

Up or Down? Trends in the Oil & Gas Sector's Contribution to the Canadian Economy

EXECUTIVE SUMMARY

- This Policy Brief highlights how different Statistics Canada measures of the contribution of the oil and gas sector to the national economy during the 2000s yield opposing trends.
- The oil and gas sector's share of national GDP is estimated to have declined from 2002-2008 when using inflation-adjusted real GDP data, but to have increased when instead using nominal GDP data.
- Several potential explanations for the apparent contradiction are advanced, though the opaqueness of Statistics Canada's approach to calculating real sector-level GDP data makes it difficult to ascertain whether the observed divergence in real and nominal GDP contribution trends is genuine or else a statistical artifact.
- Improvements in the transparency and public availability of statistical data on the oil and gas industry, and the creation of a dedicated agency like the Energy Information Administration in the U.S., would benefit public and private sector decision-making in one of Canada's largest economic sectors.

INTRODUCTION

The analysis of industry economic trends over time is an essential input into private and public sector planning. An accurate understanding of historic changes within and among industry sectors enables decision-makers to create better forecasts of the future, facilitating capital investment, employment and expenditure decisions. Reliable economic data is especially crucial for planning in industries such as oil and gas that are characterized by large, sunk capital investments that last for several decades.

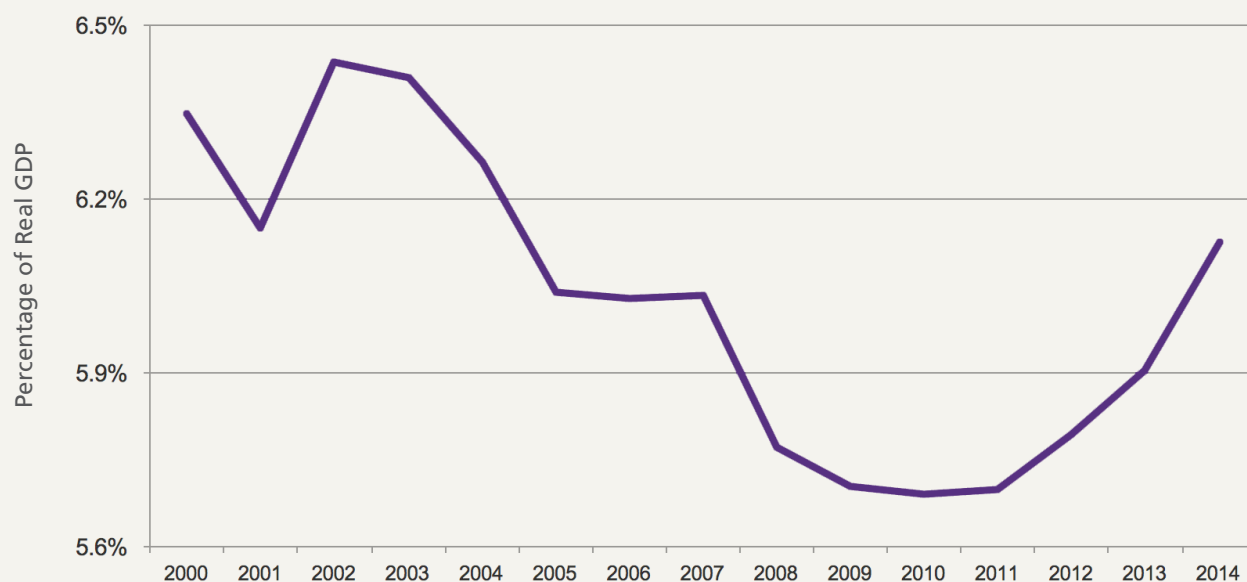
This Policy Brief describes different government estimates of the economic contribution of the oil and gas sector to the Canadian economy. Despite the commonly acknowledged importance of the sector, publicly available statistical data on its historic growth trend provide inconsistent and apparently conflicting patterns. After attempting to reconcile several data series on oil and gas sector contributions to gross domestic product (GDP), the Policy Brief argues for improvements in the transparency and accessibility of key statistical data on the oil and gas sector.

