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Economic Benefits to Canadian Households of Increased Natural Gas Supply

Prepared by:
Informetrica Limited

For:
Contracting Authority
Canadian Natural Gas Initiative (CNGI)

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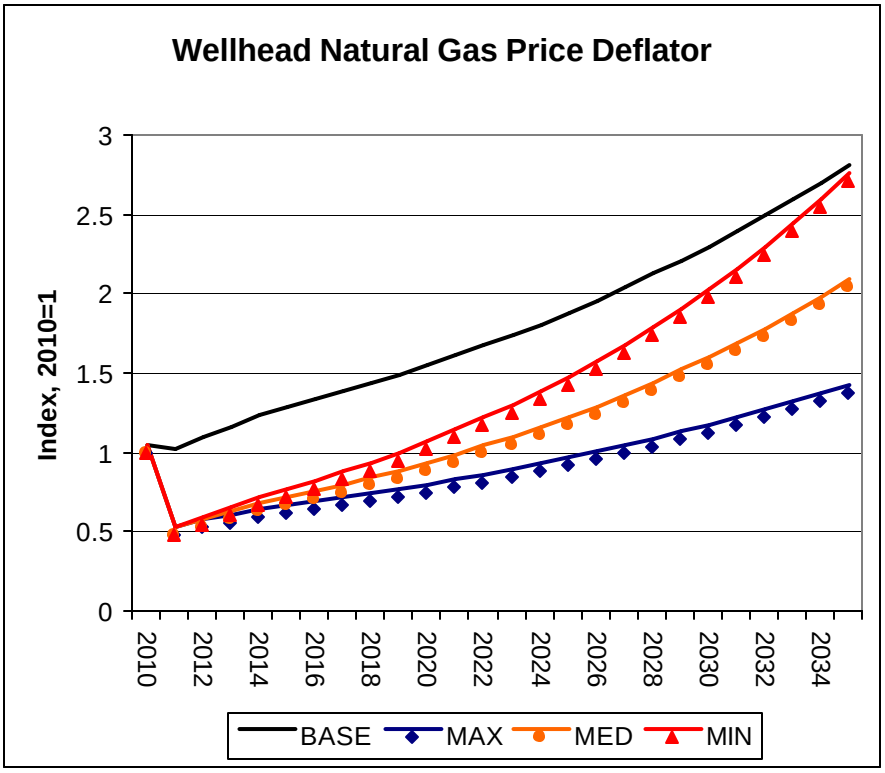
EXECUTIVE SUMMARY

The development of new technology, coupled with existing technologies such as hydraulic fracturing, has unlocked previously unattainable gas reserves in shale gas formations. This has greatly increased the supply of natural gas in North America and has resulted in significant reductions in the price of natural gas. Since these developments have opened up access to a huge resource base, it is expected that North Americans will enjoy lower natural gas prices for decades to come. This report measures the economic benefits to Canadians from this price reduction over the years 2011-35, with a particular emphasis on the benefits to Canadian households.

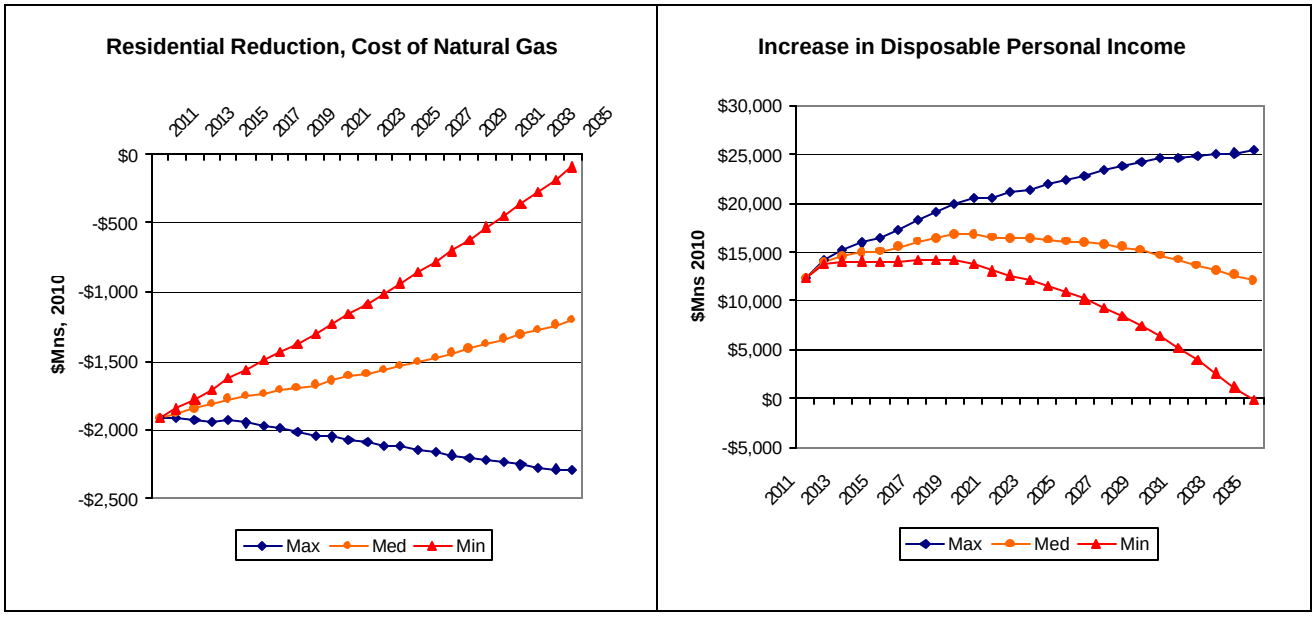


In order to assess the impacts of lower gas prices, we needed to assess the changes against a "base case". The base case that was chosen was the NEB's growth of wellhead natural gas prices from 2011 – 2035, as published in its November 2011 report on Canada's Energy Future. The 2011 level has been reduced from that of 2010 by 50 per cent. While the access to an expanded resource base will be a long-lasting phenomenon, the magnitude of the gas price reduction and its durability over the next twenty-five years is uncertain. Accordingly, three impact scenarios have been developed.

As shown in the diagram, in a "Maximum" Case, we have assumed that the North American commodity price of gas as seen by the producer is reduced by 50 per cent in every year of 2011-35, versus the base case as developed by the NEB in 2011. A "Medium" Case assumes that this reduction erodes so that by 2035, the reduction in prices is one-half that of the "Maximum" Case. A "Minimum" Case assumes that the price reductions versus the base case have essentially been eliminated by 2035. Note that, because natural gas transportation and distribution costs account for roughly half of the delivered price to end-users, a 50 per cent fall in wellhead prices translates into a 25 per cent fall to natural gas consumers. This relationship was used in all scenarios to estimate the fall in consumer prices in each year.

As the panel on the left in the chart below details, a 25 per cent reduction in the consumer price of natural gas saved Canadian consumers $1.9 billion in costs of natural gas in 2011 when measured at 2010 prices. In the Maximum Case, the annual savings grow over time reaching almost $4.8 billion by 2035. In the other two cases, annual savings are still large but erode over time. In 2035, annual savings in the Medium Case have been reduced to $2.5 billion, and in the Minimum Case, annual savings have been reduced to less than $200 million.

In *per capita* terms, annual savings average $55 in the Maximum Case. These are reduced to $40 in the Medium Case and $24 in the Minimum Case. In per household terms, impacts are larger: Maximum ($134), Medium ($95) and Minimum ($57). We have assumed that current provincial availability of natural gas persists over the analysis period, so there are no savings for residents of Newfoundland, Prince Edward Island, Yukon and Nunavut, and annual per person savings in Nova Scotia, New Brunswick and Quebec are small (in the range of $12 or less). Elsewhere, annual savings range around the national average. Given provincial distinctions in usage and the size of the population, total savings are concentrated (almost 90 per cent) in Ontario, Alberta and British Columbia. For example, Ontarians would save about $189/household in the maximum case.



In addition to the direct savings from lower natural gas prices, there will be important economic benefits from the stimulus to the economy that lower prices provide. The gas price reduction is a North American phenomenon, which implies that there are major benefits to US consumers and the US economy. This means that the size of the US economy will be increased and that US price levels for almost all commodities and services will be reduced. The former effect will be positive for Canadian exports and the

latter effect means that, in addition to reduced prices of natural gas, Canadians will benefit from reduced import prices for a wide range of commodities and services. These two effects provide a major benefit to the Canadian economy and household incomes.

Including the effects of reduced gas and other import prices for Canadian consumers and industry, and the spur to Canadian economic activity in our dominant export market, we estimate that increased disposable (after tax) income of Canadian households has been and will be increased by major amounts. This effect far exceeds the direct benefit of savings from reduced costs of spending on natural gas. We estimate that this amounted to more than $12 billion in 2011, and will be in the range of $15 billion per year in the next few years. Longer term, the amount may rise if the Maximum Case price assumption is realized, with the annual amount growing to more than $25 billion. In the Medium Case, the amount rises initially and then gradually falls so that in 2035 benefits are close to the amount reported for 2011. In the Minimum Case, annual impacts are close to the 2011 amount through this decade but then erode steadily and have evaporated wholly by 2035.

Averaged over 2011-35, increases in annual *per capita* real disposable income average $711 (at 2010 Consumer Prices) in the Maximum Case, $514 for the Medium Case, and $345 for the Minimum Case. Again, impacts are larger in per household terms: Maximum ($1,721), Medium ($1,238) and Minimum ($831). A distinguishing feature of this effect is the positive impact on the incomes of households in *all* provinces and territories. This noted, the underlying provincial distribution of the population means that total disposable income effects are concentrated in a few provinces. Partly because of their relatively strong export sensitivity to US economic performance, the biggest beneficiaries are Ontario and Quebec, followed by Alberta and BC. Together, these four provinces account for slightly more than 90 percent of the increased disposable income.

