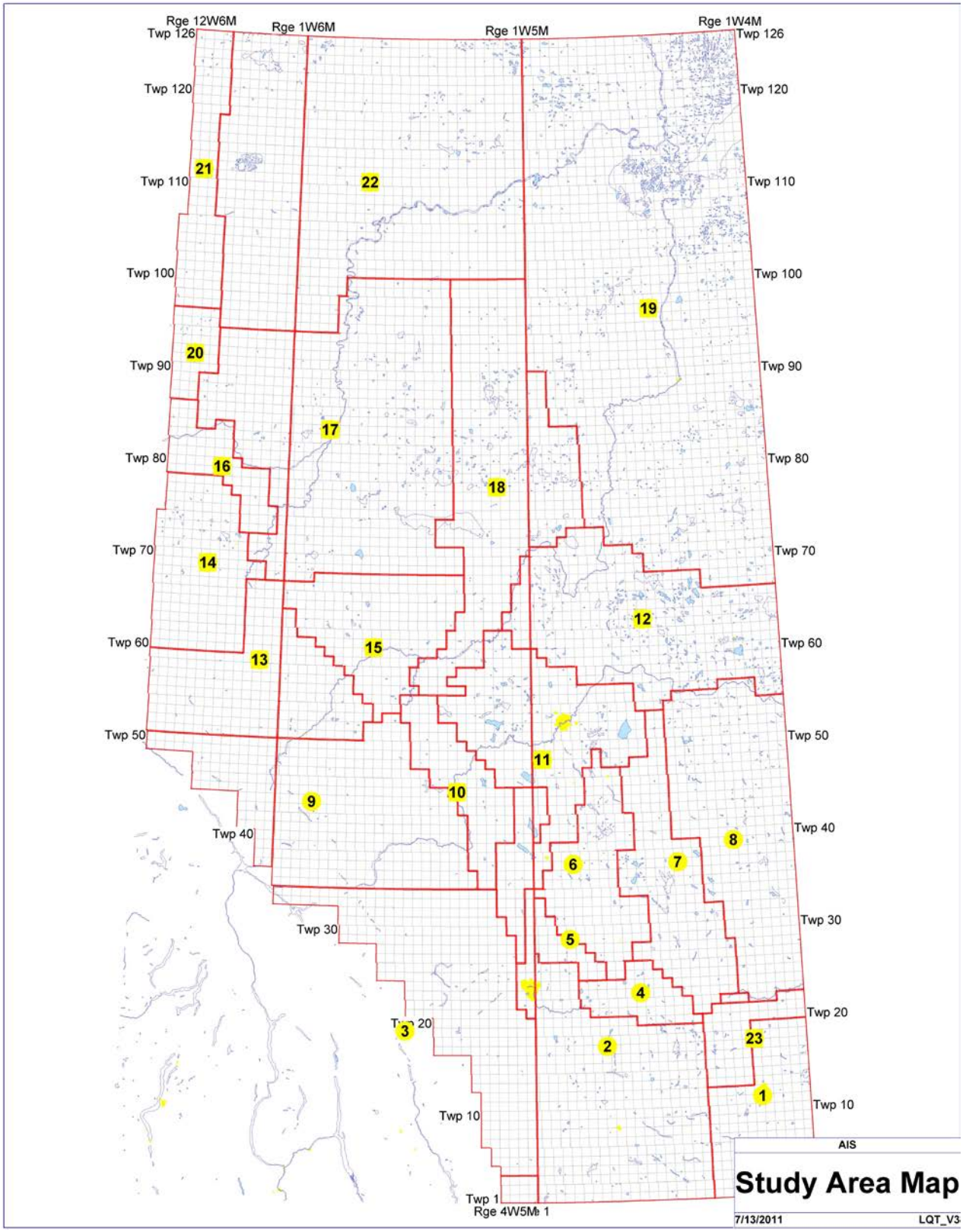


Figure A.4: Pipeline Influence Area: British Columbia