CALCULATING THE OIL AND GAS SECTOR'S SHARE OF GROSS DOMESTIC PRODUCT: REAL AND NOMINAL MEASURES

The standard approach to measuring the importance of a sector to a nation's economy is to assess the sector's share of GDP. While there is debate about the relative merits of using real or nominal GDP data in calculating sector shares, both approaches should yield consistent measures that permit analysis of how sector shares change over time. Shares based on real GDP data correct for sector-specific inflation, so a sector experiencing above average cost inflation would account for a smaller share of the economy when calculated with real GDP data than with nominal GDP data. Statistics Canada provides real GDP data in national accounts datasets that can be analyzed across multiple industry, geographic, and time dimensions. Industry sectors are classified according to the North American Industry Classification System (NAICS), which includes "Oil and Gas Extraction" (NAICS 211),¹ and real GDP by sector is available from CANSIM Table 379-0031. Dividing the sector-specific data by total Canadian GDP from this table yields a sector's economic contribution as a percentage share of real GDP.

A surprising feature of this data series is that it depicts a downward trend in the percentage share of real GDP attributable to the oil and gas sector from 2002 to 2009 (Figure 1). It accounted for a maximum of 6.4% of

Figure 1: Oil and Gas Sector's Share of Real GDP (Percentage Share)



Source: Statistics Canada. Table 379-0031 - Gross Domestic Product at Basic Prices, by North American Industry Classification System, chained 2007 dollars.

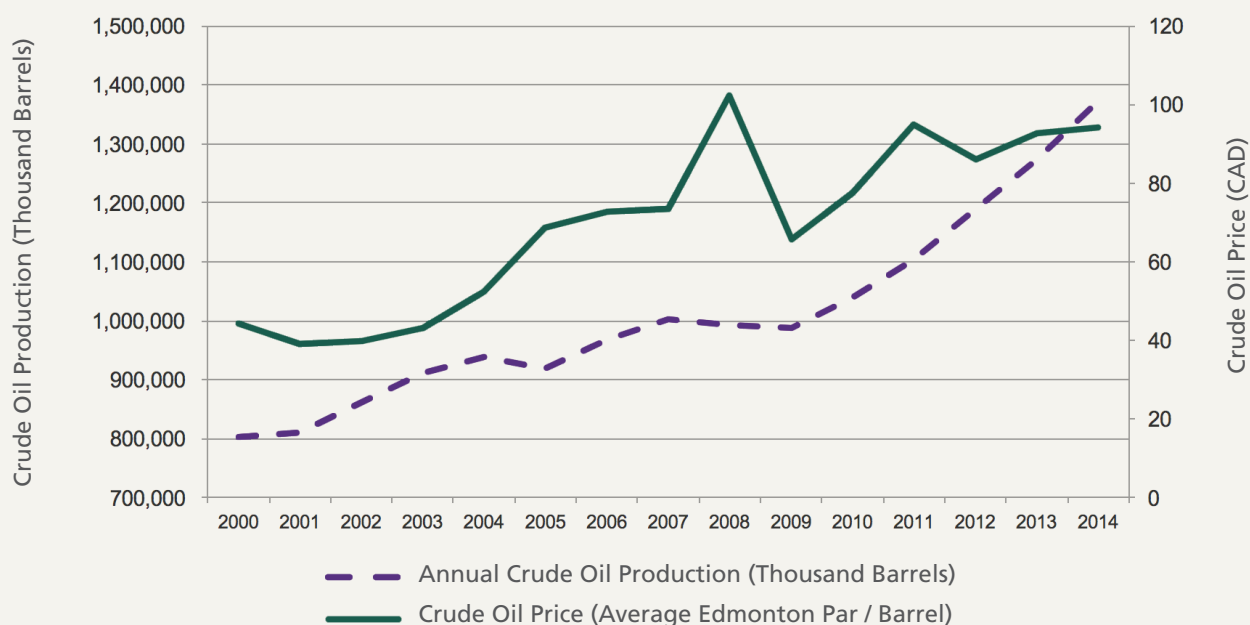
¹ The NAICS classification system defines this as "establishments primarily engaged in operating oil and gas field properties. Such activities may include exploration for crude petroleum and natural gas; drilling, completing and equipping wells; operating separators, emulsion breakers, desilting equipment and field gathering lines for crude petroleum; and all other activities in the preparation of oil and gas up to the point of shipment from the producing property. This subsector includes the production of oil, the mining and extraction of oil from oil shale and oil sands, and the production of gas and hydrocarbon liquids, through gasification, liquefaction and pyrolysis of coal at the mine site."