Impacts have been generated with the aid of an econometric model of the Canadian and provincial/territorial economies developed and maintained by Informetrica Limited. Imbedded in this model is an input-output table so that direct, indirect, and induced effects of the changes to natural gas and import prices and exports are evaluated. Given this, results include positive effects on measures of economic activity (real Gross Domestic Product) and employment across a wide spectrum of industries and in all provinces/territories. Initial positive effects are sustained in the Maximum Case, but erode over time in the other two.

Overall corporate profits fall, reflecting the major reduction in natural gas prices for producers. Lower natural gas prices and reduced royalty payments produce negative effects on the balances of provincial governments, where the budgets of Alberta and BC would be most severely impacted as the two jurisdictions account for the dominant share of total national gas production. We expect small positive effects for the federal government and small negative effects for local governments.

The magnitude of current price reductions has been based on previous analysis developed in a major study published by IHS Global Insight. Estimates of effects on household consumption of natural gas draws on underlying natural gas price growth produced in the November 2011 release of the National Energy Board's Energy Futures report. The authors of these reports would recognize that the evolution of prospects over the next twenty-five years is uncertain, and for that reason, three impact cases have been developed. While we do not know the exact trajectory of price impacts and their consequences in Canada and the US, these three scenarios capture a very wide range of outcomes. Other qualifications to the results centre on the extent to which there may be impacts on the exchange rate, interest rates, and fiscal reactions to government balance effects. These could alter the detail of results, but not the major impact profiles.

Finally, while it is recognized that there will be consequences for the Canadian supply of natural gas, this assessment does not consider the likely effects of lower prices from the shale gas revolution on the supply side of the industry. There will undoubtedly be a number of effects, including: a likely fall in conventional natural gas drilling in the short term, with attendant downward impacts on employment and incomes; likely increased production of shale gas in BC with associated investment in pipelines and liquefaction facilities to export LNG to Asia; increased profits to oil sands producers because of the fall in the cost of natural gas; a fall in natural gas exports to the US and an increase in natural gas imports to central Canada from the US. All of these effects would be complicated to estimate and, because the emphasis on this study was to estimate the impacts on Canadian households from lower natural gas prices, these supply side effects have been ignored.

In summary, energy is a major input to our economy and when energy prices fall, it provides a major boost to the economy and direct savings to energy users. Canadians will enjoy the direct and indirect benefits of lower natural gas prices for many years to come. Although the exact size of these benefits are unknown, we estimate that the average Canadian household will reap benefits in the range of $888 to $1,846 per year, averaged over 2011-35 and counting benefits of costs of gas consumed and increased incomes. Since lower natural gas prices stimulate the US economy, there will be major economic benefits accruing to Ontario and Quebec as the two provinces with the greatest sensitivity to trade with the US.

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1 Context

In the last 3-5 years, there have been some major breakthroughs in natural gas extraction techniques that have greatly increased the economically exploitable reserves in North America and that have already resulted in an unanticipated increase in natural gas supplies.

Until a few years ago, when natural gas was often discovered in shale formations that are characterized by a lack of porosity, the gas was considered to be uneconomic to extract because it would not flow to the well bores. However, the confluence and application of three technologies has recently enabled producers to access this gas and to economically produce these reserves. First, by using existing hydraulic fracturing techniques, through which water and other materials such as sand are injected into the reservoir under pressure, the gas is released and begins to move through the fractures in the reservoir to the well bore. Second, the development of horizontal drilling techniques, by which wells can be drilled horizontally through a formation to maximize the contact between the well and the gas in the formation, much more of the gas can be extracted. In the last decade, industry has learned how to control the hydraulic fracturing process along the length of horizontally drilled wells. Third, the refinement of 3-D seismic techniques, and development of micro-seismic techniques, has enabled producers to more accurately map these reservoirs, and pinpoint the targets for both the drilling and fracturing procedures to maximum advantage in extracting the gas. The combination of these technologies has resulted in a revolution in the industry's ability to produce natural gas.

The shale gas revolution caught most of the industry by surprise. Only five years ago, most market observers believed that North American natural gas supply was on the decline, and there was a rush to build LNG import terminals on both coasts, and to build major pipeline projects to remote natural gas reserves in the Mackenzie Delta and in Alaska. Instead, production in the lower 48 states has grown rapidly, and has resulted in a sudden drop in prices. IHS International estimates that, by 2011, the shale gas revolution had caused wellhead natural gas prices to drop by 50 per cent from what they would have been if the revolution had not occurred. [1]

The Canadian Natural Gas Initiative (CNGI) has asked Informetrica to estimate the economic benefits of reduced prices for natural gas to Canadian households, both nationally and by province. In this report, we rely on IHS's estimate, which accords with a review of wellhead prices in Canada, as the starting point in our analysis. Further, because the North American natural gas market is completely integrated, increases in

[1] In late 2011, shale gas accounted for more than one-third of US natural gas production. It is expected to grow to more than two-fifths by 2015 and to reach 60 per cent by 2035. IHS Global Insight (USA) Inc., **The Economic and Employment Contributions of Shale Gas in the United States**. Washington D.C., September 2011. pp. 24-27.

shale gas supply in either the US or Canada have an effect on the prices paid by all end-users in Canada and the US.

There are two sources of benefits for households.

1. **Savings from Reduced Costs of Gas:** For the country as a whole, Statistics Canada estimates that the cost (including taxes) of natural gas to consumers amounted to $6.1 billion in 2010 and $6.2 billion in 2011 (an average 0.6 per cent of all consumer spending). Supplies are not available in some jurisdictions (Newfoundland, PEI, Yukon and Nunavut) and are available in only small quantities in Nova Scotia, New Brunswick and the Northwest Territories. Elsewhere there is significant consumer spending on gas.

   As noted, we assume the 50 per cent reduction in the commodity price has occurred in Canada[2] because of the integrated natural gas market in North America. We assume the price paid by the consumer is reduced by a smaller 25 per cent. This reflects the fact that the cost to the consumer includes distribution costs that are not changed directly. In any event, there was a direct savings to Canadian consumers of approximately $1.9 billion in 2011[3]. In other words, if the shale gas revolution hadn't occurred, Canadians would have paid $8.1 billion instead of just $6.2 billion for the natural gas they consumed that year.

   Since demand and supply responses to a reduced price are likely, how long can one expect the major (50 per cent) reduction in price to last? We evaluate impacts based on three impact scenarios.

   Maximum Impact: In this case, the technologies associated with the shale gas revolution are disseminated throughout North America and new gas fields are developed that were previously thought to be inaccessible or uneconomic to produce. Because the dissemination effect is so powerful, the impact of the shale gas revolution persists throughout the projection period and commodity prices are reduced by 50 per cent in every year up to 2035 with consumer prices reduced by 25 per cent.

   Medium Impact: In this case, the technologies associated with the shale gas revolution are also disseminated throughout North America and result in the development of new gas fields and increased supplies. However, at the same time, due to low prices, the demand for natural gas is stimulated and drilling activity is suppressed somewhat. Therefore, due to market adjustments the impact on prices is somewhat muted over time. In this case, we assume that the impact on commodity prices declines by one percentage point a year over the projection period such that, by 2035, prices have been reduced by 26 per cent

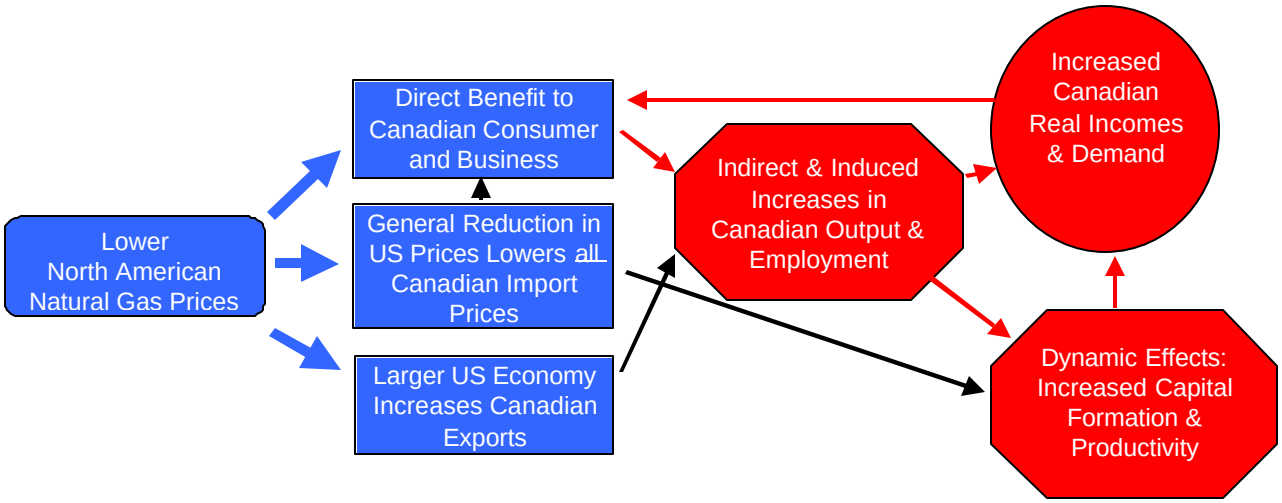
[2] This includes a reduction in prices paid to Canadian producers of gas.
[3] The shale gas effect on price was well established and significant prior to 2010, IHS Global, *op cit*., p. 24.

from what they otherwise would have been. Consumer prices are reduced by 13 per cent.