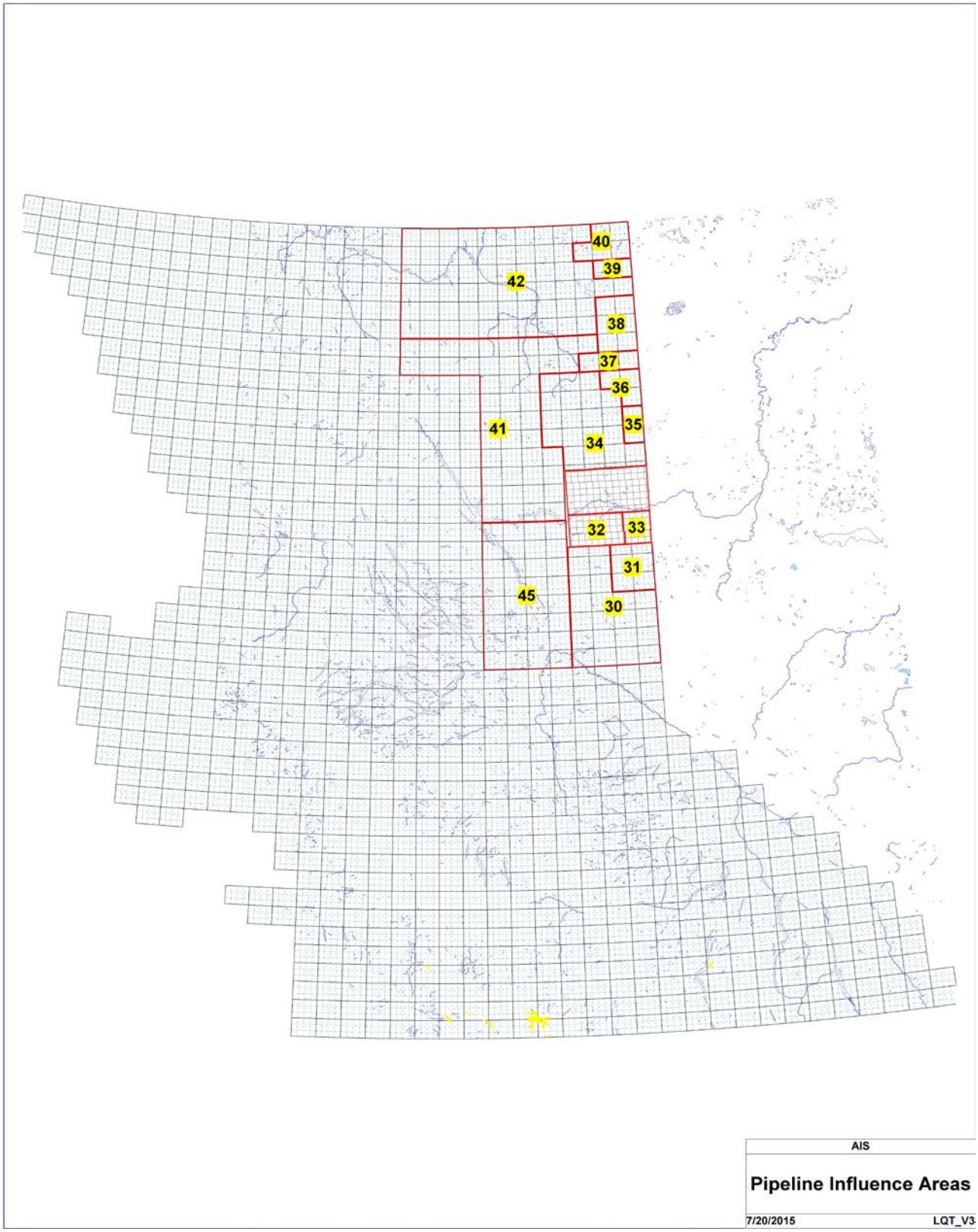
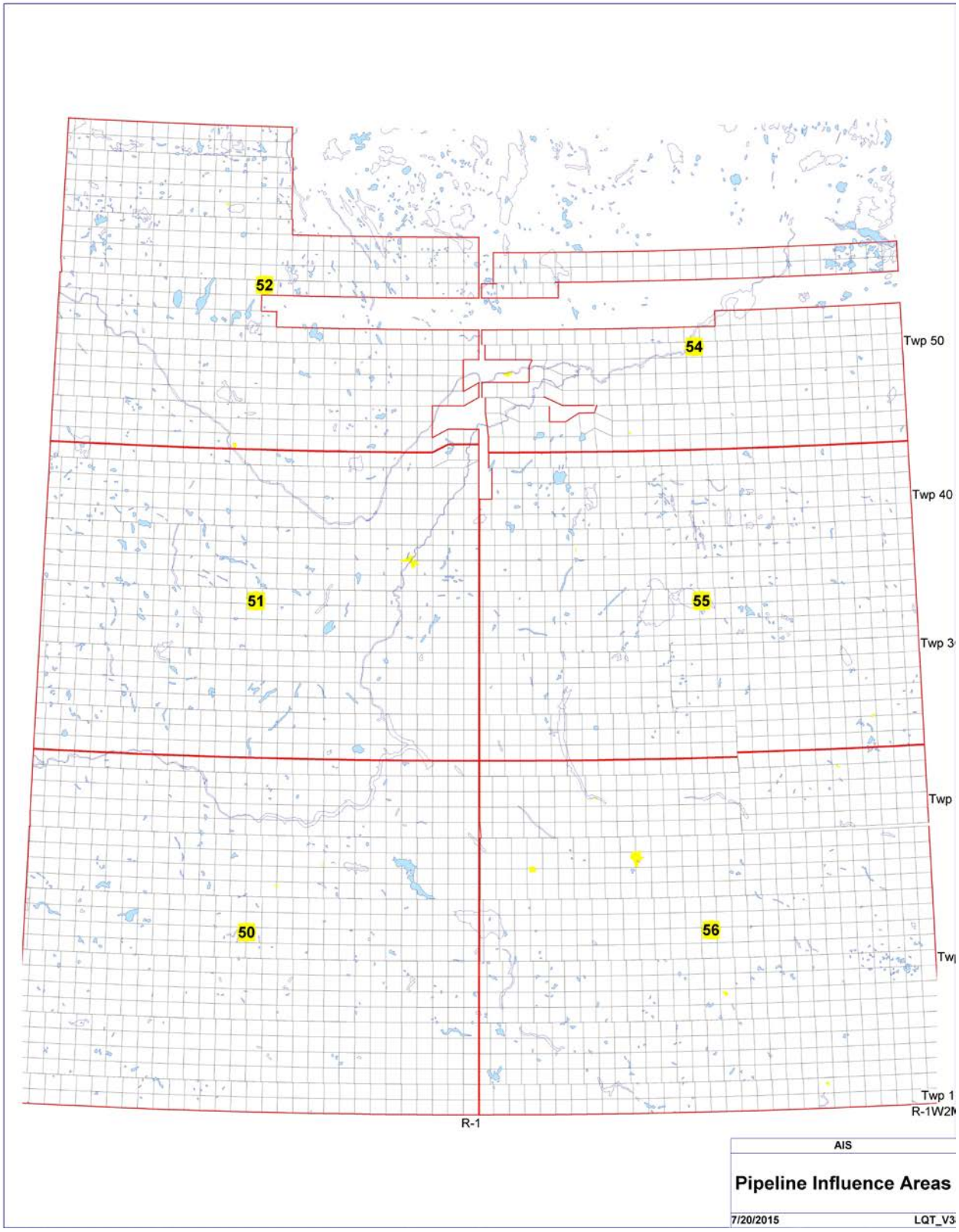


