A CARDUS DISCUSSION PAPER

SIGNS OF THE TIMES

Canada's New Industrial Revolution

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EXECUTIVE SUMMARY

Canada is in the midst of a new industrial revolution which is changing the face of our economy. Resources—long lamented as the means by which Canadians served other, more developed countries—have instead held Canada steady through a global economic crisis and maintained an industrial core.

While many have focused on and some have lamented the development of Canadian resources, behind the scenes the development of a new, productive, industrial centre has emerged. The hundreds of billions of dollars of investment in hydrocarbon extraction, production, and refining capacity fueled by massive global demand—often from the very countries to which traditional manufacturing has fled—have led to a resurgence of industrial activity in this country. That resurgence has been led not only by the resources the world demands, but by an energetic construction sector which builds the means to extract, refine, and transport those resources to global markets.

Far from being mere hewers of wood and drawers of water, Canadians have seen resource development and related construction enliven Canada's economy and prop up tax revenues, employment, and a wide range of ancillary sectors.

While many are aware that these trends are true in the largest resource development in Canada—Alberta's oil sands—what often goes overlooked is that this industrial revolution is benefiting every region in the country. With potential multi-billion dollar resource developments present in the extraction and transmission of natural gas from northeastern B.C., the extraction of conventional oil from the Bakken fields straddling Saskatchewan's border with the US, the mining of Ontario's mineral resources in "the ring of fire," the development of hydroelectric power in Labrador, and the potential extraction of gas hydrates along Canada's eastern and northeastern coastlines, resources and construction are emerging as key drivers of our country's economy. In short, the industrial revolution currently taking place in Alberta's oilsands is not just Alberta's industrial revolution, but the largest piece of a pan-Canadian industrial revolution. A revolution which, like its earlier counterparts, provides both tremendous challenges and opportunities.

TABLE OF CONTENTS

Canada's industrialization effectively began around the mid-19th century, and it was initially driven by an international demand for natural resource commodities. However, as the second industrial revolution kicked into high gear in the early 20th century, Canada's industrialization accelerated with its entry into automotive manufacturing centred in southwestern Ontario and southern Michigan.

While many Canadians might think of automobiles, machinery, or equipment when they think of industrial production, Canada's industrial production has always been tied to resources, and especially forestry. Whether it is British Columbia's logs, lumber, and manufactured wood products or Quebec and Labrador's newsprint mills that supplied the US daily newspapers, such production was powered by the development of hydroelectric generation.

As demand for cheaper energy drove global oil exploration, the discovery of oil in Alberta drove its industrialization following World War II. The development of Alberta's petroleum industry clearly signaled its entrance into the first ranks of the industrialized world. Petroleum production is full-scale, industrial production.

The industrial production of oil and gas, framed by innovative public policy and capital infrastructure investment, transformed Alberta's public finances and economy from the bankrupt province it was during the Great Depression into an economic powerhouse with a public treasury to match.

Alberta's prosperity was the result of three components. The first component was Alberta's natural resource endowment of hydrocarbons: oil, gas, thermal coal, and bitumen. The second component is the degree to which private capital investment flowed to the development of Alberta's petroleum industry. However, what made this second component possible was the third component: Alberta's public policy and public capital infrastructure investment framework. Initially put in place by the Government of Alberta led by Premier Ernest Manning from 1943 to 1968,[1] Alberta's public policy and public capital infrastructure investment framework positioned the province to compete very effectively for the private capital investment needed to create and to grow the petroleum industry.

Next-Generation Industrial Revolutions

The rise of digital technology and computerization has been dubbed "the digital revolution" since computer automation has been the next large step in industrial manufacturing and production. However, as with the rise of digitization and information technologies, the introduction of nano-technology, biotech, and quantum-based systems in the industrial sectors may indicate yet another "next-generation" industrial revolution. We may be witnessing how the development of Internet infrastructure and the linking of mass networks of personal computers to create cheap super-computing capacity has laid the groundwork for a "big data," analytics revolution.

Technological innovation has always held significant implications for industrial production. Since the early 1990s, Japan has leveraged technology in order to shift from traditional, second industrial revolution production, to high-technology, very high value-added, knowledge-intensive manufacturing.[2] The present Government of Germany has taken note of these revolutions and is attempting what they are calling "Industry 4.0" with a view to realizing an industrialization shift similar to that in Japan.

1. See Brian Brennan, *The Good Steward: The Ernest C. Manning Story*. Markham, Ont.: Fitzhenry & Whiteside, 2008.
2. Cf. Exhibit 5 in Charles Roxburgh, et al., "Trading myths: Addressing misconceptions about trade, jobs, and competitiveness." *McKinsey Global Institute* (May 2012):11.

The rise of the digital and computing sector in the U.S., however, was accompanied by the deindustrialization of US regions formerly devoted to steel production and automobile manufacturing through the 1970s, 1980s, and 1990s. This deindustrialization was a consequence of the movement of manufacturing in certain industries to Japan initially, but later to Taiwan and Korea and, more recently, to Mexico and China.

Of course, the US has not been alone in its deindustrialization of key sectors. The European Union, too, has shifted industrial capacity and production offshore in key sectors. In a bid to meet Kyoto Accord commitments, many EU countries adopted a three-pronged approach: the development of "cap and trade," the search for alternative fuel sources, such as ultra-low sulfur diesel, for the EU automobile and trucking fleet, and the shifting of greenhouse gas (GHG) emissions from certain kinds of industrial production to other, off-shore jurisdictions. And yet, despite exemptions of certain vulnerable industrial sectors from carbon taxes and cap and trade quota shortfalls EU governments have failed to stem the rate of job loss in industrial production (Figure 1).

FIGURE 1: GOODS PRODUCING JOBS IN THE EUROPEAN UNION AND NORTH AMERICA

Total Goods Producing Jobs*	**1991**	**1995**	**1997**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**91 - 08**
United Kingdom	7,414	5,788	5,786	5,344	5,155	5,007	4,758	4,457	4,471	4,413	4,489	4,306	-41.9%
Germany	14,011	10,730	10,065	9,972	9,972	9,829	9,553	9,383	9,338	9,432	9,695	9,843	-29.7%
Sweden	1,069	926	909	894	872	837	812	802	772	772	794	789	-26.2%
Denmark	705	654	631	617	593	564	543	539	538	529	534	521	-26.1%
United States	26,324	26,224	26,500	25,365			20,895	20,423	20,250	20,456	20,326	20,116	-23.6%
France	6,110						5,219	5,082	4,995	4,980	4,884	4,732	-22.5%
Finland	715	626	616	635	632	619	589	576	577	579	579	574	-19.7%
Norway	484	456	461	416	411	410	393	376	375	384	385	398	-17.2%
Canada	3,293	2,741	2,840	3,012	2,956	3,014	3,020	3,038	3,983	2,992	2,931	2,860	-13.2%
Belgium	906	912	905	887	860	844	824	840	854	843	849	855	-5.7%

*Goods Producing Jobs include: agriculture, fishing, hunting, forestry, mining, oil and gas extraction, manufacturing, electricity production transmission and distribution, water and sewer system operations.

SOURCE: *Aldyen Donnelly, WDA Consulting, Inc.*

As seen in the table above, beginning with 1991 (a year after the first "Kyoto year" of GHG reductions) through to 2008's economic downturn, Europe's GHG reductions were realized largely due to deindustrialization and the flight of manufacturing capacity to lower-wage, less regulated jurisdictions. While deindustrialization in the United States has matched the median levels from EU countries, in the same period, Canada's deindustrialization was on the low end, at a little more than half the rate of US deindustrialization. Much Canadian deindustrialization is represented in the manufacturing sectors of central Canada, the collapse of newsprint demand and production (mainly from Quebec), and the temporary reduction in demand relative wood products for US housing construction, produced in BC as well as Alberta, Saskatchewan, Ontario, Quebec, and New Brunswick.

Yet, in the face of this decline, demand for Alberta oil was unabated throughout the economic downturn of 2008 and 2009. While the value of oil exports from Alberta diminished, the total volume of oil shipped increased. Since the economic downturn Canada's recovery has been driven primarily by two industrial and export trade sectors: hydrocarbon production and manufacturing of machinery and equipment. I will suggest that these two are connected in important ways.

Canada's New Industrial Revolution

Europe's GHG reductions were realized largely due to deindustrialization and the flight of manufacturing capacity to lower-wage, less regulated jurisdictions.

With the passage of Part 3, "Responsible Resource Development," in Bill C-38, one of the budget implementation acts for 2012, the current Government of Canada has demonstrated its commitment to encouraging the construction of infrastructure related to resource extraction and their transport to new and existing markets. This commitment includes the potential in Ontario's "ring of fire," hydroelectric power development in Labrador at "Lower Churchill," uranium and potash in Saskatchewan as well as the Bakken conventional oil fields, various mining prospects in the territories and northern B.C., and hydrocarbon extraction and transport in Saskatchewan, B.C., and Alberta.