Minimum Impact: In this case, the technologies associated with the shale gas revolution are also disseminated throughout North America and result in the development of new gas fields and increased supplies. However, decline rates from gas reservoirs turn out to be higher than expected and the increases in supply are somewhat less than in the other scenarios. Consequently, the impact on price from the shale gas revolution falls more quickly. In this case, we assume that the impact on commodity prices declines by two percentage points a year over the projection period such that prices in 2035 are only two per cent below what they would have been without the shale gas revolution, with consumer prices reduced by one per cent (i.e. the annual benefits are essentially dissipated by the end of the projection period).

2. **Strengthened Incomes from Increased Economic Activity** Some part of the household savings on gas expenditures will be reallocated to increased spending on other consumer goods and services, thereby stimulating increased production, employment and incomes in other sectors of the economy. Also, the reduction in natural gas prices extends to industrial, commercial and other non-residential users, which effect will reduce prices of their commodities and services to end users.

Figure 1 Principal Impacts on the Canadian Economy



In addition to the benefits for households of reduced costs of gas, as Figure 1 portrays, because the shale gas revolution is a North American phenomenon, the U.S. economy also experiences the benefits from lower natural gas prices. This results in a strengthened market for Canadian exports and, in addition to lower prices of natural gas, provides reduced prices for a wide range of other imports.

Imports are the source of one-third of the country's final domestic demand[4] requirements. This import price impact directly strengthens real incomes in Canada. For this analysis, we have assumed that natural gas price impacts the US as well as the Canadian economy as outlined above.[5]

Informetrica is employing its macroeconomic model of Canada and each province/territory (The Informetrica Model or TIM). This model is highly detailed in that the principal commodities and industries that are directly impacted by the change in natural gas prices, all import prices, and exports are separately identified in the modelling structure to facilitate introducing key assumptions into the analysis. An imbedded input-output table identifies indirect impacts (implications for industries supplying those directly affected). Finally, as the model integrates demand, output/employment, price formation and income effects, spending that is induced by the increased incomes of those who are directly and indirectly impacted is accounted for. In other words, full multiplier effects are developed.

In short, from the standpoint of the household, this provides a second benefit as generally increased economic activity and employment, and reduced price levels improve household real disposable (after tax) incomes.

As is suggested by expectations that shale effects on natural gas supplies will extend over time, the impact of shale on gas prices and economic activity has lasting, if uncertain, effects. In this context, our focus extends beyond an impact in one single, initial year to those of many years (through 2035). The economic responses that follow from this perspective are many. Reduced price levels trigger changes to wage rates[6], with positive impacts on business investment leading to changes in productivity. With positive impacts on employment, these are key factors in determining effects on the real incomes of households. In a multi-year evaluation, impacts are "dynamic" in the sense that impacts in one year have implications for impacts in succeeding years. For example, an initial tightening of labour markets may subsequently increase unit costs of production to mitigate positive effects from a strengthened US demand for Canadian exports.

[4] Spending on consumption, business and government investment, and government spending on goods and services, and labour.

[5] Competitiveness benefits may exist for Canadian trade with non-US partners if equivalent shale gas impacts do not occur elsewhere. This analysis does not account for such effects.

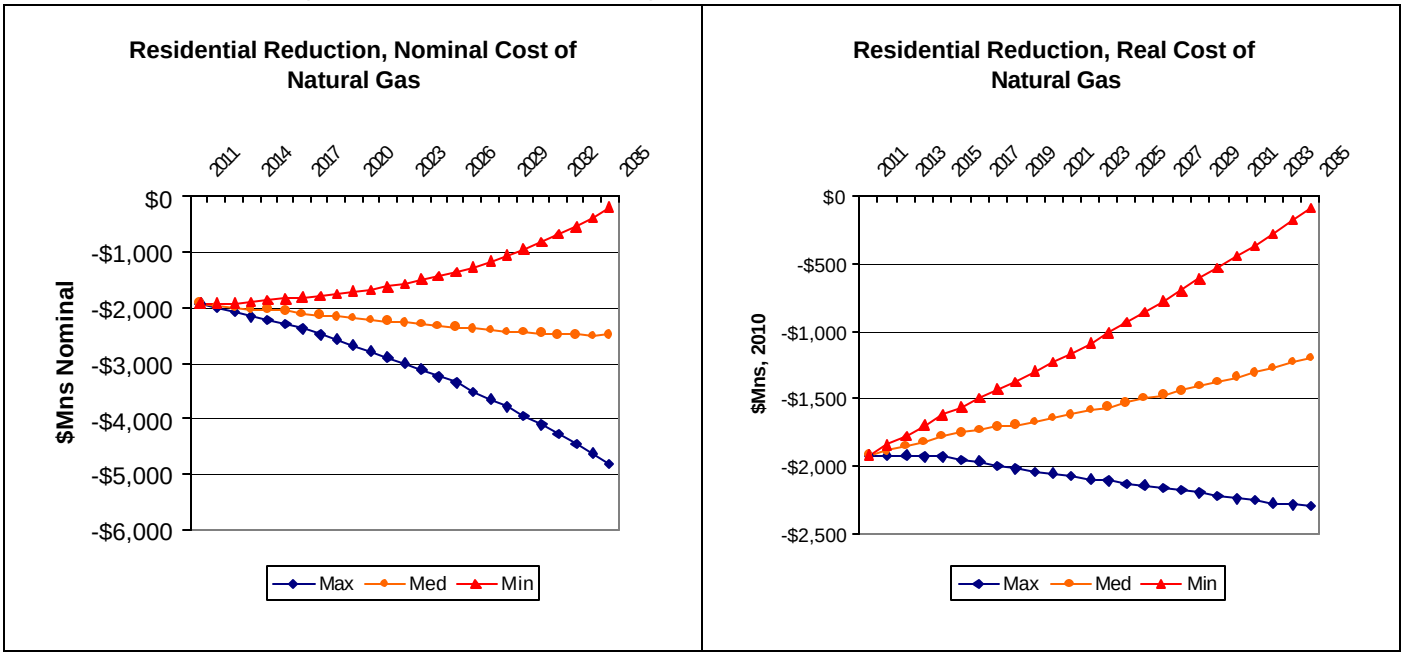
[6] Including supplementary benefits, labour income ("wages") per employee is reduced in nominal terms, but increased in real terms (i.e., after accounting for changes to the Consumer Price Index -- CPI). In the Maximum Case, the nominal wage rate is reduced by 0.3 per cent in the first year but the CPI is reduced by 1.7 per cent to yield an increase in real wages of 1.4 per cent. Averaged over 2011-35, the annual real wage is increased by 1.7 per cent. In the Medium Case, the increase is 1.3 per cent and in the Minimum Case, 0.9 per cent.

2 Major Findings: Impacts on Canadian Households

2.1 Impact on Household (Residential) Costs of Natural Gas

Figure 2 graphically displays the savings to Canadian households' from spending for natural gas. We report the savings in terms of the prices for natural gas in 2010, and those that are expected to prevail in the prices of each future year.[7] We use expected residential price growth for natural gas in 2012-35 reported by the National Energy Board in its recent review of long-term energy prospects to establish a baseline.[8] Year-to-year growth varies but the average annual increase in the nominal price is 3.1 per cent. At 2010 prices, the average increase is 0.9 per cent.[9]

Figure 2 Household Savings on Natural Gas Costs: Canada



Our analysis begins with impacts in 2011.[10] Canadian consumers saved $1.9 billion in spending on gas in that year. After that, effects vary with the scenario. At the 2010 price for natural gas in the Maximum Case, the savings increase slowly over time as volumes

[7] TIM assesses the economy in terms of 1997 dollars. For purposes of reporting impacts on households, we have converted the impacts to a more recent year: 2010 dollars using official price measures.
[8] National Energy Board, **Canada's Energy Future: Energy Supply and Demand Projections to 2035**, November, 2011, Table A2.1: Demand, Reference Case, Canada, Section 1.
[9] Calculated as the change in the nominal price deflated by the change in the GDP deflator.
[10] Our analysis begins in 2011 for model technical reasons. As was noted earlier, IHS Global has indicated major price reductions pre-date 2011 so that, for example, there were savings effects prior to 2011 that we do not measure.

purchased[11] slowly increase. At the 2010 price, the annual savings in 2035 have grown to almost $2.3 billion. Accounted for in the nominal dollars of each future year, the annual savings grow to $4.8 billion in 2035.

Savings erode over time in the other two cases. At 2010 prices, the 2035 savings for the Medium Case are almost $1.2 billion and for the Minimum Case, a small $91 million. In nominal terms, the savings in 2035 for the Medium Case are almost $2.5 billion and for the Minimum Case, fall to almost $200 million.

As the role of natural gas in consumer spending for energy varies from jurisdiction to jurisdiction, the savings are unevenly distributed across the country.

For provinces, dollar amounts change over time in line with the patterns indicated in Figure 2. As is detailed in Table 1, in overall dollar terms, the savings are concentrated in Ontario, Alberta and BC[12], where gas is a relatively important source of residential energy.[13] As is indicated by the results in *per capita* terms, gas is also a relatively important source of residential energy in Manitoba and Saskatchewan but the small size of their populations limits their importance to overall dollar savings. Impacts in Nova Scotia, New Brunswick, Quebec and NWT reflect the current and expected modest importance of gas to residential energy requirements.

