Natural Gas, Unnatural Prices

How SNG and Artificially High Natural Gas Prices Will Affect Indiana's Economy

SCHOOL OF PUBLIC AND ENVIRONMENTAL AFFAIRS
INDIANA UNIVERSITY

KELLEY SCHOOL OF BUSINESS
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RESEARCH TEAM LED BY

Barry M. Rubin, Ph.D.
Professor and Chair, Policy Analysis and Public Finance Faculty
School of Public and Environmental Affairs
Indiana University

Timothy F. Slaper, Ph.D.
Director of Economic Analysis
Indiana Business Research Center
Kelley School of Business
Indiana University

ON BEHALF OF
Vectren Corporation

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CONTACTS FOR THIS REPORT (BASED ON AUTHORSHIP)

- Barry M. Rubin, Ph.D.
  Professor and Chair, Policy Analysis and Public Finance Faculty, School of Public and Environmental Affairs

- Timothy F. Slaper, Ph.D.
  Director of Economic Analysis, Indiana Business Research Center, Kelley School of Business

- Jerry N. Conover, Ph.D.
  Director, Indiana Business Research Center, Kelley School of Business

ADDITIONAL CONTRIBUTORS

- David Warren, Ph.D. Student and Graduate Research Assistant
- Zachary Wendling, Ph.D. Student and Graduate Research Assistant

With the assistance of Madison Busker, MPA/MSES Graduate

School of Public and Environmental Affairs
Indiana University
1315 E. 10th Street
Bloomington, IN 47405

812-855-4556

Indiana Business Research Center
Kelley School of Business
100 S. College Avenue, Suite 240
Bloomington, IN 47404

812-855-5507

Executive Summary

This report presents estimates of the Indiana employment and economic output effects of artificially high natural gas prices due to the production of substitute natural gas (SNG). In order to ensure the profitability of the SNG investment when natural gas prices are below SNG prices or, conversely, to ensure that consumers are able to share in the profits in the event of large increases in conventional natural gas prices, the agreement between Indiana Gasification—the company building and operating the SNG plant—and the Indiana Finance Authority (IFA) calls for 100 percent of any economic losses or 50 percent of any gains from the production to pass through to natural gas customers.

The recent technological advances in natural gas extraction were not foreseen at the time of the project's conception. Current forecasts of natural gas prices through 2025 suggest that the IFA will incur heavy losses under the contracted pricing scheme. These losses will act like an excise tax applied to natural gas customers. The surcharge is approximately $895 million, or $110 million per year, from 2018 to 2025. All values, unless stated otherwise, are in constant 2011 dollars.

Researchers at Indiana University's School of Public and Environmental Affairs (SPEA) and the Indiana Business Research Center (IBRC) at the Kelley School of Business measured the expected impact of the SNG plant construction, operations and the SNG loss tax. The research team's analysis was generous on the positive side of the SNG plant job creation and economic impact ledger and was conservative in terms of the negative effects of the SNG surcharge.

The SNG plant *construction* will have a positive effect on Indiana's state gross domestic product (GDP) and employment. From 2013 through 2016, the cumulative positive effect on state GDP is estimated to be $738 million (averaging $185 million annually), and it is expected to increase employment statewide, on average, by about 700 jobs annually. Once the plant is built and operating, however, the economic effects turn negative.

The Indiana employment estimates for the SNG plant operation and additional coal mining are debatable. Even still, the research team folded in estimated economic and employment effects of the SNG plant operation. Once operational, the SNG plant is expected to employ 200 full-time workers. If Indiana coal is used, there will be an expected 300 Indiana coal mining jobs added to the Hoosier workforce.

The research team considered three scenarios to estimate the effects of elevated natural gas prices on the Indiana economy. Those scenarios include applying the surcharge, or loss tax, to three different combinations of consumers: only residential customers, residential and commercial customers, and all customer types—residential, commercial and industrial.