real GDP in 2002, falling to a low of 5.7% from 2009 to 2011. Yet this trend appears to be inconsistent with key industry metrics that suggest an industry growing more rapidly than the overall economy, as well as with conventional wisdom about the sector's outperformance at the time. Crude oil extraction and production volumes increased by 15% between 2002 and 2009, and by 71% from 2000 to 2014 (Figure 2). Crude oil prices experienced significant increases, from a low of approximately \$40 per barrel in 2002 to over \$100 in 2008. Similar dramatic upward trends are observed in capital expenditure, employment, and oil and gas sector exports, all of which approximately tripled from 2000 to 2014.²

The record of natural gas extraction over the 2002 to 2009 period is quite similar to crude oil, with the impact of U.S. shale gas development becoming especially marked only after 2008. Natural gas prices followed a similar upward trend to those of crude oil over much of the period, increasing rapidly from a low of \$2.57 USD/million BTU in 2002 to \$7.99 in 2008. Natural gas production was essentially flat from 2002 to 2006, then gradually decreased by approximately 18% to 2014 (Figure 3).

The growth dynamics of the combined oil and gas sector thus suggest an expanding share of the overall Canadian economy from 2002 to 2008, as opposed to a shrinking share as indicated by the real GDP data.

Figure 2: Canadian Oil Production and Prices



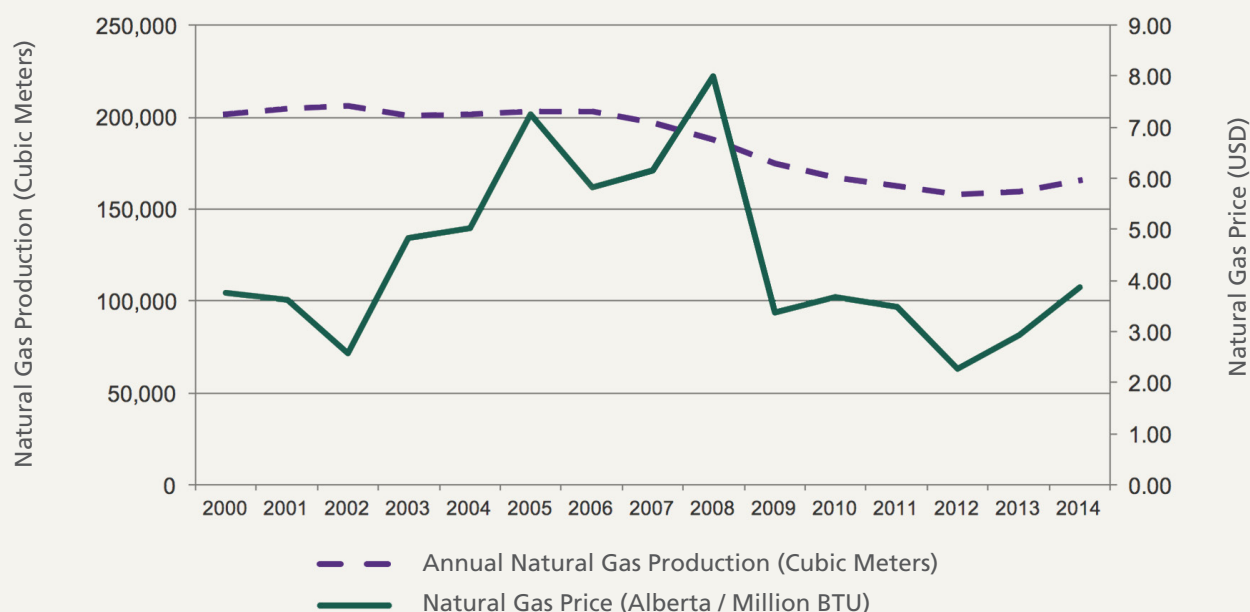
Source: Statistics Canada. 126-0001 – Supply and Disposition of Crude Oil and Equivalent, monthly; Natural Resources Canada: Fuel Focus, Crude Oil Prices.

² Statistics Canada Table 029-0007 Capital and repair expenditures, industry sector 21, mining and oil and gas extraction; Statistics Canada Table 383-0031 - Labour statistics consistent with the System of National Accounts, by province and territory, job category and North American Industry Classification System; Industry Canada Trade Data Online.

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Figure 3: Canadian Natural Gas Production and Prices



Source: Statistics Canada. 131-0001 – Supply and Disposition of Natural Gas, monthly; BP Statistical Review of World Energy 2015.