Table 1 Household Savings on Natural Gas Costs: by Province/Territory

Household Spending Reduction: Natural Gas
(average 2011-35)

	$2010 Mn				$2010					
	Total				Per Capita			Per Household		
	Maximum	Medium	Minimum		Maximum	Medium	Minimum	Maximum	Medium	Minimum
Canada	-$2,126.8	-$1,517.7	-$908.5	100.0%	-$55	-$40	-$24	-$134	-$95	-$57
Newfoundland	$0.0	$0.0	$0.0	0.0%	$0	$0	$0	$0	$0	$0
Prince Edward Island	$0.0	$0.0	$0.0	0.0%	$0	$0	$0	$0	$0	$0
Nova Scotia	-$2.1	-$1.5	-$0.9	0.1%	-$2	-$2	-$1	-$5	-$4	-$2
New Brunswick	-$3.0	-$2.1	-$1.2	0.1%	-$4	-$3	-$2	-$9	-$6	-$4
Quebec	-$106.2	-$75.9	-$45.6	5.0%	-$12	-$9	-$5	-$28	-$20	-$12
Ontario	-$1,108.8	-$793.2	-$477.6	52.3%	-$76	-$55	-$33	-$189	-$135	-$81
Manitoba	-$68.4	-$48.8	-$29.1	3.2%	-$47	-$34	-$20	-$121	-$86	-$52
Saskatchewan	-$85.5	-$60.9	-$36.2	4.0%	-$71	-$50	-$30	-$177	-$126	-$75
Alberta	-$457.2	-$323.8	-$190.5	21.3%	-$97	-$69	-$40	-$251	-$178	-$104
British Columbia	-$295.3	-$211.3	-$127.3	13.9%	-$57	-$41	-$25	-$133	-$95	-$57
Yukon	$0.0	$0.0	$0.0	0.0%	$0	$0	$0	$0	$0	$0
Northwest Territories	-$0.4	-$0.3	-$0.2	0.0%	-$8	-$6	-$4	-$20	-$15	-$10
Nunavut	$0.0	$0.0	$0.0	0.0%	$0	$0	$0	$0	$0	$0

[11] NEB *Ibid*., Section 2.

[12] The proportions accounted for by each province are the same for each scenario.

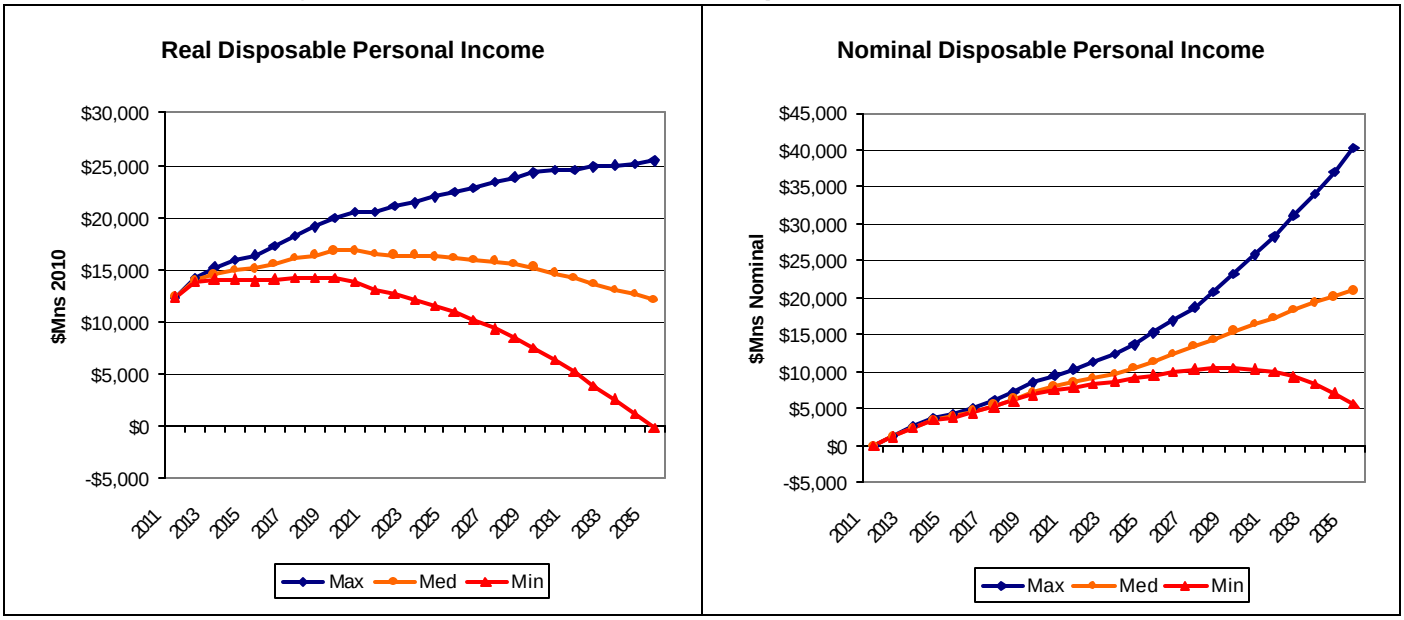
[13] TIM does not measure residential consumer spending on natural gas by province. We have derived the results reported in Table 1 by allocating the national savings based on NEB's projection of residential natural gas (volume) use for each province as a share of NEB's national projection for such use. Any changes in provincial taxes levied at the point of consumption would not be reflected in this method.

2.2 Impact on Disposable Income

The benefits to Canadian households of increased disposable income far outweigh the benefits to them of reduced costs of natural gas. Using the Consumer Price Index for an adjustment, the impact on Canadian disposable incomes at the prices of 2010 is $12.3 billion in 2011, or more than six times the $1.9 billion "benefit" from reduced gas prices.

This real annual amount increases steadily through time and reaches more than $25 billion per year by 2035 in the "Maximum" Case[14] where it is assumed the commodity gas price reduction is a permanent 50 per cent over each year of 2011-35. In the Medium Case, the increase in disposable income by 2035 has been reduced slightly to $12 billion and in the Minimum Case, the last-year amount is negative at -$172 million.

Figure 3 Increase in Household Disposable Income: Canada



The extent to which the disposable income impact exceeds that of consumer savings on spending for gas increases in each scenario from the initial six times to 11-12 times by the middle of next decade. This ratio varies little between the three scenarios and on average is close to ten times over 2011-35.

Nominal measures of the impact on disposable income are initially very slightly negative (-$45 million in 2011) but rise to positive amounts over time[15]. In 2035, this ranges from

[14] Dominating the effect are steadily increased employment from 0.5 per cent in 2011 to one per cent by 2035 and a strengthening real wage rate from 1.4 per cent in 2011 to two per cent in 2035.

[15] The initial small negative in nominal terms is a "close" finding. Although the positive impact on employment more than compensates for the small nominal reduction in the wage rate, this is approximately fully offset by reduced government transfers (e.g., reduced EI payments) in the first year. Nominal

a high of more than $40 billion in the Maximum Scenario and a Low of $5.7 billion in the Minimum Scenario.

Table 2 Household Increase in Disposable Income: by Province/Territory

Disposable Income Impact
(average 2011-35)

	$2010 Mn				$2010					
	Total				Per Capita			Per Household		
	Maximum	Medium	Minimum		Maximum	Medium	Minimum	Maximum	Medium	Minimum
Canada	$27,251.2	$19,704.0	$13,223.6	100.00%	$711	$514	$345	$1,712	$1,238	$831
Newfoundland	$178.4	$128.7	$88.8	0.7%	$335	$242	$167	$786	$567	$392
Prince Edward Island	$18.1	$13.1	$10.2	0.1%	$110	$80	$62	$261	$189	$148
Nova Scotia	$201.9	$147.3	$107.1	0.8%	$213	$156	$113	$488	$356	$259
New Brunswick	$211.8	$154.0	$108.6	0.8%	$263	$191	$135	$616	$448	$316
Quebec	$3,933.6	$2,895.6	$2,092.2	15.0%	$453	$334	$241	$1,021	$752	$543
Ontario	$10,078.9	$7,375.5	$5,122.1	37.7%	$693	$507	$352	$1,716	$1,256	$872
Manitoba	$881.3	$631.0	$417.6	3.2%	$607	$434	$287	$1,562	$1,118	$740
Saskatchewan	$1,113.4	$794.3	$503.6	4.0%	$920	$656	$416	$2,310	$1,648	$1,045
Alberta	$7,571.4	$5,380.1	$3,326.7	26.7%	$1,610	$1,144	$707	$4,151	$2,949	$1,824
British Columbia	$2,941.7	$2,116.7	$1,406.0	10.7%	$567	$408	$271	$1,329	$956	$635
Yukon	$22.5	$12.9	$8.0	0.1%	$566	$323	$200	$1,411	$805	$499
Northwest Territories	$89.2	$49.8	$29.6	0.3%	$1,855	$1,037	$615	$4,642	$2,594	$1,539
Nunavut	$8.9	$5.1	$3.1	0.0%	$206	$118	$73	$590	$337	$209

Further, where reduced costs of gas had no or little consequence for households in several provinces and territories, there are benefits to households in terms of increased disposable income in all provinces. There are positive effects on household incomes in Newfoundland, PEI, Yukon and Nunavut, in which provinces there are no benefits to households of reduced gas prices. This noted, approximately 90 per cent of the income gains in the country are concentrated in Quebec, Ontario, Alberta and BC.[16] Relatively large per capita increases in Saskatchewan and Alberta reflect especially strong reductions in the overall CPI in the two provinces. This follows from the relatively large weight in the province's CPI accounted for by consumption of natural gas. The relatively strong increase in NWT is traceable to a relatively strong impact on employment. This is further traceable to an initial increase in diamond mining of more than three per cent, which is stimulated by increased US and Canadian demand. This induces a relatively strong positive effect on services in the Territory.

reductions in returns to business are reflected in small reductions in dividend payments and returns to unincorporated businesses.