As argued in "Clean Energy Superpower or Canadian Energy Strategy?"[3] it is crucial that Canadian policy decision makers create a regulatory climate that:

1. Allows construction of hydrocarbon energy infrastructure to go forward responsibly and expeditiously without duplication of processes;

2. Makes construction of this infrastructure possible, while hydrocarbon pricing remains cost effective; and;

3. Makes it possible for Canadian producers and suppliers to build capacity in order to access, to create, and to secure expanded and new markets before others capture market share.

"Clean Energy Superpower or Canadian Energy Strategy?" pointed out that industrial construction related to development of hydrocarbon energy capacity alone runs prospectively to hundreds of billions of dollars before one barrel of oil or one cubic foot of natural gas is extracted. And this industrial construction requires a great many levels of personnel and expertise, suggesting that it will be a major driver not only for production, but for employment. Construction related to extraction, upgrading, refining, and transport capacity requires highly skilled contractors, trades people, engineers, petrochemical scientists, project managers, management professionals, et al. This is to say nothing of the jobs created from supplying machinery, equipment, steel products and more.

While both the European Union and the United States have experienced significant amounts of deindustrialization,[4] Canada continues to expand its industrial capacity apace. While manufacturing capacity has reduced somewhat in the automobile industry, capacity has been maintained for machinery and equipment and has greatly expanded in regards to hydrocarbon extraction, upgrading, refining, and transport.

The hundreds of billions of dollars of investment in construction for hydrocarbon extraction, production, and refining capacity represent Canada's new industrial revolution. In short, we argue that the signs of the

3. Russ Kuykendall, "Clean Energy Superpower or Canadian Energy Strategy?" *Cardus Policy in Public* (6 Sept 2012). Found at: http://www.cardus.ca/policy/archives/3488/, January 2013.
4. In respect of the United States, there are signs of reversal as some US manufacturers – notably Caterpillar – move back their manufacturing capacity from off-shore, in order to realize cost effectiveness related primarily to quality control of manufactured products and, to a lesser extent, from reduced transportation costs.

times suggest that Canada's new industrial revolution is an industrial infrastructure construction revolution with its highest concentration in hydrocarbon extraction in the oil sands. [5] Moreover, industrial construction to expand production infrastructure and extractive capacity in the oil sands serves as a case study of Canada's new industrial revolution that could be extended and expanded for resource development elsewhere. This new industrial revolution could extend to, among others, the extraction and transmission of natural gas from northeastern B.C., the extraction of conventional oil from the Bakken fields straddling Saskatchewan's border with the US, the mining of Ontario's mineral resources in "the ring of fire," the development of hydroelectric power in Labrador, and the potential extraction of gas hydrates along Canada's eastern and northeastern coastlines. In short, the industrial revolution currently taking place in Alberta's oilsands is not just Alberta's industrial revolution, but the largest piece of a *pan-Canadian industrial revolution.*

5. Although industrial construction of utilities infrastructure and of mining and quarrying infrastructure excluding oil and gas extraction is considerable, both are dwarfed by industrial construction of oil and gas extraction infrastructure (see Appendix 'B'). For that reason, we focus our argument for a new industrial revolution based on industrial construction centred in the oil sands as a case study.

In May, 2013, Canadian building permits representing approximately $7.3 billion of construction activity were issued for all forms of construction, including single and multiple dwelling, commercial and institutional, and industrial. In June, 2013, this activity represented more than 1.3 million jobs.[6]

The Government of Canada's Budget 2013 extended its long-term commitment to sustained investment in Canada's infrastructure by budgeting $70 billion for infrastructure construction over ten years. Included in this $70 billion was $10 billion to improve federal buildings and other infrastructure assets, $7 billion for construction on First Nations land, and $47 billion for the federal Building Canada program.

But while considerable, these allocations are not indicative of the largest prospects on the construction horizon. Over the next several years, some hundreds of billions of investment dollars are anticipated for the construction of hydrocarbon extraction, production, refining, and transportation capacity centred in, but not limited to, Alberta. Development of the extraction of mineral resources in Ontario's "ring of fire" and the development of other major resource projects could see construction investment running into the trillions of dollars.

But, for the purpose of developing a test case, our focus here is on construction related to hydrocarbons, particularly in the oil sands, and the new industrial revolution this construction represents. The arguments in this test case can be carried over into, among others, northeastern BC gas production, the Bakken fields production, hydroelectric development at Lower Churchill, development in the "ring of fire," and the potential of gas hydrates extraction.

The hundreds of billions of dollars of investment in construction for resource extraction, production, and refining capacity represent Canada's new industrial revolution.

In the following, we look at various signs of the times relative to what we are calling "Canada's new industrial revolution." This includes capital investment in hydrocarbon-related construction, both in "hard" and "soft" assets. We look at all kinds of job creation stemming from this construction and attempt to estimate its impacts on economic growth in Canada. Following these more macro-economic considerations, we point out the regional economic benefits affecting almost every part of Canada. We attempt to account for the benefits to public treasuries as tax revenues drawn from this construction activity help fund various public policy objectives and reduce the draw on other sources of tax revenue. Finally, although resource extraction is sometimes characterized as an unskilled activity, we note that it requires a highly skilled, and highly educated, workforce. In sum, we want to answer the question: What are the signs of the times in regards to Canada's industrial infrastructure construction revolution?

6. Canadian Construction Association. Found at: http://www.cca-acc.com/en/information/industry-statistics, July 2013.

There are two broad categories of capital investment related to infrastructure construction. There is the capital investment in infrastructure projects aimed at the extraction and transportation of the resource, and the capital investments made by those working with project owners to enhance their ability to take on these projects successfully: for instance, the investments that construction contractors make in their own businesses. As the latter comes as a result of the former, we will focus on capital investment in infrastructure projects.

Capital investment in infrastructure projects can be broken down into two further categories: A) construction and engineering, and B) machinery and equipment. We will look at both categories in relation to oil and gas extraction.

If we look at oil and gas extraction infrastructure investments from 2002 through 2011, the accumulated capital asset base increased from a total of $235.2 billion in 2002 to $616.6 billion in 2011.[7] This represents an increase or an accumulated investment of $381.4 billion in 2011 over 2002, or a compound annual growth rate of 11.3%. From 2010 to 2011 alone, the increase was 5.8%.

Of this increase, $32.6 billion (8.5%) of the total increase was invested in machinery and equipment, representing a compound annual growth rate of 11.7% from 2002 to 2011. Construction activity accounted for an investment of $348.8 billion (91.5%) of the total increase in the accumulated capital asset base (Figure 2).

FIGURE 2: CAPITAL INVESTMENT IN OIL & GAS EXTRACTION INFRASTRUCTURE

(Accumulated Capital Investment by Type of Asset, 2002-2011)

Type of Asset	Value in $ billions*		Increase 2002 to 2011 in $ billions	CAGR** 2002-2011	% Change 2010-2011	% of Total, 2002-2011
	2002	2011				
Machinery & Equipment	19.1	51.7	32.6	11.7%	-0.5	8.5
Construction	216.1	564.9	348.8	11.3%	6.4	91.5
TOTAL	235.2	616.6	381.4	11.3%	5.8	100

*Year-End Gross Capital Stock (not depreciated) **Compound Annual Growth Rate

SOURCE: Statistics Canada (Industry Canada), Fixed Capital Flows and Stocks, 2002-2011.

To situate these figures within a national context, the investments in oil and gas extraction infrastructure represent approximately 3% of Canada's gross domestic product (GDP) for the years from 2003 to 2011.[8] But this data collection does not get at the scope of project development and construction related to petroleum.[9]

While the above ("% Change 2010-2011") suggests a slow-down of investment in 2010 to 2011 as compared to the overall compound annual growth rate for the whole period of 2002 to 2011, this should be put in perspective. The economic downturn of 2008 and 2009 saw several projects put on hold given the uncertainty around credit flows, among other factors. The slow-down of investment seems to indicate that a certain amount of time

7. No adjustment for inflation nor for depreciation of assets.
8. Statistics Canada's expenditure-based calculation of Canada's GDP for the years 2003 through 2011, inclusive, is cumulatively $13.148 trillion.
9. Accumulated capital investment from 2002 to 2011 in mining and quarrying (excluding oil and gas) amounts to $38.9 billion for a compound annual growth rate of 6.5%. Of this, machinery and equipment represent $8.4 billion and construction accounts for $30.5 billion of the increase. From 2010 to 2011, however, there was an increase of 11.7% (Statistics Canada, Fixed Capital Flows and Stocks, 2002 to 2011).

is required to recover momentum. This time is necessary to put in place the supply chains of machinery and equipment, contractors, and workers for the projects, as well as renewing any approvals, as necessary. [10]

In Alberta alone, petroleum projects of all kinds account for $151.5 billion.[11] These include projects around petrochemicals, oil and gas, oil sands, and pipelines, which account for approximately 75% of all Alberta's major projects). Oil sands and pipeline construction alone account for $140 billion and, individually, they dwarf investment in chemicals and petrochemicals and other oil and gas developments (Figure 3).