A very different trend emerges, however, when using an alternative measure of the oil and gas sector's contribution that is based on nominal GDP data. Comparable nominal GDP data at the industry sector level is not made publicly available by Statistics Canada.³ A rough proxy may be calculated instead using two separate Statistics Canada data series: nominal oil and gas sector GDP, which is included in the 'Industry Productivity Databases' (CANSIM Table 383-0032); and total national nominal GDP data from CANSIM Table 380-0064. Unfortunately, these two series are not directly comparable to each other or to the real GDP data series. The latter captures all expenditure activity in the country in current dollars. The former is from an alternative data source also in current dollars, but it only captures the economic activity of private industry, leaving out a sizable share of the Canadian economy from government activities. As a result, the share of economic activity from oil and gas extraction in nominal terms cannot be constructed from Table 383-0032 alone. However, dividing one by the other should give an approximation of the oil and gas sector's share of nominal GDP over several years up until 2012, the last year of available data.

In contrast to the trend based on real GDP data, the trend in the oil and gas sector's share of nominal GDP is upwards over an extended period of time (Figure 4). In 2002 the sector accounted for 3.4% of nominal GDP, rising to a peak of 7.2% in 2008 before the global financial crisis and decline in oil prices. This upward trend is consistent with observational data that depicts a strongly performing oil and gas sector during this period.

³ This is in contrast to its U.S. equivalent, the Bureau of Economic Analysis, which provides real and nominal industry level GDP data, industry nominal GDP share calculations, the related price indices, and details on the calculations used to obtain these data on its website.

Figure 4: Oil and Gas Sector's Share of Nominal GDP (Percentage Share)



Source: Table 380-0064 – Gross Domestic Product, Expenditure-Based; Table 383-0032 - Multifactor productivity, gross output, value-added, capital, labour and intermediate inputs at a detailed industry level, by North American Industry Classification System

RECONCILING REAL AND NOMINAL GDP MEASURES: GDP DEFLATORS

The contrast in the real and estimated nominal GDP time trends of the oil and gas sector's contribution to the Canadian economy presents a puzzle. Did the sector shrink in comparison to the broader economy after 2002 as the real GDP share data suggests—contrary to conventional wisdom—or did it increase as the nominal GDP share data suggests?

One potential explanation that could reconcile the upward versus downward trends is in the relative inflation rates of the oil and gas sector and of the overall economy. If inflation was significantly greater for the oil and gas sector than that experienced in the economy as a whole, it is theoretically possible that the sector's share of real GDP (which strips out the impact of inflation) could be decreasing while the share of nominal GDP is at the same time increasing.

This explanation could be easily tested by examining the underlying data and GDP deflation methodology that Statistics Canada uses to construct the real sector GDP data (as in CANSIM Table 379-0031). Unfortunately Statistics Canada does not make sector GDP deflators publicly available, unlike the U.S. Bureau of Economic Analysis.⁴ It is not clear why details of the sector's deflation methodology, such as Statistics Canada's estimation of value-added in the base year (2007), require confidentiality, but the end result is an inability for researchers to create an accurate time series of the oil and gas sector's contribution to nominal GDP that is directly comparable to the real GDP data.

⁴ Industry specific value added price indices are provided along with real and nominal GDP data in the BEA's GDP by Industry Accounts. See http://www.bea.gov/industry/gdpbyind_data.htm.