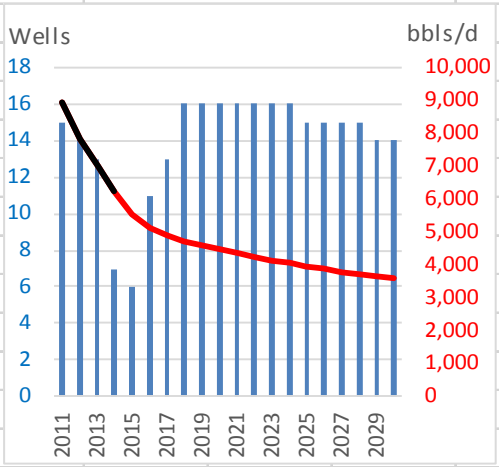
Figure A.5: Pipeline Influence Area: Saskatchewan



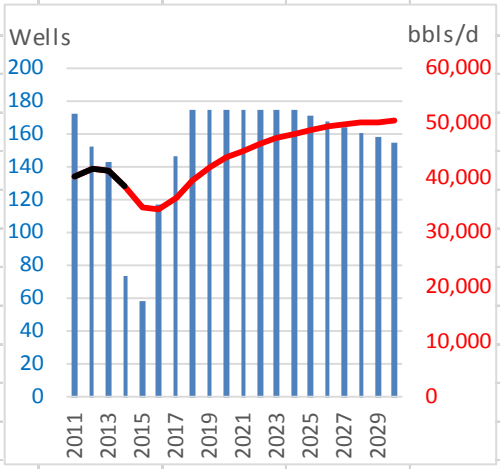
Appendix B: Selected PIA Charts for Alberta

The following charts are example PIA Area and PIA-Formation forecasts for Alberta indicating, on an annual basis, the number of new well connections along with the total average day production.