[16] The provincial distribution of disposable income effects is similar for each of the Scenarios.

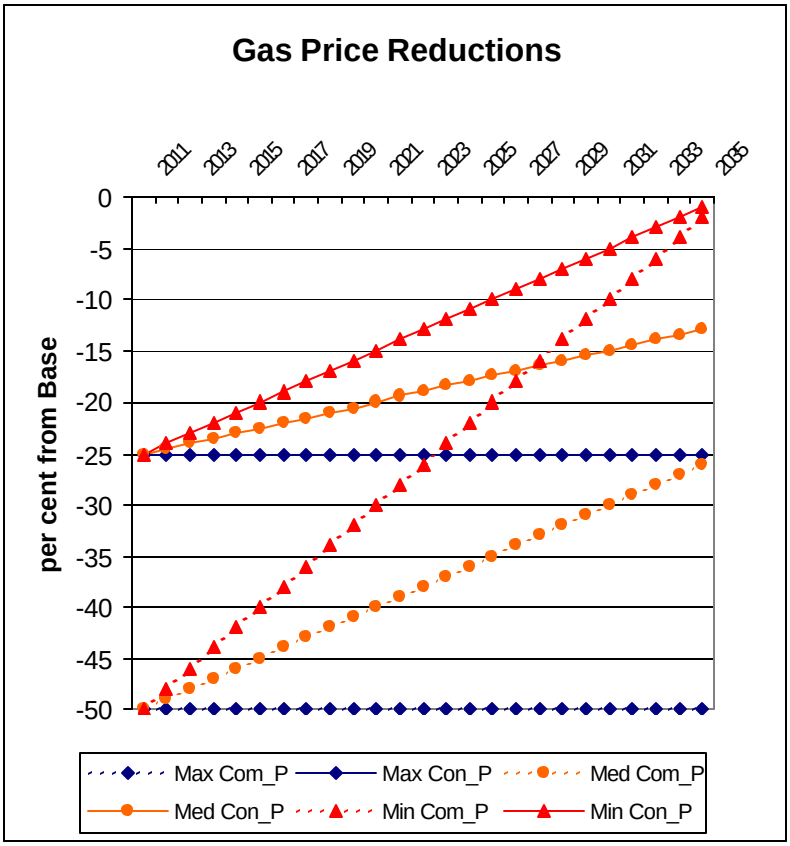
3 Major Assumptions

In this study we have aimed to estimate the benefits to the Canadian economy from a significant fall in natural gas prices. Our economic model takes into account many of the "ripple on" effects in the economy; however, to isolate the impact of the fall in natural gas prices and to keep the analysis manageable, we have made a number of simplifying assumptions that constrain impacts in the US, and responses in Canadian energy markets and among governments to the impacts on which they often focus.

3.1 Energy

Changes to energy prices and consumer demand directly impact household spending, while broader changes to energy demand and output are contributors to impacts on employment and ultimately, household real incomes.

Figure 4 Gas Price Reductions by Scenario



As was indicated above, we have assumed that the commodity ("Com") and the consumer ("Con") price of natural gas is reduced from the level of the Base Case by varying amounts for each of the three Scenarios. We have assumed that Consumer prices for competing electric power and other heating fuels (e.g., mainly fuel oil) are unchanged. Prices for gasoline are endogenous, reflecting overall impacts on refinery prices at the factory gate, and our assumptions about global energy prices. The international price (therefore, Canadian import price) for crude oil and refined petroleum products is unchanged in each impact case. Canadian refinery prices are changed somewhat by impacts on domestic and imported non-crude input costs. Compared to the Base Case, this results in annual reductions in the price of gasoline (and lubricants) of approximately five per cent initially. By 2035, the impact in the Maximum Case is a 6 per cent reduction, with the

amount for the two other cases smaller (Medium: 3.4 per cent and Minimum: 0.2 per cent).

TIM does not separately identify an upstream (or mining) producing sector for oil and for gas production, but blends these into the selling price of one oil and gas mining industry. Accordingly, the change to the oil and gas import prices is "blended" into one measure of the selling price for this industry. The initial reduction in the selling price is estimated to be more than 16.5 per cent. By 2035, this has increased to more than 23 per cent in the Maximum Case, 12 per cent in the Medium Case, and one percent in the Minimum Case.[17]

We have assumed there will be no consumer substitution of real spending on natural gas for either electric power or other heating fuels.[18] Indeed, real consumer demand for natural gas, electric power and other fuels is unchanged from that of the Base Case in all three cases. Real demand for gasoline and lubricants changes endogenously and is increased by a small amount (almost three per cent initially, which erodes to smaller amounts in the Medium and Minimum Cases) to reflect, among other considerations, lower prices and an increased stock of vehicles that is traceable to increased real disposable incomes.

Table 3 Impact on Canadian Oil and Gas Mining Industry

Canada: Oil & Gas Mining (NAICs 211)
($1997 Mns) average per cent impact

	Maximum		Medium		Minimum	
	2011-20	2021-35	2011-20	2021-35	2011-20	2021-35
Gross Output	1.4	1.2	1.2	0.7	1.1	0.4
Final Demand	0.4	0.3	0.4	0.1	0.4	0.0
Final Domestic Demand	0.5	0.4	0.5	0.3	0.5	0.1
Gross Exports	0.9	1.2	0.8	0.8	0.8	0.6
(-) Gross Imports	1.8	3.3	1.7	2.5	1.6	1.8
Intermediate Industry Requirements	2.1	2.3	1.9	1.5	1.8	0.8
of which Petroleum Refineries	2.1	2.3	1.9	1.5	1.7	0.7

Real demands for natural gas and the other energy sources are endogenous to the output of industry, so that there is an increase in the demand for natural gas from "commercial" and "industrial" activity. Increased consumer as well as industrial demands for refined

[17] The industry is modeled as a price taker. Returns to the industry will also be impacted by non-energy input costs, which in nominal terms will reflect the general lowering of price levels in the Canadian economy. In terms of energy input costs, natural gas is a major cost input for oil sands production. A sustained drop in natural gas prices will be a major positive for the returns of oil sands producers. As price takers, this should mean higher profits for oil sands producers and higher royalties for Alberta. We recognize this effect, but have do not have a defensible view of the magnitudes and therefore, do not account for this likely impact in our results.

[18] To accomplish this, we have overridden endogenous equations in TIM. Accounting for both price and income effects, these suggest that household demand for natural gas and other fuels would be increased moderately with the demand for electricity reduced by a modest amount. These suggested impacts erode over time in the Medium and Minimum Cases.

petroleum products increases the demand for crude oil. We assume there are no changes to exports and imports of natural gas from those of the Base Case, but endogenously determine exports and imports of crude oil to reflect increased demands in the US and Canada. Net of these considerations there is a small increase in the production of crude oil and natural gas[19]. In combination, these produce a sustained 1.2 per cent increase in the oil and gas mining industry output for the Maximum Case. The impact in the other two cases erodes, largely because of eroding impacts on refineries. Impacts on exports and imports are approximately balanced so while positive export impacts erode because of decaying positive effects on the US economy, eroding impacts on imports offset this.

There are similar, modestly positive impacts on other energy and related sectors. General increases in industrial and commercial demand for electric power yield an increase in that sector. Increased production of electric power as well as demand from primary metals manufacturers produce an increase in the output of the coal industry. Increased exports of crude oil as well as increased domestic demand for crude oil and natural gas promote an increase in pipeline transportation[20]. Increased production of the oil and gas, refining and pipeline industries is reflected in increased investment by those industries with constant positive impacts on mining services and related construction industries. As Table 4 reports, impacts are in the range of one to two per cent for the Maximum Case over the full length of the period assessed. Initially, these same magnitudes apply to the other two cases, but over time, the impacts are reduced.

Table 4 Impact on Other Energy Industries

Other Energy Sectors
Gross Domestic Product ($1997 Mns) average per cent impact

	Maximum		Medium		Minimum	
	2011-20	2021-35	2011-20	2021-35	2011-20	2021-35
Electric Power (NAICs 2211)	1.1	1.2	1.0	0.7	0.9	0.4
Coal (NAICs 2121)	1.0	1.3	0.9	0.8	0.8	0.4
Pipeline Transportation (NAICs 486)	1.0	1.0	1.0	1.0	1.0	1.0
Support Services for Mining (NAICs 213)	1.0	1.7	0.9	0.9	0.9	0.3
Oil & Gas Engineering Construction (NAICs 23)	1.0	0.7	1.0	0.5	0.9	0.2