The second scenario—residential and commercial customers—is the most likely scenario because the agreement calls for SNG losses to pass through to Indiana customers that purchase gas directly from their utilities. Residential customers and a vast majority of commercial customers meet this criterion and will, therefore, be subject to the SNG loss tax. Larger commercial, and most industrial, customers are exempt.

The net economic effects from 2017 to 2025, when the negative effects of the SNG surcharge are added to the benefits of jobs created at the SNG plant and at Indiana coal mines, are as follows:

Scenario 1: Surcharge Borne by Residential Customers Only

- Indiana GDP is estimated to be reduced by a cumulative total of almost $1.9 billion, or approximately $207 million annually.
- Annual employment is expected to be about 830 full-time jobs lower on average than it would have been without the SNG surcharge.

Scenario 2: Surcharge Borne by Residential and Commercial Customers

- In this scenario, Indiana GDP is reduced by a cumulative total of $1.4 billion, or approximately $150 million annually on average.
- Annual employment is expected to be about 1,800 lower on average.

Scenario 3: Surcharge Borne by Residential, Commercial and Industrial Customers

- Because each customer type bears a relatively small portion of the surcharge, this scenario has the least effect of all three, reducing Indiana GDP by a cumulative total of $1.2 billion, or approximately $135 million annually.
- Annual employment is expected to be about 1,700 lower on average.

The table below presents the net cumulative effects—positive in the case of SNG plant construction and negative in the case of the SNG loss tax—from 2013 through 2025.

Net Cumulative Change from 2013 through 2025 in GDP and Employment

2013 through 2025 **Net Cumulative Change Relative to the "Plant-Not-Built" Baseline**	**Change in GDP** (in 2011 dollars)	**Change in Employment** (person-years)
Scenario 1: Residential only	-$1.125 billion	-4,660
Scenario 2: Residential and commercial	-$634 million	-13,630
Scenario 3: All customer types	-$489 million	-12,490

At the time of the project's conception, when natural gas prices were much higher than they are today, the SNG plant seemed to be a win-win for all Hoosiers. With the drop in conventional natural gas prices, the SNG plant and the projected losses that Indiana consumers will absorb creates winners and losers. The winners are workers in coal mining and SNG production. The losers are workers predominately in retail and manufacturing. In broad strokes, one might say that mining and SNG production jobs come at the expense of jobs in other sectors.

Background

By 2007 and 2008, natural gas prices had doubled from the beginning of the decade. Indiana, with its abundant coal, considered energy source alternatives. The elevated natural gas prices made the technology to convert Indiana's coal resources into substitute natural gas (SNG) economically viable. As a result, the State approved the construction of a plant to produce and distribute SNG. Subsequently, in late 2010, the Indiana Finance Authority (IFA) entered into a 30-year agreement with Indiana Gasification (IG)—a subsidiary of Leucadia National Corporation—to purchase 38 million MMBTU[1] of SNG annually at a price based on 2008 market conditions and estimates of natural gas market conditions in the future (as reflected in natural gas futures and price forecasts of the Energy Information Administration). In order to ensure the profitability of the SNG investment when natural gas prices are below SNG prices or, conversely, to ensure that consumers are able to share in the profits in the event of large increases in natural gas prices, the agreement calls for 100 percent of any economic losses or 50 percent of any gains from the production and distribution of the SNG facility to pass through to Indiana customers.

The recent technological advances in natural gas extraction were not foreseen at the time of the project's conception. The adoption of new natural gas extraction methods have resulted in a surge in supply and a steep drop in prices. Independent projections of future natural gas market prices through 2025 suggest that IFA will incur heavy losses under the contracted pricing scheme. These losses, referred to hereafter as the "SNG loss tax," will act like an excise tax applied to smaller natural gas customers—predominantly residential and small business customers—pursuant to the state's agreement with the SNG plant developer. The Vectren Corporation estimates that this tax will total approximately $1.1 billion (current dollars) or about $895 million (constant 2011 dollars) between 2017 and 2025. Thus, in round numbers, the annual SNG tax will total about $110 million to the Indiana economy.