FIGURE 3: MAJOR PETROLEUM PROJECTS IN ALBERTA

Sector	No. of Projects	Total Value of Projects ($ million)
Chemicals & Petrochemicals	3	1,580.0
Oil and Gas	14	10,465.0
Oil Sands	66	115,211.6
Pipelines	44	24,245.7
TOTAL	137	151,502.3

SOURCE: *Inventory of Major Projects (IMAP)*, Alberta Enterprise and Advanced Education, 2013.

Investments, reinvestments, and revenues from the operation of new oil sands projects are estimated at $2,077 billion (2010 $CDN) for 2010 to 2035. Of this, some $253 billion constitutes the "strategic initial capital for construction and $1,824 billion for operation, maintenance, and sustaining capital."[12]

This projection is based on presently known oil sands development. Currently, proven reserves, given market pricing for crude from the oil sands and available technology for extracting it, stand at approximately 170 billion barrels. Pricing and technology could see "proven reserves" rise nearer the potential reserves of some 315 billion barrels in the oil sands. In total, there are estimated to be 1.7 trillion to 2.5 trillion barrels of bitumen in place in the Alberta oil sands (Figure 4).[13]

FIGURE 4: ALBERTA'S HYDROCARBON RESERVES, RESOURCES AND PRODUCTION, 2011

	Crude bitumen		Crude oil		Natural gas		Raw coal	
	million m^3	billion barrels	million m^3	billion barrels	billion m^3	trillion ft^3	billion tonnes	billion tons
Initial in-place resources	293,125	1,844	11,357	71.5	9,504	337	94	103
Initial established reserves	28,092	177	2,863	18.0	5,384	191	35	38
Cumulative production	1294	8.1	2,617	16.5	4,377	155	1.49	1.64
Remaining established reserves	26,798	169	246	1.5	1,007	35.7	33	37
Annual production	101	0.637	28.4	0.179	111	3.9	0.030	0.033
Ultimate potential (recoverable)	50,000	315	3,130	19.7	6,276	223	620	683

SOURCE: Michael Teare, et al., "Alberta's Energy Reserves 2011 and Supply/Demand Outlook 2012-2021." Energy Resources Conservation Board (ST98-2012):2.

10. Cf. the Canadian Energy Research Institute's "Realistic Scenario" for oil sands development. In Afshin Honarvar, et al. *Economic Impacts of New Oil Sands Projects in Alberta (2010-2035)*, Study No. 124, CERI (May 2011). Found at: http://www.api.org/aboutoilgas/oilsands/upload/economic_impacts_of_new_oil_sands_projects_alberta.pdf, July 2013.
11. *Inventory of Major Projects*, Alberta Enterprise and Advanced Education, Government of Alberta, 2013. This includes projects whose status is "announced," "completed," "nearing completion," "on hold," "proposed," or "under construction." Included in the overall inventory are three non-oil sands mining projects valued in the aggregate at $650 million.
12. Honarvar, et al., x.
13. "Facts about Alberta's oil sands and its industry," *Oil Sands Discovery Centre*, Government of Alberta, n.d.

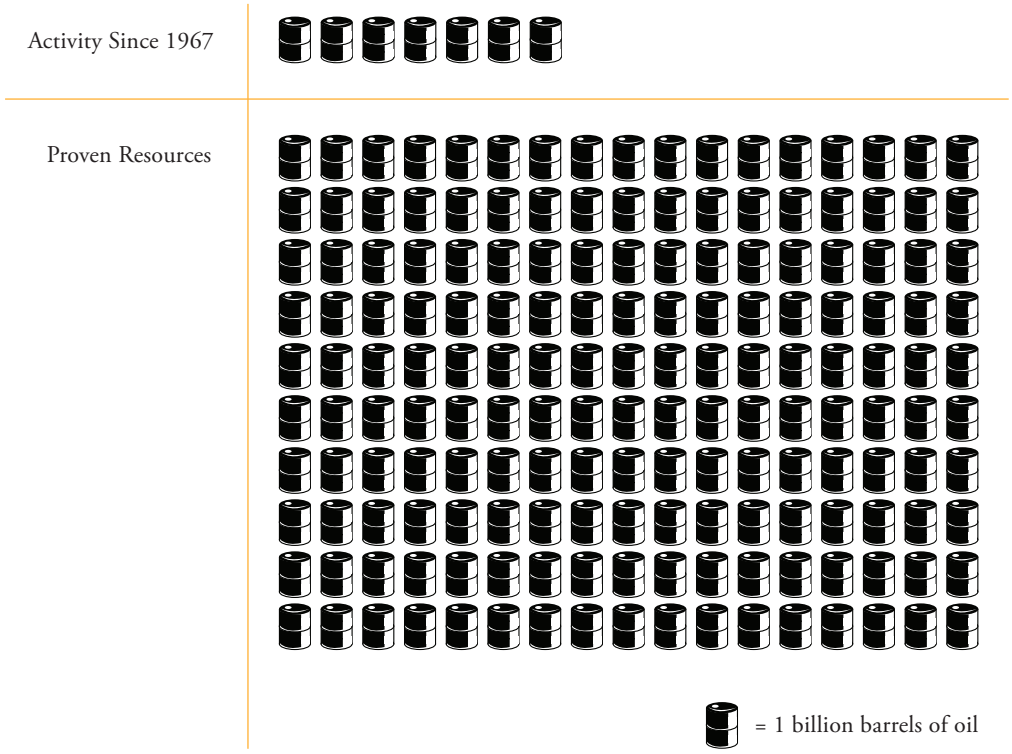
To put estimated reserves in perspective, present production from the oil sands sits at about 1.9 million barrels per day (bpd). Alberta's Energy Resources Conservation Board projects production to double to 3.8 million bpd by 2022.[14] To date, upstream producers have recovered around 7 billion barrels since Suncor began oil sands mining operations in 1967 when it was known as Great Canadian Oil Sands (Figure 5).

Further, assuming the various major pipeline projects, including Keystone XL, the Enbridge Northern Gateway, the Kinder Morgan TransMountain expansion, and the TransCanada mainline reversal and extension, all go forward, this would increase pipeline capacity to approximately 5.5 million bpd. This assumes that the expanded capacity would all be devoted to oil transmission, but says nothing of the increased demand for transmission from the Bakken fields and from "tight" (shale) oil production.

To fully leverage just the currently proven reserves will require investment and the construction of both production and transmission capacity on a mammoth scale.

To fully leverage just the currently proven reserves of 170 billion barrels will require investment and the construction of both production and transmission capacity on a mammoth scale. This will require industrial construction on a scale unmatched by Canada's largest, historical, industrial construction mega-projects taken together. Development on this scale represents nothing less than a new, Canadian industrial revolution.

FIGURE 5: OIL PRODUCTION SINCE 1967 COMPARED WITH PROVEN RESERVES



14 "Alberta oil sands production likely to double by 2022." *Reuters* (8 May 13).

By looking at the employment changes across Canadian industries during the economic downturn of 2008 and 2009 and the recovery that followed, we can track a shift in employment and job generation from manufacturing to construction and natural resources, especially oil and gas. A key, labour market analysis by Statistics Canada offers four categories:

1. "pro-cyclical industries" that declined during the economic downturn and grew during the recovery,
2. "counter-cyclical industries" that grew through the downturn and declined during the recovery,
3. industries that declined both during the downturn and recovery, and
4. industries that grew during both the downturn and recovery.

Industrial construction and manufacturing fit the "pro-cyclical" category and the third category respectively. Through the downturn and recovery, only manufacturing failed to recover employment losses during the wider economic recovery. Manufacturing declined during the downturn by -11% and recovered only slightly by +3%. However, employment levels in all forms of construction and in natural resources not only recovered but exceeded losses during the downturn. This appears to support the idea that Canada is seeing a shift to industrial construction, especially in oil and gas extraction development.[15]

Employment in industrial construction for development of oil and gas extraction, upgrading and refining, and transmission is diverse or, more precisely, takes a multiplicity of forms and organization. It includes the traditional craft unions, non-traditional union organization, contractors with non-unionized employees, as well individuals who contract their skills, services, and expertise as independent sub-contractors. Especially among the latter, many do not pay wages or salaries to themselves nor do they maintain payrolls. They have work forces composed of owners and their family members, as well as contracted workers and part-time employees.

As such, it is difficult for Canada's leading data collectors to bring precision to the numbers of jobs tied into industrial construction in oil and gas development. However, what can be precisely tracked is the number of "employer establishments" that do work in construction for oil and gas extraction. Across Canada, some 4,623 establishments are implicated, including 1,779 employers, or 38.6% of the total, and 2,834 "non-employers" or "indeterminate," or 61.4% of the total.[16] Although more than three quarters of those engaged in the construction and engineering dimension of development (see above) are in Alberta, every province and territory can lay claim to establishments involved in oil and gas extraction development (Figure 6).[17]

15 Sharanjit Uppal and Sébastien LaRochelle-Côté, "Employment Changes across industries during the downturn and recovery." *Insights on Canadian Society* (April 2013):2-4. Statistics Canada, Ottawa.

16. Statistics Canada, Canadian Business Patterns Database, December 2011.

17. This does not include machinery and equipment employed and installed in development that is sourced from other regions of Canada nor from the United States.