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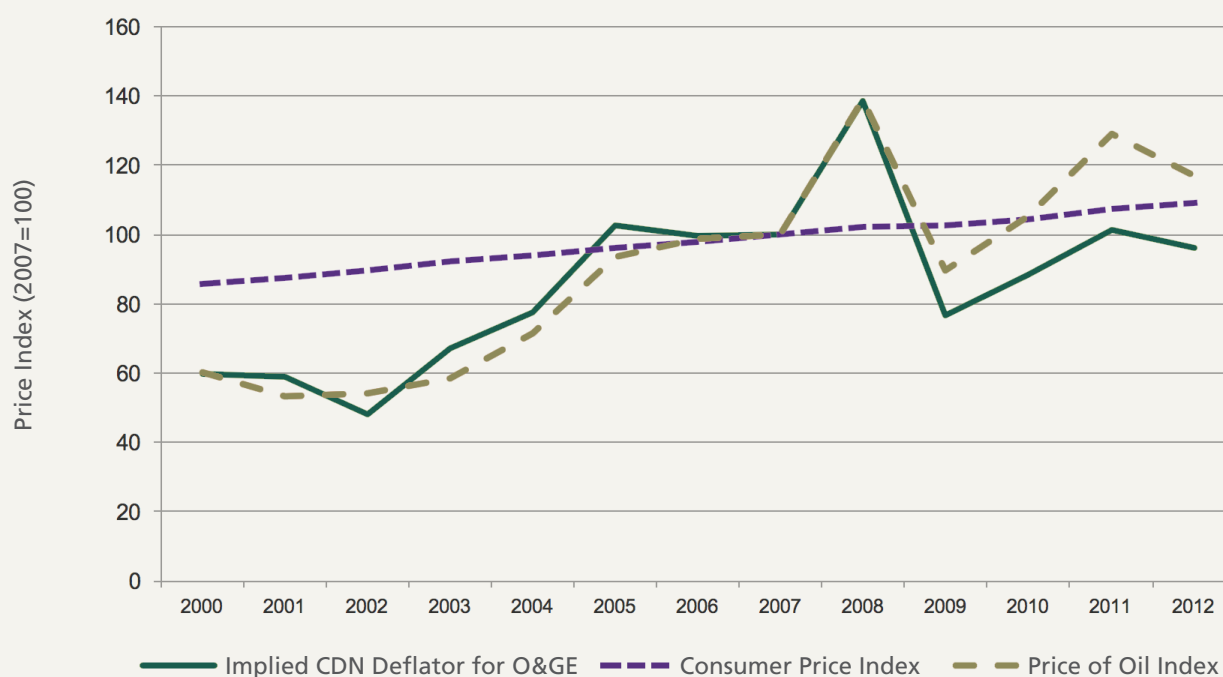
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It is possible for researchers to deduce, albeit imperfectly, the implicit sector deflators used by Statistics Canada by taking the ratio of the nominal GDP data in the Industry Productivity Databases (CANSIM Table 383-0032) to the real GDP data (in CANSIM Table 379-0031) since the numbers are similar in 2007, which is the base year for the real GDP series.

Figure 5 shows the estimated annual GDP deflator for the oil and gas sector from 2000 to 2012. Based on this analysis, it appears that Statistics Canada has ascribed a significantly greater level of inflation to the oil and gas sector than to the overall economy as represented by the consumer price index. The overall economy-wide price level increased by approximately 14% between 2002 and 2008, while that for oil and gas was estimated to have increased by 189%. Interestingly, the estimated oil and gas deflator data correlates almost perfectly with changes in the global price of oil, which increased by 156% over this period.

It is possible that inflationary pressures in northern Alberta's oil and gas sector were sufficiently excessive that they more than offset significant nominal GDP growth, leading to a shrinking share of real GDP between 2002 and 2009.⁵

Figure 5: GDP Deflators for the Oil and Gas Sector and National Economy



Source: Authors' calculations using Table 379-0031 and Table 383-0032; Statistics Canada - 326-0021 Consumer Price Index, 2011 basket.

⁵ Another possible explanation for the observed trend arises from changes in the composition of production in the oil and gas extraction sector. Statistics Canada suggested to the authors that the observed divergence in real and nominal GDP share trends may be attributed to different growth rates during the 2000s of the oil sector and of the gas sector, which are combined together in the single NAICS 211 Oil and Gas Extraction category. The Industry Account Division at Statistics Canada identified three data sources (CANSIM Tables 381-0009, 381-0022, 381-0033) which, when used together, can approximate the separate outputs of oil and gas, and be used to coarsely proxy for each sector's contribution to the economy. These data demonstrate the shifting split between oil and gas output from a 50:50 equal contribution in 2000 to a 80:20 oil-gas split in 2011. Applying these allocations to the sector-wide measures would lead to an upward trend for oil's share of economic output and a corresponding decline for gas extraction. However, without additional information that is not publicly available, it is not possible to determine if these differential growth rates explain the divergence in the real and nominal GDP trends for the combined oil and gas sector without making significant, unverifiable assumptions.