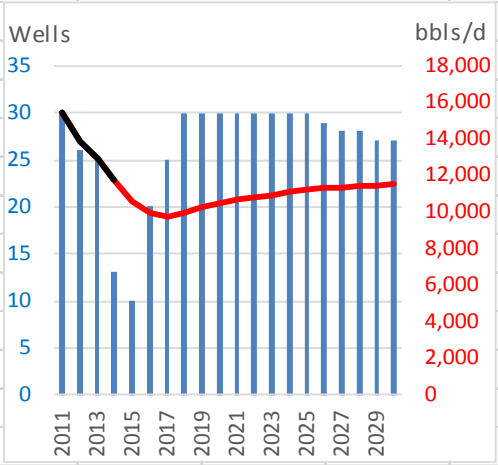
PIA01-9999-OIL
Area Oil Pools



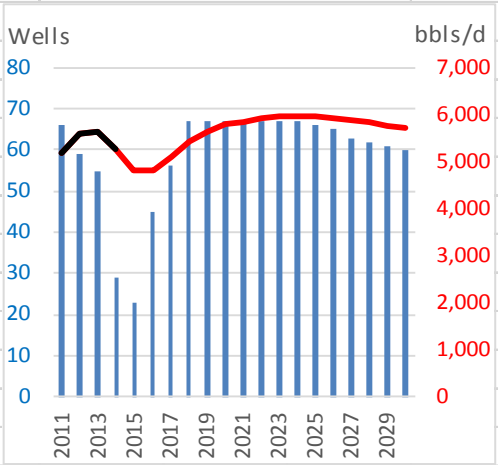
PIA02-9999-OIL
Area Oil Pools



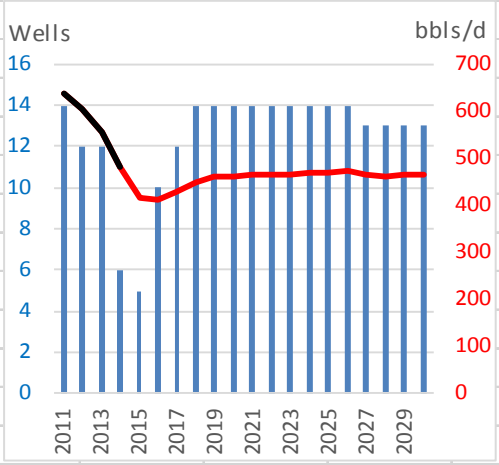
PIA03-9999-OIL
Area Oil Pools



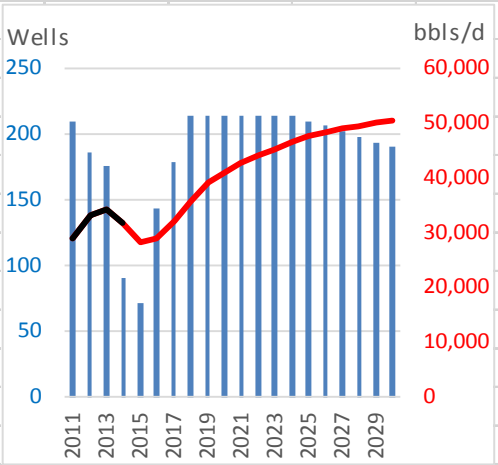
PIA04-9999-OIL
Area Oil Pools

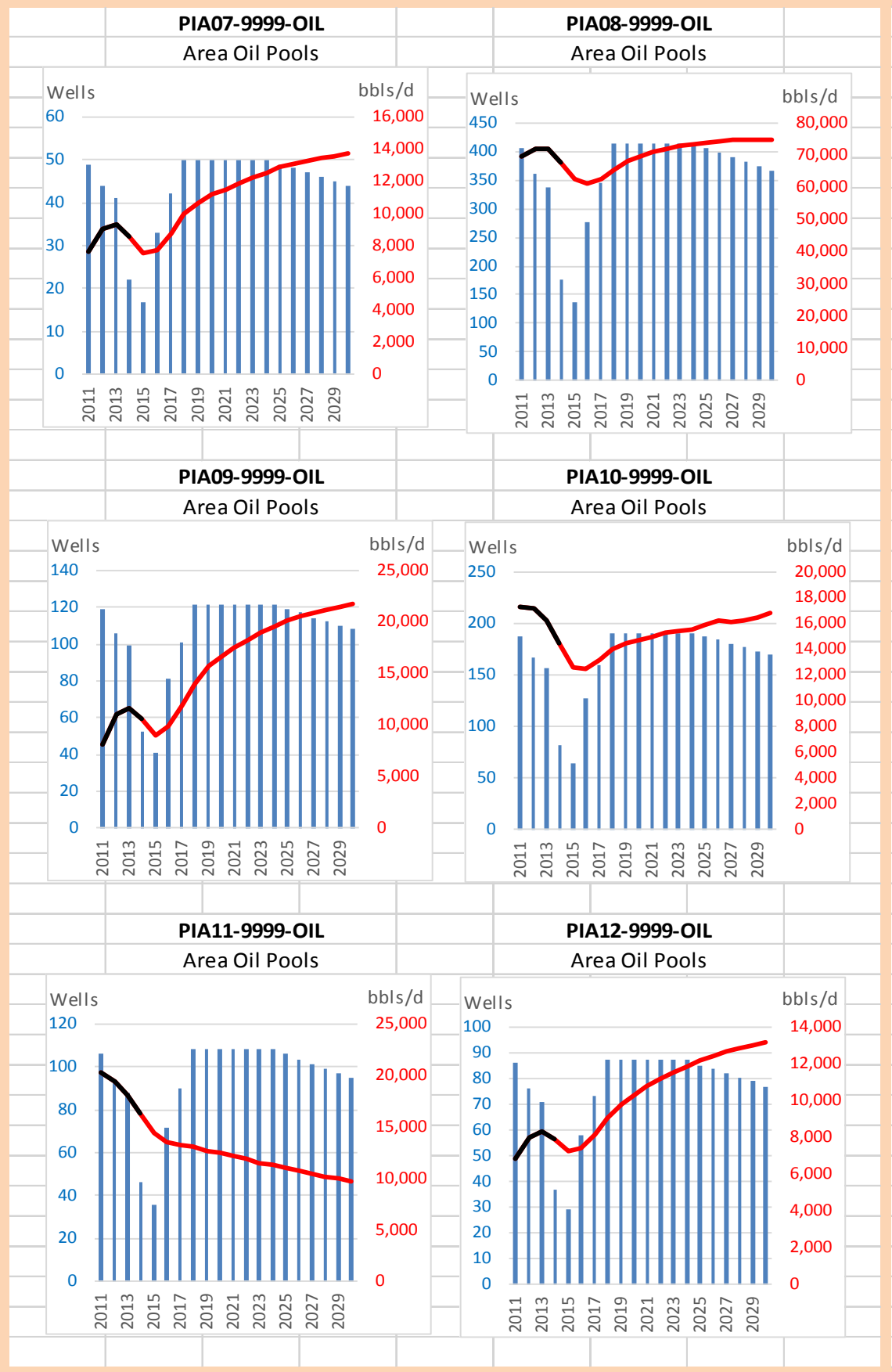


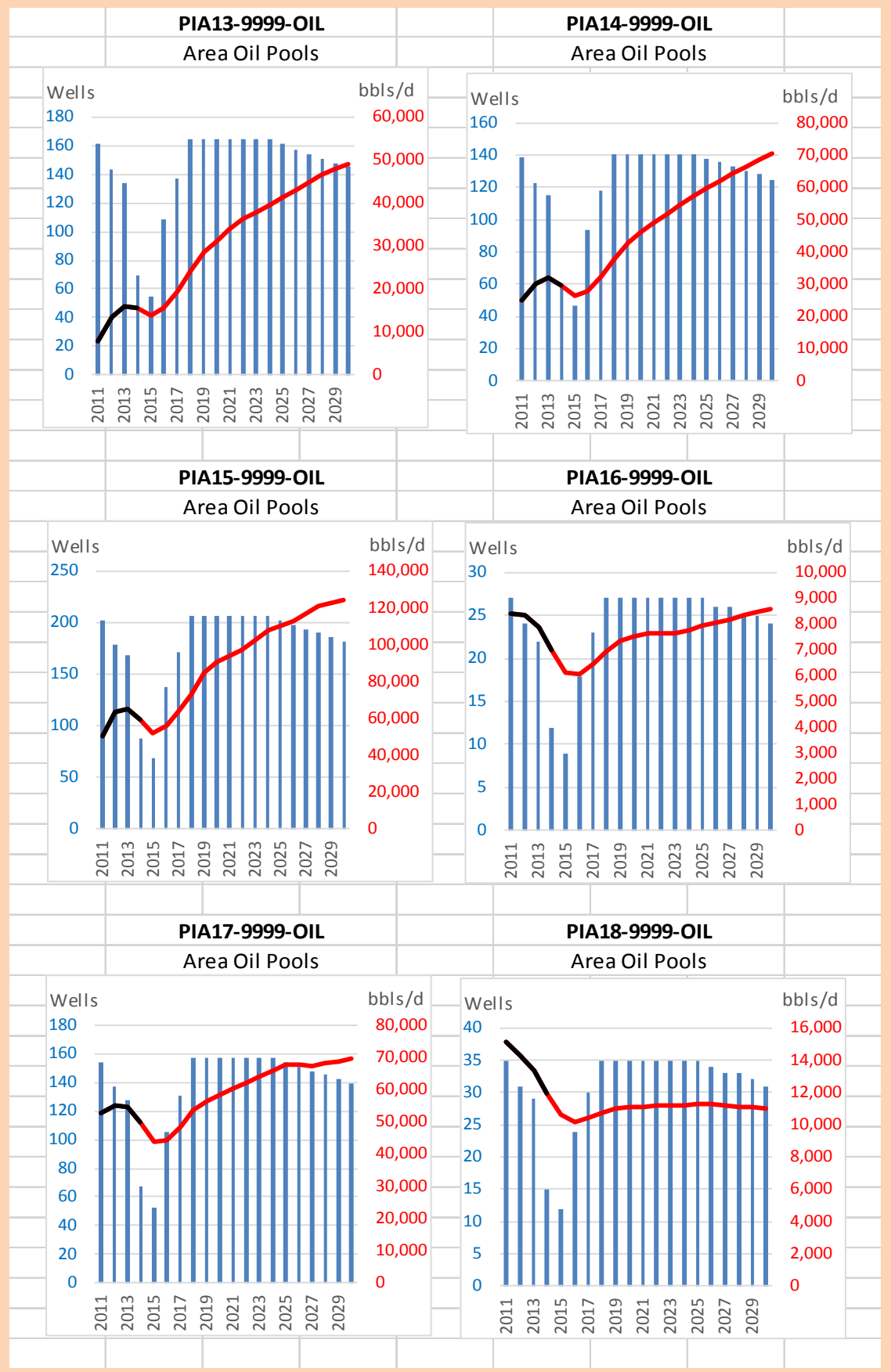
PIA05-9999-OIL
Area Oil Pools