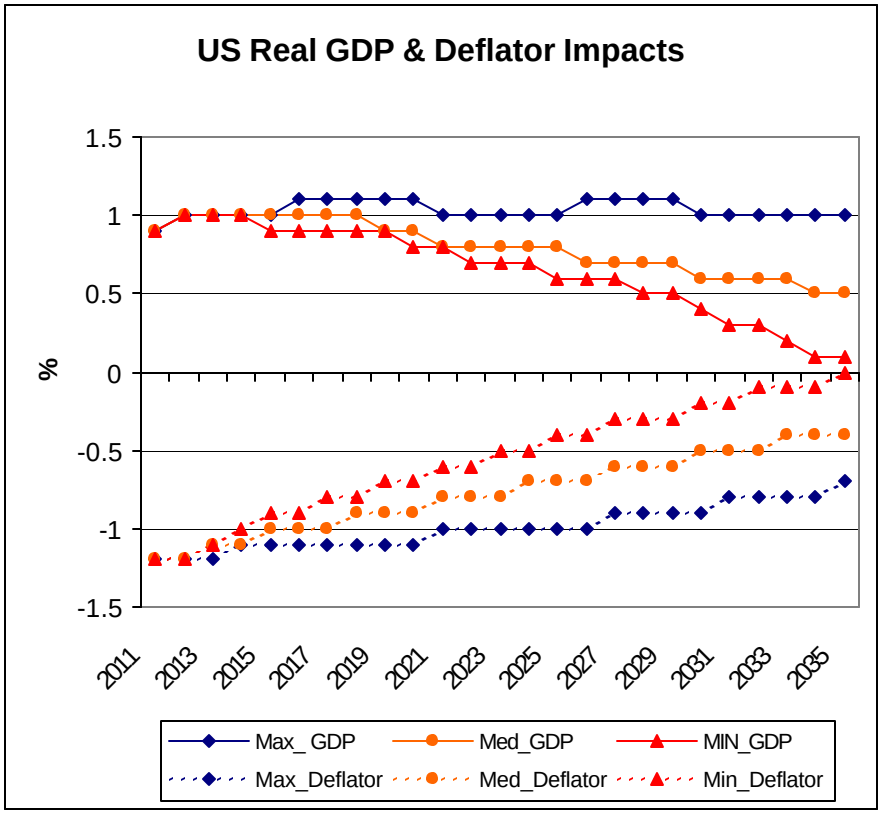
[19] TIM does not separately identify the production of oil from gas, using input-output information to properly weight demands for these two commodities to estimate the output of the industry that combines their production. We also make no assumption about whether the additional gas produced in Canada is conventional, frontier or shale, but the magnitude of the impact may be understood to represent no major increase in either shale or frontier gas development and production, as supply-side impacts on shale production were excluded from consideration in this analysis.

[20] We have assumed there is no impact on imports (or exports) of gas. In the event, as is possible, that increased electric power and other demand for gas as an input in Central Canada is met by imports and gas production is diverted to support of the oil sands, it is possible this will lead to reduced gas pipeline and increased oil pipeline activity in the Base Case. The extent to which the effect of shale gas on natural gas prices will accelerate this is unknown and not considered in this analysis.

3.2 US Economic Impact

As noted, impact of the shale gas revolution on natural gas prices is significant to the US economy as well as to Canada. The IHS study[21] provides a very brief review of a 50 per cent gas price reduction on US economic activity. It reports an initial impact on real GDP that quickly grows to an approximate one per cent increase.

Figure 5 Summary Impacts on US Economy



For the Maximum Case, we have assumed the impact on the real GDP of the US is sustained at close to one per cent through the next twenty-five years. For the Medium and Minimum Cases, we have reduced the impacts by a proportion that is equivalent to the reduction in the natural gas commodity price.

The IHS report provides no indication of impacts on overall price and cost levels in the US. To avoid assuming that relative (between the US and Canada) cost impacts would provide a competitiveness edge to the Canadian economy, we have assumed these would approximately match those we are reporting for the Canadian economy. The reductions in prices and costs in the US erode modestly over the longer term, and in the Minimum Case effectively return to Base Case levels by 2035. Finally, notwithstanding reduced price levels (initially, a significant reduction in inflation), we assume there are no consequences for either short or long-term interest rates.

[21] IHS Global Insights, *op. cit.*, pp. 24-27.

3.3 Other "Macro" Assumptions

Changes to the energy price levels and to US economic activity have broad consequences for the Canadian economy. They alter overall inflation of price and wage levels and inflation and alter incomes of households, businesses and governments, the consequences of which raise the possibility that monetary and fiscal authorities may react. The magnitude of these and the instruments that may be used are uncertain. As these may "mask" the structural effects of the changes in natural gas prices and US activity, we adopt assumptions that produce a "cautious" or "modest" real effect on the economy.

- Notwithstanding a reduction in price levels, we assume that, as in the US, Canadian nominal interest rates are unchanged from those of the Base Case.

- Notwithstanding a deterioration in the Canadian Current Account balance (a deficit impact), we assume that the nominal exchange rate with the US dollar is also unchanged from that of the Base Case.[22]

- Government tax rates are unchanged.

- Government spending to support current operations (payment for public sector employment and purchases of supporting goods and services) are unchanged from those of the Base Case in nominal and real terms. Transfer payments (e.g., employment insurance and welfare) adjust to employment and price level impacts. Government spending on capital formation ("infrastructure") is allowed

[22] This is an uncertain result. In real terms, exports and imports are both increased, the former because of a strengthened US economy and the latter because of increased Canadian domestic demand. The impacts on exports are larger than those on imports to provide a modest positive effect on the trade balance in real terms. In addition to assuming that North American prices for natural gas are reduced, we have assumed that US-dollar prices for other (non-energy) resource prices are reduced by the same proportion as the reduction in the US GDP deflator. Given the large trade surplus accounted for by resources, this represents a deterioration in the Canadian "terms of trade", which more than compensates for the positive effects of real trade performance to produce the negative effect on the Current Account balance. Arguably, impacts on non-energy resource prices, which would be influenced by but not necessarily dominated by US considerations, would be less negative mitigating the impact on the Current Account we have reported.

Further, impacts on the Current Account are sensitive to the price Scenario, with small price impacts in the Minimum Case restoring the trade balance to a negligible impact by the end of the impact period. Earlier large deficits are funded by foreign savings, which over time adds substantially to net interest payments to foreigners. Were the assumed natural gas (and other commodity) price reductions reduced to negligible proportions after ten years (rather than the 25 assumed), the neutral trade impact would occur sooner and net interest payments to foreigners would be reduced.

Technical measures in TIM suggest that a sustained depreciation of the Canadian exchange rate would be little more than one per cent in the Maximum Case, and less than that in the other two.

to adjust endogenously (to support increased business capital and activity) and is increased modestly throughout the projection.

4 General Economic Impacts

4.1 National

Figure 6 Component Impacts on Disposable Income: National Perspective

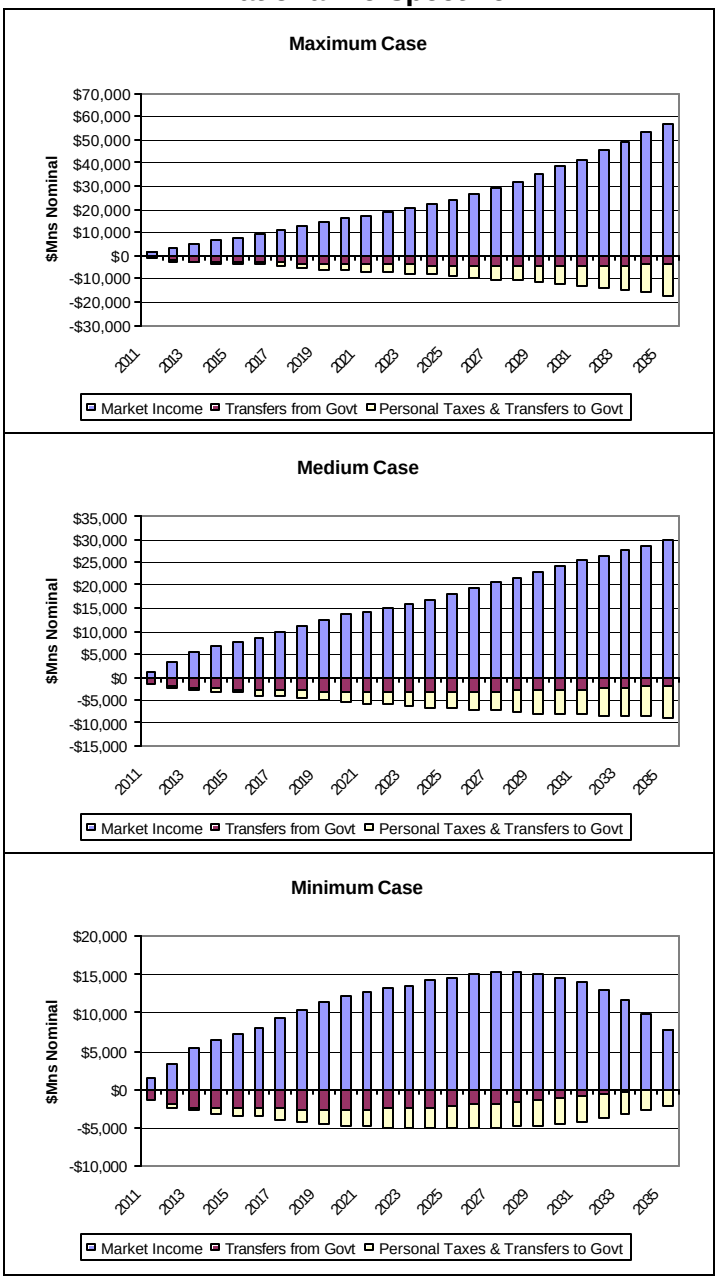


Figure 6 breaks down the impacts on household disposable income for each of the three cases. The positive bars in light blue illustrate the increases in market incomes and the negative bars in red and white show the "offsets" that occur due to reduced transfers from government to households and increased taxes.

Market-based income impacts are positive. They rise steadily but at different paces in the Maximum and Medium Cases, and erode over the longer term in the Minimum Case. In the main, this reflects increased wages as employment and real wages are increased through productivity gains. There are also increases in unincorporated incomes offset by reductions in dividends from corporations, whose nominal returns are reduced with lower natural gas and other price levels, and reduced personal saving rates in a low inflation environment.