Another possibility, however, is that the oil and gas sector GDP deflators constructed and used by Statistics Canada overstate the true level of sector inflation, resulting in estimates of real oil and gas sector GDP that are too low—in which case the downward real GDP share trend is a consequence of Statistics Canada’s sector-specific economic data collection methods and data transformation assumptions. Statistics Canada’s technical documentation specifically references problems in applying its deflation method to energy products, stating that “as early as the 1970’s, the economy witnessed several periods of volatility when changes in the prices and quantities of energy products were so large that the use of fixed weighted measures could no longer provide good approximations for **real growth over an extended period of time**” (emphasis added). More generally, “If soaring output or accelerating quality changes in some industries are combined with rapidly falling prices, the contribution of these industries to total GDP will be unduly magnified....”⁶ Given the significant volatility exhibited by oil and gas prices and production volumes since 2000, it is possible that Statistics Canada’s method of sector GDP deflation understates real GDP, which would make the observed divergence in reported real and nominal GDP data a statistical artifact.

In sum, the lack of transparency about sector GDP deflation data and methods leaves researchers unable to reconcile apparently conflicting time trends in the contribution of the oil and gas sector to the Canadian economy. There are multiple explanations that are consistent with the reported data. Making sector GDP deflators publicly available, and explaining the methods used in their construction, would enable researchers to determine the true reason for the apparent divergence in real and nominal GDP share trends.

POLICY IMPLICATIONS

Effective policy-making in government and in the private sector relies on the availability of accurate statistical data, including on the economic growth trajectories of specific industries. In the absence of high quality data, decision-makers must make assumptions and estimates, which may prove inaccurate, leading to mistaken resource allocations. The importance of accurate, reliable, publicly available economic data increases with the magnitude of a sector’s contribution to the economy. This Policy Brief highlights ambiguities in government statistical data on the economic growth record of one of Canada’s largest industry sectors, oil and gas extraction. As a consequence of not making publicly available industry GDP deflator data and methods, real GDP data is open to misinterpretation. It remains a matter of speculation whether the oil and gas sector was an engine of superior economic growth during the 2000s or whether it underperformed the broader economy. For provincial and federal governments, whose budget forecasts and planning depend on oil and gas sector economic performance, uncertainty about future growth trajectories in the sector is particularly challenging. In addition, Statistics Canada is the primary data source for a range of government agencies such as Natural Resources Canada and Industry Canada, which rely on Statistics Canada data for their own analyses and policy making.

Given the importance of the energy sector to the Canadian economy, the federal government should make it a priority to improve the scope and availability of detailed statistical data on the sector. Highlighting this issue of data integrity and transparency comes at a time when the federal government is pursuing a renewed commitment

⁶ Statistics Canada appears to use the ‘double deflation’ method of calculating sector GDP deflators but this has been shown to be problematic when relative prices or technology are changing, or price indices are not regularly rebased. See Statistics Canada Catalogue no. 15-547-XIE, 2002, “Gross Domestic Product by Industry: Sources and Methods”, p.31.

to openness. Prime Minister Trudeau's mandate letter to the Minister of Innovation, Science and Economic Development calls for an improvement to the quality of publicly available data and for Statistics Canada to develop an "Open Data initiative that would consider big data and make more of the data paid for by Canadians available to the public." Such reforms are urgently needed.

U.S. government statistical agencies such as the Bureau of Economic Analysis (BEA) and the Energy Information Administration (EIA) provide models of what can be achieved with sufficient funding and organizational leadership. The BEA provides detailed, comprehensive, internet-accessible economic data, permitting an analysis of the U.S. oil and gas sector's contribution to economic growth in minutes. The EIA, an agency of the Department of Energy, collects and provides an abundance of independent data and reports on the U.S. and global energy sectors. To put the creation of a comparable agency in perspective, the budget for the EIA in 2013 was approximately \$116 million (USD) out of a total federal budget of \$3.5 trillion (i.e., 0.0003%). Oil and gas extraction accounted for approximately 1.7% of GDP in the United States in 2013, and the entire energy sector less than 5%. While Canada's federal budget is smaller at \$289 billion in 2015, Canada's overall energy sector accounted for an estimated 13% of GDP in 2013.⁷

Creating a Canadian statistical agency dedicated to the energy sector, like the EIA, would ultimately help improve the sector's performance through planning and policy development that is based on reliable, high quality statistical data.

ABOUT THE IVEY ENERGY POLICY AND MANAGEMENT CENTRE

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⁷ This figure includes includes oil and gas extraction, support activities for oil and gas extraction, natural gas distribution, petroleum refineries, pipeline transportation, electricity generation and distribution, and industries that supply goods and services to the energy industry (e.g. equipment manufacturing, construction, financial services). See Natural Resources Canada, Energy Market Factbook 2014-2015, p.4.