FIGURE 6: EMPLOYMENT ESTABLISHMENTS IN OIL & GAS EXTRACTION

(Type, Province/Territory & Region, December 2011)

Province, Territory or Region	Employers	Non-Employers / Indeterminate	Total	% of Canada
British Columbia	116	228	344	7.5
Alberta	1415	2165	3580	77.6
Saskatchewan	143	236	379	8.2
Manitoba	22	40	62	1.3
Ontario	50	118	168	3.6
Quebec	11	15	26	0.6
New Brunswick	6	1	7	0.2
Nova Scotia	7	20	27	0.6
Prince Edward Island	0	1	1	0.0
Newfoundland & Labrador	7	7	14	0.3
British Columbia (Pacific)	116	228	344	7.5
Prairies	1580	2441	4021	87.2
Ontario	50	118	168	3.6
Quebec	11	15	26	0.6
Atlantic	20	29	49	1.1
Canada	1779	2834	4613	100
Percent distribution	38.6%	61.4%	100%	

SOURCE: Statistics Canada, Canadian Business Patterns Database, December 2011.

The size of these employer establishments varies widely. They range from the 1,088 "micro" establishments that employ 1 to 4 employees (61.2%) to the 17 "large" employers with 500 or more employees (1%); and from the "small" entities with 5 to 99 employees (33.5%) to the "medium" entities with 100 to 499 employees (4.4%).[18] Among small and medium-sized enterprises in the sub-sector, the average value of expenses from labour and commissions in 2010 was $123,900, or 27.7% of revenues (Figure 7).[19]

FIGURE 7: EMPLOYMENT ESTABLISHMENTS BY SIZE CATEGORY

(Type, Province/Territory & Region, December 2011)

Province, Territory or Region	Size Category (number of employees)			
	Micro 1-4	Small 5-99	Medium 100-499	Large 500+
British Columbia	84	28	3	1
Alberta	847	488	64	16
Saskatchewan	91	46	6	0
Manitoba	15	6	1	0
Ontario	36	14	0	0
Quebec	5	6	0	0
New Brunswick	3	3	0	0
Nova Scotia	3	3	1	0
Prince Edward Island	0	0	0	0
Newfoundland & Labrador	3	2	2	0
British Columbia (Pacific)	84	28	3	1
Prairies	953	540	71	16
Ontario	36	14	0	0
Quebec	5	6	0	0
Atlantic	9	8	3	0
Canada	1088	596	78	17
Percent distribution	61.2%	33.5%	4.4%	1.0%

SOURCE: Statistics Canada, Canadian Business Patterns Database, December 2011.

18. *Op. cit.*
19. Statistics Canada, special tabulation, unpublished data, Small Business Profiles. Found at: http://www.ic.gc.ca/cis-sic/cis-sic.nsf/IDE/cis-sic211bece.html#bec2, July 2013.

Not accounted in the above, however, is the scope and reach of demand from oil and gas development for machinery and equipment made mainly in Quebec and Ontario, steel production from Ontario, rolled pipe from Saskatchewan, business services from across the country, and other services. The total scope of employment in the oil and gas industry for the twenty-five years from 2010 to 2035 is estimated at 25 million person-years, or 1 million person-years (jobs), annually.[20] If we eliminate the jobs from operations—*jobs required* once projects are underway and producing—Canadian employment, including direct, indirect, and induced, by oil sands investments is projected to rise from some 75,000 jobs in 2010 to 905,000 jobs in 2035 (Figure 8).[21]

FIGURE 8: JOBS FROM INVESTMENT IN NEW OIL SANDS PROJECTS, 2010-2035
(Thousand Person Years)

Province, Territory or Region	Direct	Indirect	Induced	TOTAL
British Columbia	0.0	30.3	43.3	73.6
Alberta	707.4	466.2	418.4	1592.0
Saskatchewan	0.0	6.8	7.7	14.5
Manitoba	0.0	6.2	7.7	13.9
Ontario	0.0	60.5	79.4	140.0
Quebec	0.0	15.3	21.7	37.0
New Brunswick	0.0	0.9	1.3	2.2
Nova Scotia	0.0	0.8	1.4	2.3
Prince Edward Island	0.0	0.1	0.1	0.2
Newfoundland & Labrador	0.0	0.2	0.4	0.6
Nunavut	0.0	0.0	0.0	0.1
Northwest Territories	0.0	0.2	0.2	0.3
Yukon	0.0	0.0	0.1	0.1
British Columbia	0.0	30.3	43.3	73.6
Prairies	707.4	479.2	433.8	1620.4
Ontario	0.0	60.5	79.4	140.0
Quebec	0.0	15.3	21.7	37.0
Atlantic	0.0	2.0	3.2	5.2
North	0.0	0.2	0.3	0.5
CANADA	707.4	587.5	581.7	1,876.7

SOURCE: Table 2.7 in Afshin Honarvar, et al. *Economic Impacts of New Oil Sands Projects in Alberta (2010-2035)*, Study No. 124, CERI (May 2011):20.

Although most job creation from development (construction) is located in Alberta, as the table above indicates, the job creation *from oilsand investment alone* in other regions of Canada is considerable. This huge demand will be a major challenge for grasping not only the opportunities in the oil sands but also other resource developments across the country. Worth noting is that despite geographical distance, the benefit to central Canada—Ontario and Quebec—is second only to Alberta. Much of this can be attributed to demand for machinery and equipment made mainly in Ontario and Quebec and installed as part of the investment/construction phase of development.

As growth has slowed in automobile and other traditional manufacturing sectors, the loss of employment and new jobs has been more than compensated for by oil and gas development. Further certain segments of the manufacturing sector—particularly—the machinery and equipment sector of central Canada—has seen growth partially because of the demand from oil and gas development. As the Atlantic fishery has seen embargoes on certain kinds of fish and jobs have been lost, many Atlantic Canadians have found work in oil and gas development and some have migrated west. But many others have maintained their home bases

20. Petroleum Resources Branch, Energy Sector, Natural Resources Canada. "Canadian Crude Oil, Natural Gas and Petroleum Products: Review of 2009 & Outlook to 2030." (May 2011):5. This "includes indirect jobs such as services driven by oil and gas jobs."
21. Honarvar, et al., x.

in the Atlantic provinces or have returned later. For example, despite the collapse of the coal industry in Nova Scotia and out-migration trends, house prices in Cape Breton Island have generally risen over the past generation as skilled trades people from Cape Breton have worked in industrial construction on oil and gas development and have found themselves able to purchase and build houses for their families, at home on Cape Breton Island.[22]

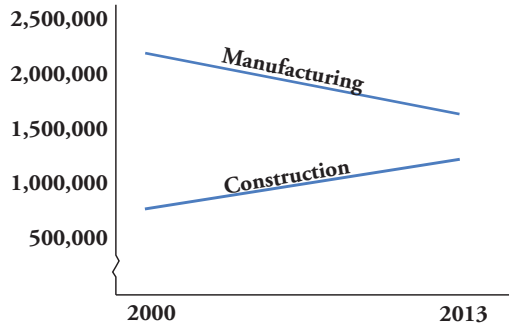
Heavy industrial jobs have moved from the automotive sector to industrial construction in oil and gas development. This has further driven labour demand in machinery and equipment manufacturing to supply this development. Employment associated with oil and gas development is projected to rise by a power of ten as ancillary and supporting merchandise and services are included. This is employment in Canada's new industrial revolution.

22. Median housing prices in Cape Breton rose from $160,222 in 2008 to $220,000 in 2012 – an increase of 37.3%. Only St. John's saw a higher increase (60.2%) in the same period (*Cape Breton Regional Municipality's Vital Signs*, Community Foundation of Nova Scotia, 2013, p. 8. Found at: http://www.vitalsignscanada.ca/files/localreports/2013_NSCape-Breton_report.pdf, December 2013).