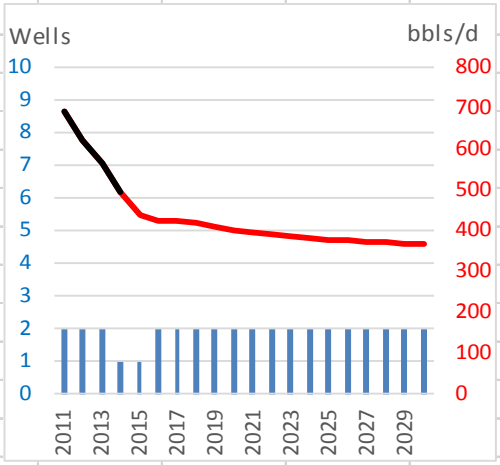
PIA06-9999-OIL
Area Oil Pools



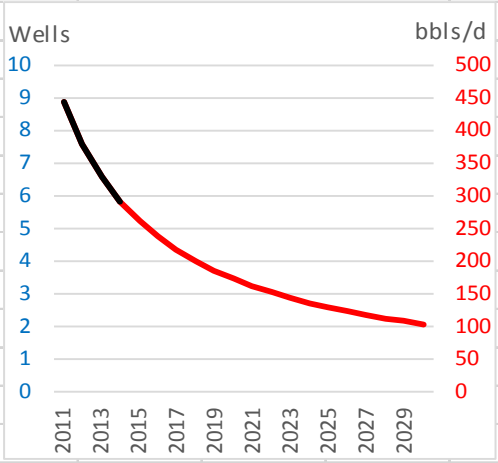

PIA07-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA08-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA09-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA10-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA11-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA12-9999-OIL
Area Oil Pools
Wells
bbls/d