There will, however, be some offsets to the increases in market incomes. These offsets include reduced transfers from government, where this includes reduced EI and welfare payments, which reflects reduced unemployment. There are also reduced nominal payments for Old Age Security, GST and other credits, which reductions reflect lower overall price levels in the economy. Also offsetting market-based personal incomes are increased personal taxes and increased contributions to social insurance programs. As the Figure illustrates, these offsets also vary in magnitude over time in the three Scenarios.

These features noted, as illustrated in Figure 3 on page 7, there are significant and growing increases in *real* disposable income. In the Maximum Case, these grow steadily over time as employment and real wages are increased over time. In the Medium Case, these rise from initial amounts and then fall back to the initial, substantial amounts by 2035. In the Minimum Case, the initial substantial amounts are sustained through this decade, but then erode back to negligible amounts by 2035.

Increased market incomes are derived from the positive effect on the economy. As Table 5 illustrates these are widespread through the economy. Positive effects are derived from (1) the direct and induced reductions in domestic price levels of lower natural gas and import prices on real household incomes that promote increased household consumption, and (2) the stimulus to the Canadian economy through exports of a strengthened US economy.[23] Associated increases in Canadian production further induce increases in business capital formation that promote increased construction and other production and lead to productivity increases in all sectors.

Positive effects in the Maximum Case are sustained for almost all sectors throughout the twenty-five years. Positive effects in social service sectors (health care, education and public administration) are mitigated by our assumption that impacts on government current spending are minimal.[24] In the Medium and Minimum Cases, impacts erode in all sectors over time.

Table 5 Real GDP Impact, By Major Sector, Canada

Real Gross Domestic Product at Basic Prices
average per cent impact

	Maximum		Medium		Minimum	
	2011-20	2021-35	2011-20	2021-35	2011-20	2021-35
Total	1.6	1.5	1.4	0.9	1.3	0.5
Goods	2.1	2.2	1.9	1.4	1.8	0.8
Services	1.4	1.2	1.3	0.7	1.1	0.3
Sector Detail						
Resource-Based	1.7	1.7	1.5	1.1	1.4	0.6
of which: Energy	1.2	1.2	1.1	0.7	1.0	0.4
Other	1.9	2.0	1.7	1.3	1.6	0.7
Cyclical Durables & Construction	2.4	2.6	2.2	1.7	2.0	0.9
Business-related Services	1.8	1.2	1.6	0.7	1.5	0.3
Transportation & Storage	2.6	3.3	2.4	2.2	2.2	1.2
Other Business Services	1.6	0.8	1.5	0.4	1.4	0.1
Consumer Goods & Services	1.7	1.6	1.5	1.0	1.4	0.6
Imputed Rent of Home Ownership	0.4	0.4	0.3	0.3	0.3	0.2
Other Consumer-related	2.2	2.1	2.0	1.3	1.8	0.7
Social Services	0.5	0.7	0.4	0.5	0.4	0.3

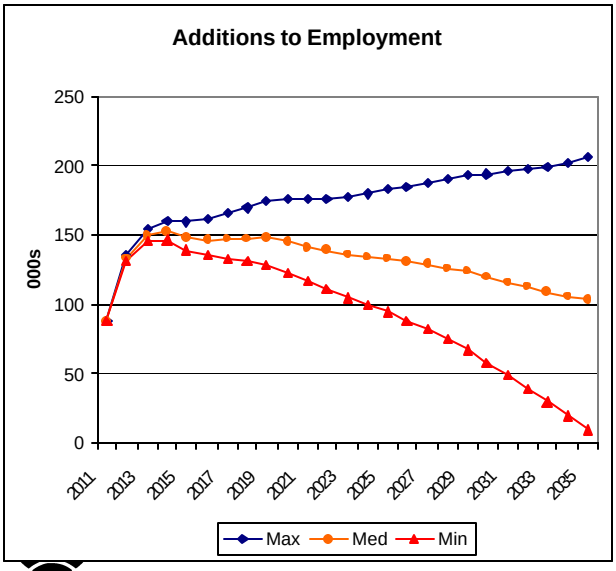
[23] See Figure 1 for an outline of the principal direct impacts.

[24] Increased consumer spending on health care and private education account for much of the increased social service GDP reported in the table.

The contribution of demand components to overall GDP growth varies over time and across scenarios. In the Maximum Case, increases in real consumption account for the dominant share of increased real demand throughout the projection, with net exports accounting for the second-most important impact. Over time, there is a shift from net exports to consumption. This reflects circumstances that mitigate the "pull" on the Canadian economy of a strengthened US economy. Increased employment, although partially offset by increased participation in the labour force, leads to a reduction in unemployment. Over time, this increases the positive effect on real wage rates. At the same time, initial cyclical effects on productivity are reduced and positive impacts erode. In combination, the initial reduction in unit labour costs of more than one per cent are reduced to 0.7 per cent by 2020, and by 2035, the net impact is to increase unit labour costs (+0.9 per cent). Although changes in these magnitudes are small, the effect of this is to erode the positive effects on demand from trade impacts while there is a weaker mitigating impact on consumer spending. There is a steady modest positive effect on business investment over the whole impact period.

In the Medium and Minimum Cases, initial-year impacts are the same as or very close to those of the Maximum Case, but the impacts vary over time. In the Minimum Case, consumption is again the major source of demand increase initially, but by 2035, impacts on consumption are negligible while net trade impacts remain positive at about the same scale as in initial years and they account for all of the positive overall GDP impacts at the end. Tightened labour markets have also led to positive effects on unit labour costs in later years, but these are smaller than in the Maximum Case. The Medium Case lies between the Maximum and Minimum Cases. In this instance, the contribution of net trade and consumption to overall GDP impacts is roughly the same (i.e., the contribution of net trade does not erode as it does in the Maximum Case, nor grow as it does in the Minimum Case). Contributions from business and government capital formation are positive in the Medium and Minimum Cases, but at smaller magnitudes than in the Maximum Case. The impact on government current spending is negligible in all three cases.

Figure 7 Employment Impacts: Canada

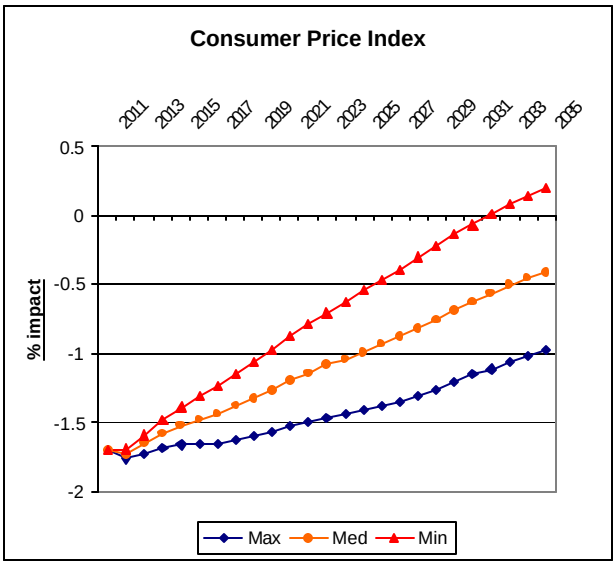


A summary of employment impacts is illustrated in Figure 7. Employment impacts, along with impacts on the overall Consumer Price Index, are key determinants of the impacts on real disposable income. The first-year impact on employment is about 87,000 (Full-Time Equivalent) jobs in all three cases. This grows to almost 207,000 in the Maximum Case, but erodes in the other two cases to lower amounts by 2035 (Medium to 103,000 and Minimum to only about 9,000). In all of the cases, impacts on employment in the goods-producing industries account for about one-

third of all impacts initially, with this proportion decaying to one-sixth to one-fifth by 2035.

The total employment additions in all three cases are initially equivalent to a 0.5 per cent increase over that of the Base Case in the first year, but rise to an amount equivalent to about 0.8 to 0.9 per cent through the middle of this decade. As a benchmark, this mid-decade per cent increase is close to the per cent increase expected for employment in 2012. Across the scenarios, the employment gains in goods producing industries are initially equivalent to about two-fifths of all employment increases, with this share reduced to one-fifth by 2035. The aggregate impact in services is biased downwards by assumptions that limit impacts in social services.

Figure 8 Impact on Consumer Prices



Another ("the" other) major influence on real disposable income effects is the change in consumer prices. As Figure 8 illustrates, there are significant reductions in overall consumer prices initially in all three scenarios. These effects erode over time as labour markets tighten and initial positive productivity changes dampen. In cases where the natural gas and import prices move back toward Base Case levels, the CPI also moves back to Base Case levels. In the Minimum Case, the CPI exceeds that of the Base Case by a small amount after 2031.

Table 6 reports effects on government balances. These are reported in nominal terms. Key influences include increased real economic activity and employment to provide increased tax and other revenues, offset at least partly by lower price, wage, and profit[25] levels. Also contributing to improved balances are reduced payments for Employment and Insurance and at the provincial and local government level, welfare (social assistance) payments. As should be clear from previous comparisons, these influences vary across the scenarios with positive and offsetting influences both eroding over time.

[25] Overall business profits are reduced by up to 4 per cent in nominal terms, reflecting substantially reduced returns in the oil and gas mining industry from reduced gas prices and a general lowering of price and cost levels. Arguably, as a major input to the oil sands, lowered natural gas prices will add significantly to returns in the oil sands, an influence that is not accounted for in these results.