As suggested in the preceding discussion of employment, virtually all areas of Canada are positively affected by industrial construction in oil and gas development. To a point, this is consistent with Stephen Gordon's findings regarding "the Dutch disease" that "(t)he 2002-2008 commodity price boom and exchange rate appreciation produced a manufacturing sector that paid higher wages, that provided its workers with more and better equipment and that had increased employment in R&D." Gordon further concludes that "(i)f the real measure of an industry's health is its ability to create value and not in the size of its workforce, then the net result of Dutch disease was a Canadian manufacturing sector that was healthier in 2008 than it was in 2002."[23]

We suggest that Canada's new industrial revolution in development of extractive capacity not only contributes positively on the various fronts identified by Gordon, but also tends to enhance employment and workforce participation across Canada. Indeed, the trend lines for employment of all kinds suggests that a significant part of the "slack" left by reduced employment in traditional manufacturing is significantly taken up by increased employment in construction. From July, 2000, to July, 2013, Canadian employment in manufacturing fell from a high of more than 2.3 million to slightly more than 1.7 million—a loss of approximately 600,000 jobs. But in the same period, Canadian employment in construction rose from just above 800,000 to approximately 1.3 million—a gain of approximately 500,000 jobs (Figure 9).[24]

FIGURE 9: TREND IN MANUFACTURING AND CONSTRUCTION EMPLOYMENT



The demand for machinery and equipment from other parts of Canada and installed by industrial construction in the development phase of expanding production capacity suggests that the GDP impacts in this phase tend to be spread out across the country and are less geographically concentrated where construction is underway than in the operations phase: "For 1 direct job created in Alberta, about 1 indirect job and 1 induced job will be created in the rest of Canada."[25]

Based on a "Realistic Scenario" (see above), royalties collected by Alberta from oil sands development from existing and new projects are forecast to grow from approximately $3.2 billion in 2010 to $47 billion by 2035. Cumulatively, the benefit to the Alberta treasury from royalties will be $623 billion from 2010 to 2035. Excluding royalties, the benefit to the Alberta treasury will be cumulatively $105 billion and some $444 billion will be collected by all governments—provincial, federal, and municipal—in this period from new oil sands projects. Approximately 92% of this money will be paid in Alberta. Of this, the Government of Canada will receive 68% and provincial governments will collect 32%.[26]

The benefit to the Government of Canada's treasury is projected to be $311 billion for the same period, 2010 to 2035. The provincial percentage is smallest in Alberta because of Alberta's low provincial corporate tax rate. Further, the tax benefit to Alberta is greatest from operations which follow construction. The tax benefit

23. Stephen Gordon, "The Canadian Manufacturing Sector, 2002-2008: Why is it called Dutch disease?" *The School of Public Policy (University of Calgary), SPP Research Papers*. Vol 6, Issue 26 (Sept 2013):11. Found at: http://policyschool.ucalgary.ca/?q=content/canadian-manufacturing-sector-2002-2008-why-it-called-dutch-disease, December 2013.
24. "Canadian Construction Overview," *Reed Construction Data* (September 2013):32.
25. Honarvar, et al., xii. For definitions and explanations of "direct effects/impacts" (synonymous terms), "indirect effects/impacts," "induced effects/impacts," "total economic effects/impacts," "I/O model" (input-output model), and "multiplier," please see "A Note about Economic Terms" in Honarvar, et al., xiii-xiv.
26. Honarvar, et al., 22-23.

to provincial treasuries is most widely distributed in the investment (construction) phase because inputs are sourced especially from Ontario and Quebec.[27]

The total GDP benefit to the Canadian economy from new oil sands projects from 2010 to 2035 is estimated at $2,106 billion.[28] The greatest economic impact—be it from capital investment, job creation, or royalty and tax revenue collection—goes to Alberta. But the effects, especially on the job creation and tax revenue collection sides, are considerable for Ontario and Quebec. The economic effects may be most immediately felt by workers and families in Atlantic Canada from income earned by workers in industrial construction to develop the oil sands.

These are the economic growth projections, regional benefits, and tax revenues from Canada's new industrial revolution.

27. Honarvar, et al., 25-26.
28. *Ibid*, 59.

Detractors of the oil sands – oil, gas and hydrocarbons in particular, and of the natural resources sector as a whole – have been known to allude to the Gibeonite curse suggesting that natural resources extraction relegates Canadians to be "hewers of wood and drawers of water." The decline of Canada's traditional manufacturing base is taken as a sign that Canada's industrial sector is, therefore, lagging behind an increasingly knowledge-intensive and sophisticated global economy. This suggestion, that Canada is failing to keep up with the leading knowledge-based, value-added economies of Japan in the east and Germany et al. in the European Union, could hardly be farther from the truth. As Mansell and others have argued,

> Compared to manufacturing, oil and gas activity generally has a higher capital and knowledge intensity, greater production, market/price and regulatory/policy risks and a greater requirement of high levels of ongoing investment in order to maintain production levels.[29]

Contrary to what some would have Canadians and the world believe, Canada does not export raw bitumen. Whether crude is extracted by mining or *in situ* by steam-assisted gravity drainage (SAGD), bitumen oil has been upgraded, or "value-added," by the very process of extraction.

Industrial construction of *in situ* sites, upgraders, refineries, and carbon capture and storage requires intensive knowledge, engineering, and industrial skilled trades. The manufacture and installation of required machinery and equipment is also knowledge intensive. And the professional services related to contract procurement, estimating, and project management of oil sands projects is also highly knowledge intensive. As suggested above, the capital intensity of oil and gas development, too, suggests a knowledge intensity component stemming from the financing and accounting.

Further, given the sensitivity of oil and gas development to policy changes, there is also a knowledge intensity required on the policy development side as proposals are presented to decision makers. This is true on the corporate side of the industry and on the public policy and political side. It is incumbent on decision makers to make sound choices, and on policy analysts and developers to provide good information and analysis to the decision makers.

Those who describe individuals involved in natural resource extraction as merely "hewers of wood, drawers of water" devoid of knowledge intensity, especially as compared with Canada's traditional manufacturing base, have gotten it wrong. The true situation is that oil and gas activity, including the development and construction phase, is more knowledge intensive than Canada's traditional manufacturing base. That is, the shift from Canada's traditional manufacturing base to oil and gas development represents a shift to a higher level of knowledge intensity in Canada's new industrial revolution.

29. R.L. Mansell, et al. "Size, role and performance in the oil and gas sector." SPP Research Papers. Vol. 5, Issue 23 (July 2012):1. The School of Public Policy, University of Calgary.

Developing Natural Gas in Northeastern British Columbia

While Canada's new industrial revolution may be more advanced in respect of oil sands development, it need not be limited to this particular industry alone. There are signs that Canada's new industrial revolution has spread to natural gas extraction and transmission in northeastern BC and to the conventional Bakken oil fields straddling Saskatchewan's border with the US. Furthermore, as development of hydroelectric power at Lower Churchill Falls, Labrador, proceeds, the impacts of this development on Atlantic Canada's regional economy will be comparable to those of the oil sands nationally. Also, the potential for development of Ontario's "ring of fire" could achieve impacts on a scale equal to, or surpassing, oil sands development. And while it is speculative, we will offer a glimpse of gas hydrates potential off Canada's east and northeast coasts.

Two of the largest unconventional natural gas resources in the world are found in northeastern BC and northwestern Alberta. These are the Horn River Basin of northeastern BC, which surrounds Fort Nelson, British Columbia, and the Montney Formation that straddles the BC-Alberta border between Dawson Creek, British Columbia, and Grande Prairie, Alberta.

Canada's National Energy Board (NEB) estimates the ultimate potential for unconventional shale gas in the Horn River Basin to be 78 trillion cubic feet (Tcf). As of 2011, "discovered resources" were pegged at 3 Tcf versus "undiscovered resources" of 75 Tcf. Despite the disparity between discovered and undiscovered resources, however, the NEB's analysis suggests that "(d)ue to the absence of national parks, large urban areas and large lakes in northeastern B.C., there does not appear to be any significant resource volumes that, in theory, cannot be accessed through directional drilling technology."[30]

In the Montney Formation, the potential is even larger:

> The ultimate potential for unconventional petroleum in the Montney Formation is estimated to be very large, with expected volumes of 12,719 billion barrels (449 Tcf) of marketable natural gas, 2,308 million m^3 (14,521 million barrels) of marketable NGLs (natural gas liquids), and 179 million m^3 (1,125 million barrels) of marketable oil.

The Montney Formation represents one of the world's largest marketable unconventional natural gas resources. To underscore its sheer scale, Montney's potential is "equivalent to 145 years of Canada's 2012 consumption."[31]

With the expansion of natural gas supply brought on by unconventional gas discoveries across North America and by other global fields bringing natural gas on-stream, marketability is a key challenge. To expand the marketable supply, producers will want to see increased demand for natural gas, whether from thermal electricity generation, expanded use as compressed natural gas (CNG) in transportation, increased consumer use in home heating and large appliances, or distributed power generation. Indeed, given its affordability, and cleanliness, an increase in demand is plausible, especially as major energy users move away from use of coal in electrical generation and as manufacturers seek affordable energy inputs.

30. NEB, "Ultimate Potential for Unconventional Natural Gas in Northeastern British Columbia's Horn River Basin," *Oil and Gas Reports 2011-1 – May 2011*. Found at: http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/ntrlgs/hrnrvr/hrnrvrm-eng.html, December 2013.
31. NEB, "The Ultimate Potential for Unconventional Petroleum from the Montney Formation of British Columbia and Alberta," *Energy Briefing Note, November 2013*. Found at: http://www.neb-one.gc.ca/clf-nsi/rnrgynfmtn/nrgyrprt/ntrlgs/ltmtptntlmntnyfrmtn2013/ltmtptntlmntnyfrmtn2013-eng.html, December 2013.

While Canada exports 3 Tcf per year to the United States, this is declining. The greatest potential for increasing demand for Canada's natural gas may lie offshore. When liquefied natural gas (LNG) projects were initially planned in Canada, it was with a view to bringing natural gas to Canada from off-shore, as with Canaport's LNG receiving and re-gasification terminal at Saint John, New Brunswick. By 2008, existing LNG project plans were shifted with a view to exporting Canadian natural gas to offshore customers. As of September, 2013, eleven LNG projects were proposed—all but two in British Columbia (Figure 10).