PIA13-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA14-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA15-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA16-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA17-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA18-9999-OIL
Area Oil Pools
Wells
bbls/d

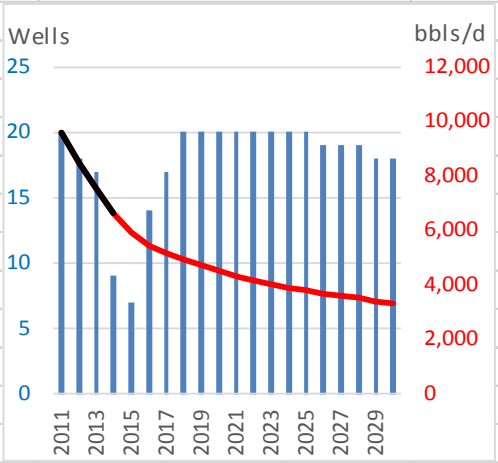
PIA20-9999-OIL
Area Oil Pools



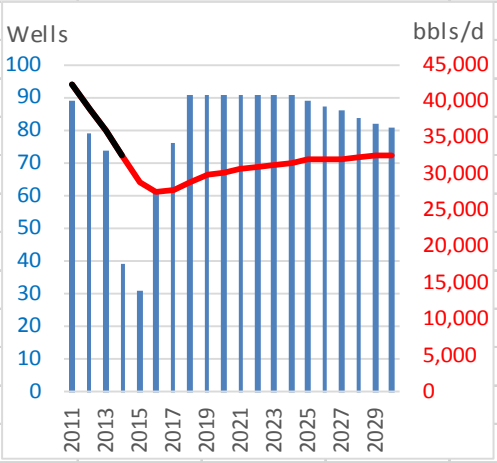
PIA21-9999-OIL
Area Oil Pools



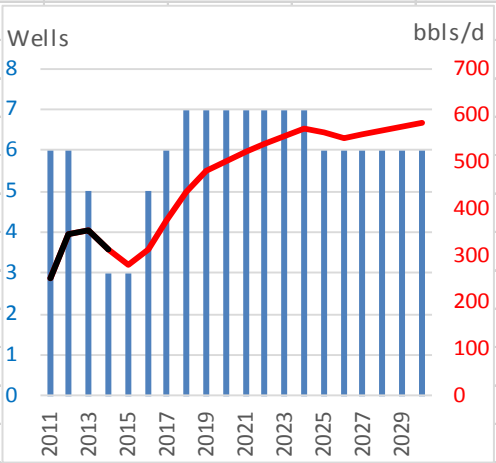
PIA22-9999-OIL
Area Oil Pools



PIA23-9999-OIL
Area Oil Pools

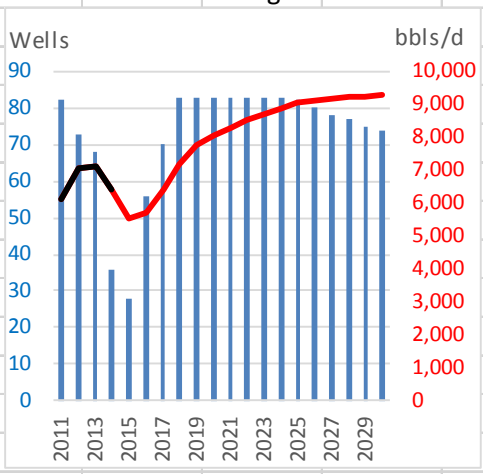


PIA04-6425-OIL
Upper Pekisko



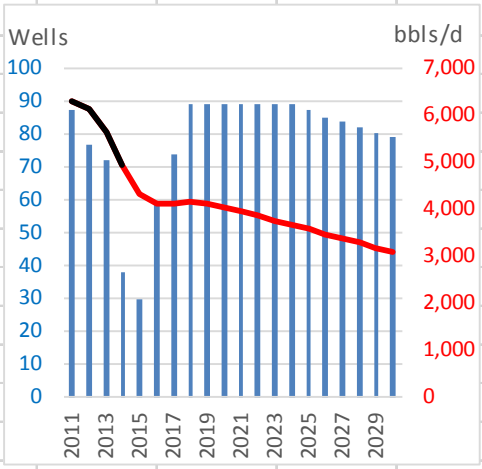