Table 6 Impact on Government Balances

Government Balance (Net Lending) Impacts
($Mns, Nominal, average)

	2011-15	2016-20	2021-25	2026-30	2031-35
			Maximum Case		
Federal	$723	$1,247	$1,147	$1,079	$739
Provincial	-$2,336	-$3,655	-$6,446	-$9,959	-$14,409
Local	-$960	-$1,387	-$1,511	-$1,555	-$1,152
CPP/QPP	$310	$1,128	$2,086	$3,406	$5,399
			Medium Case		
Federal	$688	$1,018	$630	-$101	-$1,584
Provincial	-$2,199	-$3,067	-$4,923	-$7,132	-$9,926
Local	-$928	-$1,223	-$1,217	-$1,102	-$636
CPP/QPP	$300	$1,023	$1,743	$2,577	$3,640
			Minimum Case		
Federal	$684	$1,001	$687	-$125	-$2,220
Provincial	-$2,038	-$2,310	-$3,025	-$3,773	-$5,313
Local	-$898	-$1,068	-$930	-$656	-$125
CPP/QPP	$294	$950	$1,484	$1,911	$2,122

At the federal level, there are modest positive effects on the balance with small negative effects in the Minimum Case in the longer term. At this level, impacts on revenues are small negatives because reduced price levels reduce indirect taxes and negative nominal impacts on corporate incomes reduce corporate taxes. Both of these effects tend to offset the positive effects of increased real economic activity with attendant positive impacts on personal taxes.

Given these circumstances, the net positive effect on the federal government balance is accounted for mainly by reduced spending in all three scenarios. As expected, this reflects reduced payments for EI. Reduced overall price and wage levels also lowers nominal spending for transfers more generally (e.g., Old Age Security payments are indexed with the Consumer Price Index (CPI), which is lowered).[26] Public pension plans (CPP and QPP) benefit from increased employment (contributions) and reduced benefit payments, which are also indexed to the CPI. In the Minimum (and to some degree, the Medium) Case, small positive effects on the real economy and a return of price levels to the Base Case erode the spending reductions to virtually eliminate this "benefit" to the federal balance in later years.

The negative impact on local government balances is explained largely by reduced nominal receipts of their key revenues (property taxes). We estimate property values are reduced in nominal terms, reflecting the general lowering of price levels. Over time, as negative balance effects increase debt, increased interest costs add to the size of the annual deficits for local governments.

[26] For both the federal level and the other two levels of government, it may be recalled that we have assumed there is no change to nominal spending for wages and purchased goods and services. Were these to adjust to reduced general levels of wages and general prices, nominal spending would be reduced, with a positive effect on government balances.

As is the case for the federal government, provincial government revenues are highly sensitive to the positive effects of increased personal taxes. At the same time, spending on social assistance is reduced. Accounting for these influences only, we would expect small positive effects initially that continue over time. Impacts on corporate profits and indirect taxes, as outlined for the federal government, would result in negative impacts on other revenues, and would likely produce small overall negative effects on balances. However, as explained below, other results are significant negatives, resulting in an overall negative effect on provincial government balances.

- Reduced natural gas prices are estimated to lower royalty payments by large amounts ($1.9 billion in 2011 rising to $7.3 billion by 2035 in the Maximum Case) for provincial budgets taken as a whole. The return of natural gas commodity prices to the Base Case amount in the Minimum Case limits the royalty loss to a small $300 million in 2035. In the Medium Case, the loss in 2035 is $3.1 billion.

  We do not assess the implications for budgets of specific provinces in TIM, but the NEB Reference Case may be a useful indicator of where this would be important.[27] The budgets of Alberta and BC would likely be most severely impacted as the two jurisdictions account for the dominant share of total national gas production.[28] Judging from production, impacts would also be notable in Nova Scotia and Saskatchewan in the near term, but the NEB Reference Case projects rapidly declining levels of production in these two provinces over the next decade and beyond. Therefore, the reduction in royalties from lower gas prices will be swamped by the reduction from the decline in production.

- Over time, increased annual provincial deficits add to the size of the debt to produce annual increases in debt service costs. Notice that large royalty losses occur in all three scenarios in early years.

4.2 Provincial

As key factors in the effect on household incomes, the effect of lower natural gas prices is positive in each province/territory in each year of the impact when measured by impacts on real GDP and employment.

Seen as a contribution to overall Canadian impacts, the GDP effects in Central Canada, Alberta and BC dominate. In all cases, the effects in Ontario are disproportionately large (by a significant margin) when compared to the location of population, a feature that reflects the especially strong sensitivity of the province's economic structure to impacts of foreign trade, consumer spending on durables and business investment in machinery

[27] NEB, *Op Cit*., Table A4.2
[28] We have not accounted for differing royalty rates among the jurisdictions.

on manufacturing. GDP impacts in Alberta are slightly larger than would be indicated by population shares. Elsewhere impacts are smaller than is indicated by population shares.

Table 7 GDP Impacts by Province

Real Gross Domestic Product
average per cent impact in province

	Maximum		Medium		Minimum	
	2011-20	2021-35	2011-20	2021-35	2011-20	2021-35
Canada	1.6	1.5	1.4	0.9	1.3	0.5
Newfoundland	1.3	1.3	1.2	0.8	1.1	0.4
Prince Edward Island	1.0	0.8	0.9	0.5	0.8	0.2
Nova Scotia	1.2	1.0	1.0	0.6	1.0	0.3
New Brunswick	1.2	1.0	1.0	0.6	1.0	0.3
Quebec	1.7	1.7	1.6	1.1	1.5	0.6
Ontario	1.8	1.7	1.6	1.0	1.5	0.5
Manitoba	1.3	1.3	1.2	0.8	1.1	0.4
Saskatchewan	1.2	1.1	1.0	0.7	1.0	0.3
Alberta	1.4	1.2	1.3	0.8	1.2	0.4
British Columbia	1.3	1.1	1.2	0.7	1.1	0.3
Territories	1.6	1.4	1.4	0.9	1.3	0.4

Measured from the point of view of each province, there are positive effects everywhere. Impacts in the Maritimes are the smallest, with those in Central Canada the strongest across the three scenarios. Again, this reflects the relatively strong role of manufacturing in Central Canada's economic structure.

Table 8 Employment Impacts by Province

Employment
average 000s

	Maximum		Medium		Minimum	
	2011-20	2021-35	2011-20	2021-35	2011-20	2021-35
Canada	114.1	144.4	102.8	94.2	94.4	52.6
Newfoundland	1.5	1.7	1.3	1.1	1.2	0.6
Prince Edward Island	0.4	0.4	0.3	0.3	0.3	0.1
Nova Scotia	2.7	3.0	2.4	1.9	2.3	1.1
New Brunswick	2.3	2.7	2.0	1.8	1.9	1.0
Quebec	38.7	46.2	35.2	30.3	32.7	17.4
Ontario	67.1	79.9	61.1	52.5	56.7	29.7
Manitoba	4.9	7.2	4.4	4.7	4.1	2.6
Saskatchewan	3.3	4.3	3.0	2.8	2.8	1.5
Alberta	16.3	22.1	14.8	14.3	13.7	7.7
British Columbia	17.4	22.2	15.8	14.3	14.5	7.7
Territories	0.3	0.4	0.3	0.4	0.3	0.4

The impacts by province on overall employment closely parallel that of the impacts on GDP, with impacts in Central Canada, Alberta and BC accounting for more than 90 per cent of the total.[29] Seen from each province's perspective, although positive, the weakest

[29] TIM reports *national* employment on a Labour Force Survey basis, which excludes employment in the Territories. Impacts in the Territories are modeled outside of this framework in TIM.

per cent impacts are also in Atlantic Canada, with the strongest in Central Canada in all the scenarios.

Comparison of per cent impacts in each province for GDP and employment indicates that productivity impacts are positive in each jurisdiction, a feature that would be consistent with *a priori* expectations about improvement in real household incomes. Increased employment in TIM leads to increased participation in the labour force, which partially offsets employment gains; however, the unemployment rate is reduced in all provinces except for PEI and Saskatchewan in all the scenarios. Reductions in employment gains in later years in the Medium and Minimum Cases are smaller than in the Maximum Case.

5 Qualifications to Results

Through direct effects on consumer, business and government spending for natural gas, and effects from a strengthened US economy, the reduction in North American natural gas prices yields significant, positive effects for the real incomes of Canadian households. As the three scenarios demonstrate, when measured over the next twenty-five years, the magnitude and durability of the benefits could vary widely. We conclude that impacts in the recent past and near term future may be reasonably described as "major" because shale gas production has had a significant impact on Continental gas prices and it is likely to be durable for at least the near term. In the longer term, interactions between demand and supply effects could well lead to a significant shrinkage of the gas price reduction, in which case the positive effects would likely be judged to be relatively "temporary". On the other hand, extension of the technology throughout production basins in North America could increase the price reduction impact, making the major positive effects generationally durable.

Not included in this assessment is the extent to which the shale technology may lead to major increases in domestic gas production. Assumptions in this area would centre on the amount of additional investment in gas-directed drilling, and if additional production is to be exported, development of LNG export terminals and associated pipelines. Given the increases in capacity, assumptions would then centre on the amount of increased gas produced each year and related revenue and costs of operating transportation (including terminal) systems. Impacts could well consider some "negative" offsets if for example, frontier or conventional gas development (including pipelines) were considered a part of the Base Case and were reduced because of an extended period of lower gas prices. Overall effects on the Canadian economy and household real incomes might not be affected in a major way, but provincial impacts would likely be altered significantly.

Assumptions we have made about fiscal responses and exchange and interest rates could be altered. One might assume that increased deficits could lead to reduced government spending, where our results suggest this would be mainly concentrated at selected provincial levels. If so, this would reduce the magnitude of the impacts we have reported by modest amounts. In contrast, a possible modest depreciation of the Canadian currency,

and extended currently low interest rates for a longer time into the future, would provide a boost to the size of the positive effects we have reported.