FIGURE 10: PROPOSED CANADIAN LNG PROJECTS

Facility	Sponsoring Company	Projected Capacity (Bcf/day)	Projected Start Date
Douglas Channel, BC	Haisla First Nation, LNG Partners, Golar LNG	0.09-0.18	2015
Canada LNG Kitimat, BC	Shell, Kogas, Mitsubishi, and PetroChina	1.60-3.20	2017
Kitimat LNG, BC	Chevron, Apache	0.75-1.50	2018
Prince Rupert, BC	Progress, Petronas	1.00-2.90	2015-2019
West Coast, BC	Imperial, Exxon	4.00	2015-2019
Prince Rupert, BC	BG Group	0.29	2015-2019
West Coast, BC	AltaGas, Idemitsu	1.60	2015-2019
West Coast, BC	Nexen, Inpex	TBA	2015-2019
Kitsault, BC	Kitsault Energy	TBA	2015-2019
Goldboro, NS	Pieridae Energy	0.13	2015-2019
TOTAL POTENTIAL LNG EXPORTS with all announced projects on-stream: *4.0-5.6 Tcf/year*			

SOURCE: Canadian Gas Association, *A Canadian Industry Snapshot,* September 30, 2013

As the above table indicates, two gas processing plants have been announced – near Fort Nelson and Hudson Hope – with an aggregated value of $1.01 billion. But increased natural gas production and LNG exports will also require increased pipeline capacity. At present, the NOVA Gas Transmission, a subsidiary of TransCanada, announced the North Montney Mainline project, which has a construction cost of $1.5 billion.[32] This pipeline will feed into the existing natural gas transmission line.[33] The Horn River Mainline (Komie North Section) pipeline, as announced, would move natural gas from the Horn River basin into the existing pipeline network. [34] The South Peace III Project of Spectra Energy would extend the South Peace Pipeline south of Taylor, paralleling the existing pipeline.[35]

However, the Coastal GasLink Pipeline Project, valued at $4 billion and now in the pre-application phase, would be purpose-built to transmit natural gas to the proposed Shell LNG facility (see above).[36] If all announced LNG projects come on-stream, this is but a portent of much more construction of pipelines designed to move natural gas to potential growth markets off-shore.

As with oil sands development and transmission, projects for increased natural gas pipeline capacity will put demands on the industrial construction trades, engineers, project managers, and more from the work force across Canada. In addition to the local spin-off demand for services, these projects will bring demand for rolled pipe from Saskatchewan and machinery and equipment from Ontario and Quebec. These, too, will bring benefits to public treasuries at the federal, provincial, and municipal levels of government.

32. Economic Development Division with research by Rene Corcoran, BC Ministry of Jobs, Tourism and Skills Training, *BC Major Projects Inventory* 13-03 (Sept 2013):v. Found at: http://www.jtst.gov.bc.ca/ministry/major_projects_inventory/pdfs/September_2013_MPI.pdf, December 2013.
33. TransCanada, "North Montney Fact Sheet," November 2013. Found at: http://www.transcanada.com/docs/Key_Projects/North-Montney-Fact-Sheet.pdf, December 2013.
34. *Op.cit.*, 127.
35. *Ibid.*, 129.
36. *Ibid.*, 127.

Developing the Bakken Fields of Saskatchewan

Although discovered in the 1951 and made the subject of speculations of vast quantities of oil in 1974, a 1995 field assessment conducted for the US Geological Survey estimated that the Bakken Formation could hold as much as 503 billion barrels of oil. As above, the best-case scenario for the oil sands would see 315 billion barrels of production. To give some context, Saudi Arabia's Ghawar field claims 125 billion barrels. So, this is a vast quantity of oil. The US Geological Survey estimated that 7.4 billion barrels are technically recoverable from the Bakken and Three Forks formations.[37] This estimate may be unduly conservative, since Continental Resources has publicly suggested that Bakken "will yield anywhere from 24-40 billion barrels."[38]

By May, 2013, employment of horizontal fracturing technology innovations in Bakken had propelled Saskatchewan's conventional oil production of 60,000 barrels per day (bpd) to a level rivalling Alberta's conventional oil production.[39]

Much of Bakken's crude oil production is moved by rail. Last August, CP Rail announced an investment of:

> $90 million to build a logistics hub serving its North Dakota network. The high capacity facility will serve 15 to 17 crude oil unit trains (trains of up to 104 cars that remain together until arriving at the destination. Up to 30 trains per month will be accommodated once the terminal is fully developed.[40]

CP also plans a transload facility for Estevan, which is intended for moving oil.

However, given last summer's incident with a train moving oil through Lake Mégantic, Quebec, and the very recent train derailment of a crude oil transport train near Casselton, North Dakota, political pressure to expand Bakken pipeline capacity further to handle production could increase. Enbridge's Bakken Pipeline Project, brought into service in March 2013, added 120,000 bpd of capacity to the incremental capacity increase from the Portal Link Project completed in May 2011.[41] TransCanada's $140 million Bakken Marketlink Project, expected to be in operation in 2014, will carry 100,000 bpd, connecting Saskatchewan, North Dakota and Montana to Cushing, Oklahoma.[42] In addition, TransCanada's Energy East pipeline with a capacity of up to 850,000 bpd would traverse Saskatchewan and likely feature a pipeline terminal in Saskatchewan's Bakken Formation in order to ship Bakken crude as far east as Saint John, New Brunswick.[43]

Here, again, construction of oil pipelines will increase demand for industrial construction trades and lead to the ancillary effects, as noted above.

37. "U.S. doubles oil estimate for Bakken field." CBC News (2 May '13). Found at: http://www.cbc.ca/news/business/us-doubles-oil-estimate-for-bakken-field-1.1374973, December 2013.
38. "Bakken Shale Oil Formation." Found at: http://bakkenshale.com/, December 2013.
39. "Saskatchewan Bakken Play – A Triumph of Innovation and Inspiration." *Oilfield Pulse* (19 June '13). Found at: http://www.oilfieldpulse.com/saskatchewan-bakken-play-a-triumph-of-innovation-and-inspiration/#sthash.8WvU4Hlr.dpbs, December 2013.
40. *Ibid*.
41. Cf. "Project Agreement for the Bakken Pipeline in Manitoba and Saskatchewan." Found at: http://mpmo.gc.ca/sites/mpmo.gc.ca/files/files/project-projet/pdf/bakken-eng.pdf, December 2013. Also, cf. the Government of Saskatchewan's "2013 Major Projects Inventory" listing of pipeline projects. Found at: http://economy.gov.sk.ca/2013-MPI, December 2013.
42. "Bakken Marketlink Project." Found at: http://www.transcanada.com/bakken.html, December 2013.
43. Lasia Kretzel, "Energy East Pipeline terminal could be built in Saskatchewan." *Newstalk 650* (6 Apr '13). Found at: http://www.newstalk650.com/story/energy-east-pipeline-terminal-could-be-built-saskatchewan/103983, December 2013.

Developing Ontario's "Ring of Fire"

Ontario's "ring of fire" mineral deposits of chromite, nickel, copper, zinc, and gold is found some 500 km north of Thunder Bay, Ontario, and boasts a recoverable value currently estimated at from $30 billion to $50 billion. Two companies had been pursuing development projects here: Noront Resources and Cliffs Natural Resources.

Seemingly in response to news reports of Cliffs' withdrawal (see below), Noront indicated it expected completion of its environmental assessment process by the end of 2013.[44] On January 3, 2014, Noront announced completion of a "federal-provincial environmental impact statement and environmental assessment report its Eagle's Nest Project in the Ring of Fire."[45] As well as development of the site, the project includes construction of an all-weather road to the site.

Noront estimates 780 direct jobs will be created during the construction phase and about 390 direct jobs for operations. Indirect and induced employment is estimated with a multiplier of 2.5 to 1 for the project. The economic impacts from the project are estimated at $686,250,000 during construction and at $1.215 billion during operations. Benefits to public treasuries are estimated at $207,248,000 during construction and at $366,930,000 from operations.[46]

After waiting some time for the Government of Ontario to reach agreements with nine aboriginal people groups, the US-based Cliffs Natural Resources announced an indefinite halt to its Chromite Development Project.[47] This followed earlier suspension of its participation in the environmental assessment process (June 2013), and its response (September 2013) to the Government of Ontario's allowance of mining claims to stand in the way of construction of a north-south all-weather road to its project site for which Cliffs was seeking surface right of way.[48] Cliffs' moves could serve as fair warning to future project proponents, regulators, and other stakeholders as to the thresholds beyond which some investors are unwilling to go in order to bring development on-stream.

Developing Lower Churchill in Newfoundland and Labrador

Newfoundland and Labrador's *Nalcor Energy* has proposed development of hydroelectric power on the lower Churchill River in Labrador in two states: Muskrat Falls and Gull Island. The two projects are estimated to reach a combined capacity of more than 3000 megawatts, providing 16.7 terawatt hours of electricity per annum.