PIA08-2140-OIL

Viking Oil



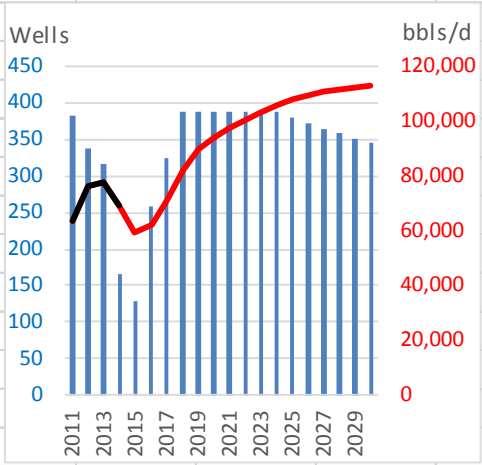
PIA08-2940-OIL

Lloydminister



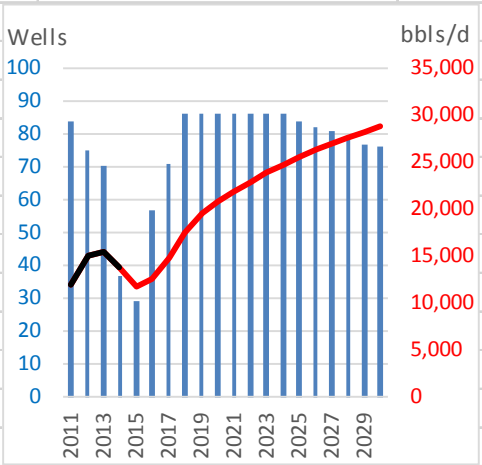
PIA10-1740-OIL

Cardium Oil



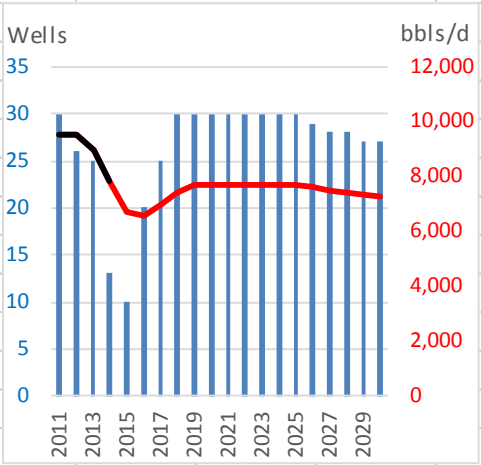
PIA15-5290-OIL

Lower Montney



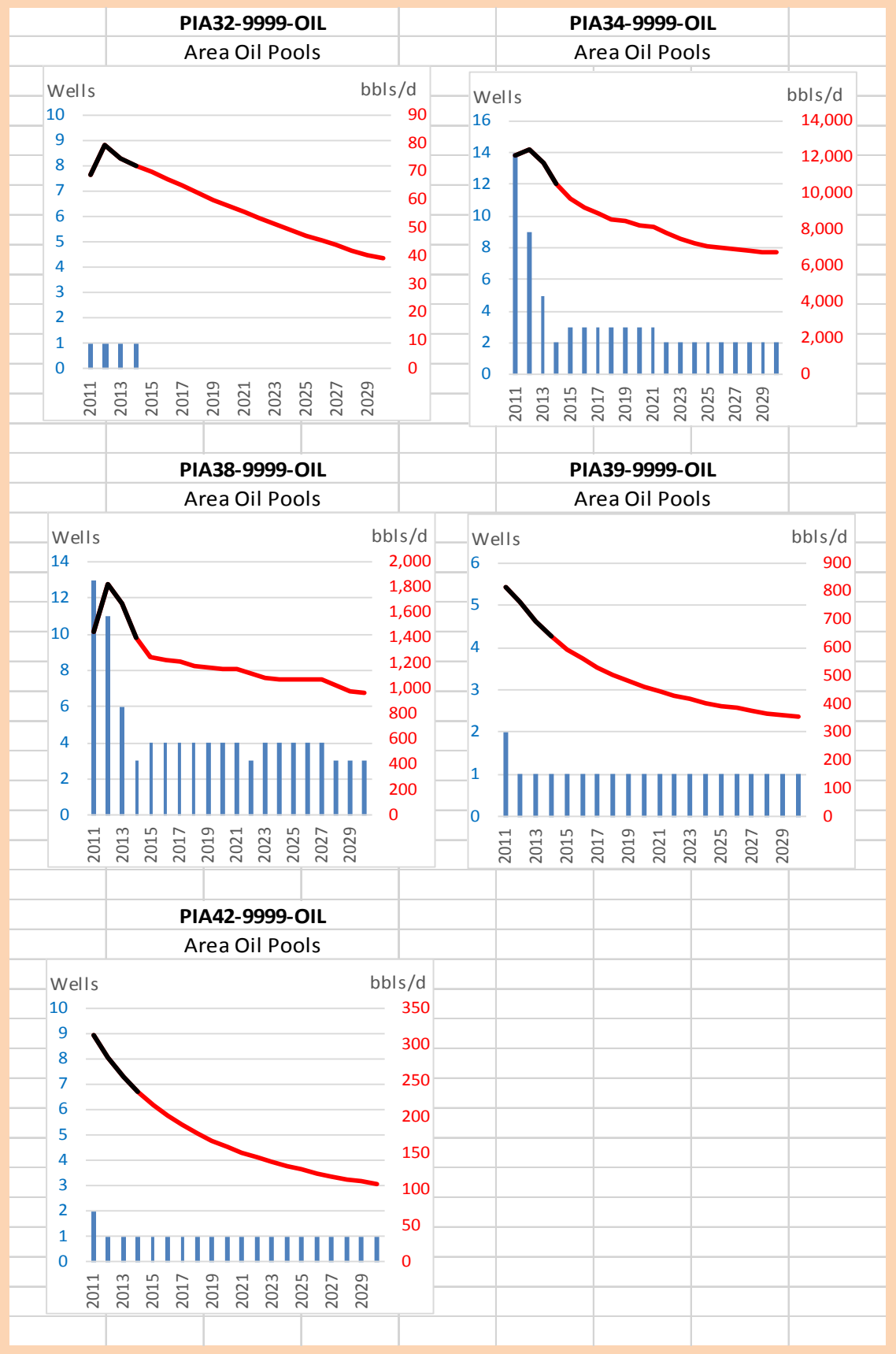
PIA17-7580-OIL

Slave Point



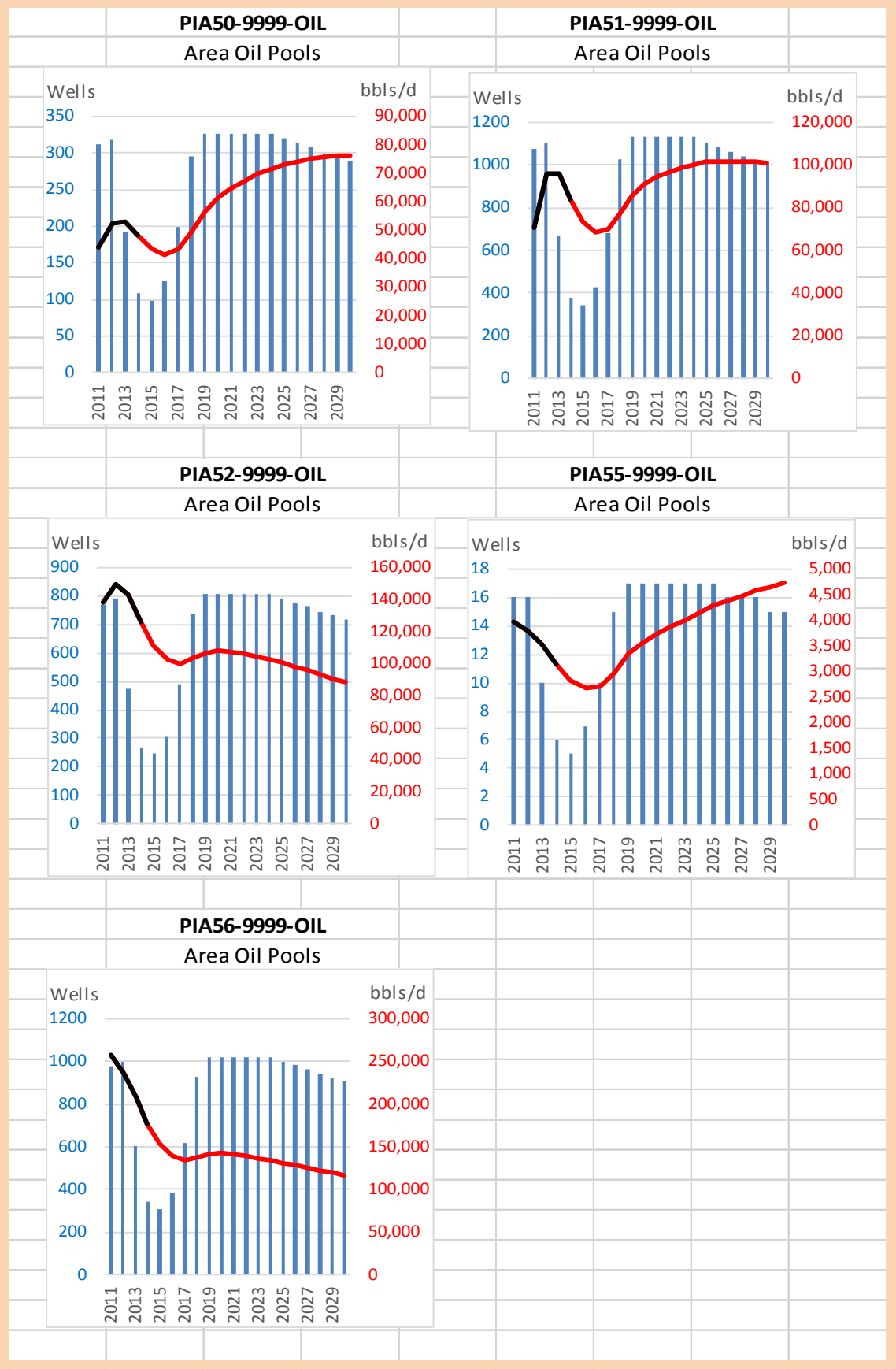
Appendix C: Selected PIA Charts for British Columbia

The following chart is an example PIA Area and PIA-Formation forecast for British Columbia indicating, on an annual basis, the number of new well connections along with the total average day production.


PIA32-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA34-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA38-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA39-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA42-9999-OIL
Area Oil Pools
Wells
bbls/d

Appendix D: Selected PIA Charts for Saskatchewan

The following chart is an example PIA Area and PIA-Formation forecast for Saskatchewan indicating, on an annual basis, the number of new well connections along with the total average day production.


PIA50-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA51-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA52-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA55-9999-OIL
Area Oil Pools
Wells
bbls/d
PIA56-9999-OIL
Area Oil Pools
Wells
bbls/d