44. "Noront Reaffirms Plans for Ring of Fire" (20 Nov '13). Found at: http://www.marketwired.com/press-release/noront-reaffirms-plans-for-ring-of-fire-tsx-venture-not-1855028.htm, December 2013.
45. Staff, "Noront completes ring of Fire EA." *Northern Ontario Business* (3 Jan '14). Found at: http://www.northernontariobusiness.com/Industry-News/mining/2014/01/Noront-completes-Ring-of-Fire-EA.aspx, January 2014. Cf. Noront's permitting documents, found at: http://norontresources.com/?pressreleases&permitting_technical=1, January 2014.
46. Knight Pièsold Consulting, "Eagles Nest Project: Volume 1, Executive Summary" (Draft), 43-44. Found at: http://norontresources.com/pdf_uploads/Volume_1_-_Executive_Summary.pdf, January 2013.
47. "Cliffs Chromite Project: Project Update" (21 Nov '13). Found at: http://www.cliffsnaturalresources.com/en/aboutus/globaloperations/chromite/Pages/default.aspx, December 2013.
48. "Cliffs natural Resources Temporarily Suspends its Chromite Project Environmental assessment Activities Pending Resolution of Various Issues" (12 June '13). Found at: http://ir.cliffsnaturalresources.com/releasedetail.cfm?ReleaseID=770776, December 1013; and "Response to Ontario Mining and Lands Decision" (20 Sept '13). Found at: http://www.cliffsnaturalresources.com/EN/aboutus/GlobalOperations/chromite/Pages/ResponsetoOntarioMiningandLandsDecision.aspx, December 2013"

The Muskrat Falls Project "includes an 824 megawatt hydroelectric generating facility, the Labrador-Island Link that will transmit power from Muskrat Falls to Soldiers Pond on the Avalon Peninsula, and maritime Link connecting Newfoundland and Nova Scotia."[49]

Nalcor estimates $1.9 billion in income to labour and business in Newfoundland and Labrador; 1500 jobs in the construction phase of the Muskrat Falls Project; 23,300 person years of direct, indirect, and induced employment; $320 million in "average income benefits per year"; and $290 million in revenue to the provincial treasury of Newfoundland and Labrador. Nalcor further claims that 95% of the engineering work was carried out in Newfoundland and Labrador.[50]

Although these numbers necessarily pale in comparison to the oil sands statistics listed above, the impacts are no less significant to Newfoundland, Labrador, and other parts of Atlantic Canada in respect to the demand for the industrial construction trades and project procurement.

Opportunities in Gas Hydrates Off Canada's East Coast

Gas hydrate is a solid composed of gas molecules surrounded by a "cage" of water molecules. Canada's supply of gas hydrates is estimated to be anywhere from 1,550 Tcf to 28,600 Tcf, which translates into 1000 years of supply at present demand. Also, anywhere from 671 Tcf to 2,753 Tcf is found on the "Atlantic Margin" (slope). The inhibition to development of this resource is primarily demand and price. In order for extraction to be economically viable with present extraction technology, natural gas pricing would have to rise above $10MMBtu.[51]

Japan cooperated with Canada in developing production technology in a gas hydrate production research well program in the Mackenzie Delta, and in March, 2013, successfully completed a test producing "methane gas from offshore hydrate formations for the first time, using extraction techniques pioneered in Canada." They produced 120,000 cubic metres of methane gas and researchers hope to bring commercial extraction on-stream by 2019. The inducement to Japan is to reduce dependence on foreign producers of natural gas by achieving recoverable gas from hydrates sufficient to meet current power demands for the next 100 years.[52]

It may be that a project off Canada's east coast could become economically viable sooner than one based off Canada's Arctic shore. Development of the resource would be highly knowledge intensive, as current research on the extraction of gas hydrates indicates.

49. Found at: http://www.nalcorenergy.com/lower-churchill-project.asp, December 2013.
50. Gilbert Bennett, "Lower Churchill Project" presentation (22 Mar '13). Found at: http://muskratfalls.nalcorenergy.com/wp-content/uploads/2013/04/Project-Presentation.pdf, December 2013.
51. Kirk G. Osadetz, et al., "Gas Hydrates – Fuel of the Future: Characteristics, Occurrences, Significance and Resource Potential." Earth Sciences Sector, Natural Resources Canada. Found at: http://www.neb-one.gc.ca/clf-nsi/rnrgyn-fmtn/nrgyrprt/nrgyftr/cnslttnrnd1/prsnttn/kirk_osadetz.pdf, December 2013.
52. Santiago Orlega Arango, "Canada drops out of race to tap methane hydrates." *CBC News* (7 May '13). Found at: http://www.cbc.ca/news/technology/canada-drops-out-of-race-to-tap-methane-hydrates-1.1358966, December 2013.

The signs of the times suggest huge shifts in:

- capital investment;
- employment;
- economic growth, regional benefits, and tax revenues; and
- knowledge intensity.

Such shifts suggest a drastic change from Canada's traditional manufacturing base to a new base of industrial activity – the industrial development of Canada's oil and gas resources.

These shifts are centred especially in industrial construction of extraction capacity in the oil sands. We have argued that these shifts are signs of Canada's new industrial revolution, positioned to bring a generation of prosperity leveraged across the country and benefitting workers, investors, contractors, and public treasuries at all levels of government across Canada.

But the promise stemming from this new industrial revolution cannot be taken lightly or for granted.

Opportunities and Challenges

A key strength of Canada's new industrial revolution is that it is based on extracting a resource that is highly sought after. Demand for the resource is not likely to decline drastically anytime soon, as global energy demand is such that for the foreseeable future hydrocarbons will be the global "go to" on the supply side of that equation. Chinese energy consumption remains on a ballistic trajectory, and Brazil's economy, too, is developing an insatiable appetite for energy. What may, now, be the world's most populous country, India, is also developing a mammoth energy habit, while that "energy habit" of our most proximate neighbor, the United States, remains unabated.

A second key strength of Canada's new industrial revolution is that while much of the resource endowment is publicly owned, Canadian governments are content to regulate and to have the private sector make the capital investments to extract the resource. As a result, production from the world's third-largest reserve is mostly in the hands of the private sector.[53] This makes Canada's reserve the largest to be developed by the private sector since the largest (Saudi Arabia's) and second-largest (Venezuela's) reserves have both had development, infrastructure, and production placed under sovereign control.

Canada's broad commitment to allowing the private sector to develop resources—and the inevitable competition that this entails—allows a wide variety of industry stakeholders to develop new and better methods of extracting resources, makes space for a plurality of labour providers, unions, and ancillary services to innovate and, somewhat paradoxically, opens space for public dissent about how development proceeds. The private nature of development within a democratically derived regulatory framework allows for a more stable, innovative, and socially inclusive development of resources. While some might take issue with development, the Canadian environment forces private companies to be responsive to such concerns in ways that an enterprise backed by the coercive power of the state does not.

These strengths suggest important opportunities for workers and contractors who now have much to look forward to in terms of the potential for projects on which to bid and for which to provide labour, expertise,

53. The exceptions are producers that are wholly sovereign-owned or sovereign-controlled.

and management. This requires labour, expertise and management that is ready to be activated and to deployed as projects are brought forward by investors and producers.

However, there are weaknesses, too.

First, for some time, now, Canadian producers have tended to be "price takers," not "price setters" in respect of the resources extracted and produced. As long as existing and potential customers are positioned as the price setters and Canadian producers are price takers, there will be pressure on the return on investment (ROI) side. The question is: will investors and producers be willing to inject capital into development at the price set by customers?

Secondly, the resource is land-locked and, while considerable, transmission capacity is limited. Will investors and producers bring projects forward for construction without the ability to get the production from a project to port and to customers?

These weaknesses could bring the threat of downward pressure on pricing for industrial construction workers and contractors. They could also lead to "down time" if projects were delayed for want of transmission capacity. And if this were the case, how would workers and contractors stand by in order to make themselves available when projects called on them?

Another weakness goes to the demand for workers and contractors. Given the projections relative to the demand for industrial construction in the oil sands, we must ask: can Canada supply workers and contractors in sufficient numbers to meet that demand? Can Canada attract, recruit, train, and place sufficient numbers of journeypersons and apprentices to meet the demand? What barriers exist which might unnecessarily limit this supply?

There are other challenges as well, particularly with those—within and outside of industry—who have legitimate concerns with development in an environmentally responsible manner. While certainly groups who are willing to adopt extreme measures to halt development all together pose a challenge—radical environmental non-governmental organizations (RENGOs) for instance—a greater challenge and opportunity is to find ways to work productively with conservationist non-governmental organizations (CNGOs).

CNGOs are more often quite prepared to work with policy makers, decision makers, and producers to find compromises that both fund conservation of Canada's environment for the enjoyment and use of future generations of Canadians AND allow development to go forward. They see the opportunities for leveraging the financial resources of producers and investors in order to bring both a "conservation return on investment" as well as a financial return on investment, and the production of a socially useful product. Generally, RENGOs often seem only interested in shutting down development of resources altogether, especially development of hydrocarbon resources and oil sands development.

Further, there is the matter of aboriginal land claims. If not negotiated effectively, project by project by developers and/or governments, both aboriginal communities and projects can be unduly affected. As noted in *Clean Energy Superpower or Canadian Energy Strategy* negotiations between aboriginals and those investing in resources and resource transportation have a spotty history, including cases of predatory actions taken by unscrupulous companies. However, this challenge is also a tremendous opportunity to partner with aboriginal communities and individuals to ensure that the benefits—including potential equity stakes, as well as training and employment for individuals—are seen by the communities involved.

The implications of not meeting these challenges, is that other jurisdictions with supplies of oil and gas will create the infrastructure in advance of Canadian producers, capture the huge prospective markets of China, India, and Brazil and, even, replace Canadian producers as suppliers to the US market. Such a scenario could lead to a slow-down, if not stoppage, on industrial construction to develop the resource extraction, upgrading, and transmission infrastructure along with the benefits noted above.

"What Do We Do, Now?"

Producers have been taking some very public steps in respect of ad campaigns in support of development of gas and oil. They have made a point of leveraging suppliers from Ontario and Quebec's machinery and equipment sector. They have featured key successes in mitigating emissions and in remediating oil sands mining land. These steps are an addition to their work in government relations with policy and decision makers, both public servants and political decision makers.

But workers and contractors have not appeared to take nearly as active a role, either publicly or on the government relations front. Workers and contractors may want to consider:

1. Proactively (not reactively) organizing strategic partnerships of workers, worker organizations, and/or contractors (with producers and pipeline operators) that whenever possible can speak with one voice to policy and decision makers. Such a strategic partnership should speak both to government—on both the public service and political sides—and to opposition, in respect of key issues including job training and to counter-balance especially the RENGOs;

2. Forming strategic partnerships with CNGOs (see above). Many workers are no doubt members of such CNGOs as Ducks Unlimited, and others that advocate on behalf of habitat management for fishing and hunting. Many workers and CNGOs are natural allies;

3. Opening government and media relations offices, especially in Ottawa and Edmonton, to inform policy and decision makers and to help workers and/or contractors speak with one voice whenever possible. There is no substitute for having someone "on the ground" to monitor committee and legislative proceedings;

4. Organizing regular visits and tours of oil sands developments, and other major development sites as in northeastern BC, especially for policy and decision makers, and for members of the press galleries and other media opinion leaders. Many policy and decision makers and members of the news media have not been west of the lakehead, let alone visited anything like an oil sands project, either in operation or under construction. Let them experience firsthand what is going on, as well as see up close and personal the efforts on emissions mitigations, tailings management, and mine site remediation;

5. Funding an issue and/or ad campaign in support of development, featuring workers and the benefits especially to workers and all Canadians, their families, and their communities from jobs and increased revenues to public treasuries. Industrial construction projects provide real jobs to real people, and help them make real mortgage payments on real homes that house real families in real communities. Let Canadians hear that from real workers;

6. Leveraging worker organization relationships with similar organizations, especially in jurisdictions where RENGOs have traction, such as in the US and the EU. These could afford opportunities to enlist similar organizations in other jurisdictions to speak to their governments on behalf of workers in Canada as well as in the US and the EU. Inform similar organizations of the jobs that are created in their jurisdictions because of industrial construction in the oil sands and elsewhere;

7. Funding an ongoing ad campaign to attract and recruit those typically underrepresented in the sector, including youth, young adults and their parents, women, second-career adults; aboriginals, to the industrial construction trades and other vocational roles in development. Many parents (and teachers) only encourage their children (or students) to attend college or university. Too many parents (and teachers) are unaware of the opportunities, challenges and dignity that entering the skilled trades could offer their children (and students). Is it any wonder that youth and young people don't

even give the skilled trades a first thought, let alone a second?[54] Further, many mid-career adults or "empty nesters" in their 30s and 40s could be ripe for a career shift into one of the skilled trades; and

8. Researching job creation and economic and social benefits from industrial construction. Although Statistics Canada collects data sets that could assist in understanding these, existing analysis could be pushed much further in making the case for industrial construction in extraction, including the oil sands, unconventional natural gas in northeastern BC, the Bakken fields, and elsewhere.

The Last (But Not Final) Word

Especially in Part 3, "Responsible Resources Development," Bill C-38, *Budget Implementation Act, 2012*, the current Government of Canada endeavoured to remove duplication in the environmental assessment and permitting processes in respect of major projects. During some 100 hours of hearings and deliberation on the bill, development of an industrial construction of oil sands production as well as pipelines was clearly in view. Follow-up legislation has addressed other obstacles to environmentally responsible development.

However, workers, contractors, producers, and other stakeholders likely to benefit from industrial construction in the oil sands and the new industrial revolution it represents should suffer no delusions. While the current Government of Canada promotes policy development and legislation, a future Government of Canada may well not. A future Government of Canada could conceivably rescind many of the gains for environmentally responsible resource development. Conversely, permitting of certain major projects in northern Ontario's "ring of fire" may have to wait for a future Government of Ontario.

Stakeholders must watch the signs, and should live by that Farmer's Almanac motto: "Make hay while the sun shines!"

54. A 2010 report of the Conference Board of Canada finds that: "...less than 6 per cent of upper-secondary students in Canada were enrolled in vocational or pre-vocational programs. The remaining 94 per cent were enrolled in general academic programs. This was the lowest rate of the peer countries for which data are available. In nine peer countries, over half of upper-secondary students were pursuing or (sic) vocational or pre-vocational programs" (Conference Board of Canada, "Jobless Youth." Found at: http://www.conferenceboard.ca/hcp/details/society/jobless-youth.aspx, December 2013).

APPENDIX A: Key Points for Policy/Decision Makers and Canadians

1. Affirm the Canadian governments' policy commitments to public ownership of the resources, private sector development and production from it, and public regulation of development and the operation of production;

2. Affirm the plurality of stakeholders in industrial construction in the oil sands, including workers, contractors, producers, and aboriginal peoples/First Nations. No one group or class of stakeholders should have a monopoly on responsibility for and benefit from development;

3. Affirm the plurality of roles among the various stakeholders. Ask government to lead in encouraging all stakeholders to fully assume their respective responsibilities and roles;

4. Affirm that Government should be prepared to exercise and give force to its regulation of development and operations, and to work in partnership with workers, contractors, producers, and aboriginal peoples/First Nations in order to achieve best possible outcomes for all stakeholders;

5. Promote collaboration and cooperation among stakeholders and with Government;

6. Make human flourishing your over-riding object for workers, contractors, producers, policy/decision makers, aboriginal peoples/First Nations, and Canadians.

APPENDIX B: Capital Investment in Two Goods-Producing Sectors[55]

SECTOR: MINING, QUARRYING, AND OIL AND GAS EXTRACTION

Accumulated capital investment by Type of Asset: 2002-2011

Type of Asset	Value in $ billions		CAGR* 2002-2011	% Change 2010-2011
	2002	2011		
Machinery and Equipment	36.7	87.4	10.1%	2.7%
Construction	269.2	665.2	10.6%	7.3%
Total	305.8	752.7	10.5%	6.7%

***Compound Annual Growth Rate**

SOURCE: Statistics Canada, Fixed Capital Flows and Stocks, 2002 to 2011.

SUB-SECTOR: MINING AND QUARRYING (EXCEPT OIL AND GAS)

Accumulated capital investment by Type of Asset: 2002-2011

Type of Asset	Value in $ billions		CAGR* 2002-2011	% Change 2010-2011
	2002	2011		
Machinery and Equipment	11.3	19.7	6.4%	14.7%
Construction	39.8	70.3	6.5%	10.9%
Total	51.1	90.0	6.5%	11.7%

***Compound Annual Growth Rate**

SOURCE: Statistics Canada, Fixed Capital Flows and Stocks, 2002 to 2011.

SUB-SECTOR: OIL AND GAS EXTRACTION

Accumulated capital investment by Type of Asset: 2002-2011

Type of Asset	Value in $ billions		CAGR* 2002-2011	% Change 2010-2011
	2002	2011		
Machinery and Equipment	19.1	51.7	11.7%	-0.5%
Construction	216.1	564.9	11.3%	6.4%
Total	235.2	616.6	11.3%	5.8%

***Compound Annual Growth Rate**

SOURCE: Statistics Canada, Fixed Capital Flows and Stocks, 2002 to 2011.

55. Excerpted from Statistics Canada, Canadian Industry Statistics: Fixed Capital Flows and Stocks, 2002 to 2011 (Found at: https://www.ic.gc.ca/app/scr/sbms/sbb/cis/definition.html?code=11-33&lang=eng, July 2013).

SECTOR: UTILITIES

(establishments primarily engaged in operating electric, gas and water utilities)

Accumulated capital investment by Type of Asset: 2002-2011				
Type of Asset	**Value in $ billions**		**CAGR* 2002-2011**	**% Change 2010-2011**
	2002	**2011**		
Machinery and Equipment	120.3	109.6	-1.0%	-0.8%
Construction	292.8	487.5	5.8%	5.9%
Total	413.1	597.1	4.2%	4.6%

***Compound Annual Growth Rate**

SOURCE: Statistics Canada, Fixed Capital Flows and Stocks, 2002 to 2011.

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