The question then becomes: What are the employment and economic output effects of artificially high natural gas prices?

This report presents the answers to this question under several different assumptions and scenarios. The research to address these questions was conducted by the School of Public and Environmental Affairs (SPEA) at Indiana University and the Indiana Business Research Center (IBRC) at the Indiana University Kelley School of Business.

Research Method

Over the past three years, the SPEA research team has created a modeling framework for evaluating alternative energy development and management scenarios for the state of Indiana. As part of this effort, the SPEA team constructed an econometric, multi-equation, economic and energy model of Indiana. The Indiana energy model consists of a series of econometrically estimated relationships describing the state economy with an emphasis on the connection between energy demand, energy prices and economic activity. This structure translates energy price changes and other energy demand or supply scenarios into estimated effects

[1] Natural gas units are measured in terms of millions of BTUs, abbreviated MMBTU.

on Indiana employment, output, wages, personal income, unemployment and the labor force. The model was used to estimate the economic impact of artificially high natural gas prices under several assumptions, for example, the SNG loss tax is applied to residential customers only or the SNG loss tax is applied to all types of natural gas consumers (residential, commercial and industrial) alike.

The model is flexible. It features four energy customer sectors—residential, commercial, transportation and industrial—that allow the researchers to directly apply the SNG loss tax to the targeted customers while measuring the economic ripple effects of the SNG loss tax on all sectors of the Indiana economy. For this particular analysis, the transportation sector is not affected by changes in natural gas prices because transportation currently consumes such a small volume.

The SNG loss tax is a function of future conventional natural gas prices and the cost of producing substitute natural gas from coal. The research team used projections of natural gas prices based on Energy Information Administration forecasts of natural gas production and prices, as well as natural gas futures prices on the New York Mercantile Exchange.

While the SNG loss tax will burden Hoosier consumers and reduce their discretionary income, the SNG plant will exert a countervailing employment effect that will somewhat offset those negative effects. No fair and balanced accounting of the net employment picture can ignore that building and operating the SNG plant, as well as mining the coal for the plant, will add jobs to Indiana's economy. The precise number of jobs added—both construction and employees at the plant and at the coal mines—may be in dispute. Some sources have placed the number of jobs at peak during the construction phase at 1,000, but there is no detail about whether these are full person-year jobs like the payroll clerk or short-term jobs like the heavy crane operator. A short-term job has less of an impact than a person-year job. In addition, the SNG plant will add to Indiana's stock of private fixed investment (PFI) and the investment flows will augment Indiana's GDP. The research team added the portion of the tangible physical capital flows, based on the regional purchase proportion from the IMPLAN modeling system, expected to be sourced in Indiana, namely 33 percent. This investment will not only add to Indiana's GDP but also to jobs, predominantly in manufacturing.

There are also SNG operational jobs and, if the coal is sourced in Indiana, coal mining jobs too. In order to account for all the potential gains in employment from the plant, the largest economically defendable estimate of the job gains were added to the model. In this way, the model would produce the most conservative estimate of the net negative impacts, if there were indeed net negative impacts.

The research team used the estimate of 800 full-time jobs for each of the four years of construction. Thus, the construction phase was assumed to create 3,200 person-year jobs. These jobs directly involved in construction, in turn, generate additional employment along the supply chain—the producers of rebar, concrete and piping, for example—and additional jobs in the region and state as those workers spend their new paychecks at auto repair centers, bait shops, doctor's offices and restaurants in their communities. The model estimates these ripple effect jobs for each year. Another type of analysis using input-output relationships that also estimates economic ripple effects is discussed in the IMPLAN sidebar.

The researchers assumed that the SNG plant would require 200 full-time workers. Rather than challenge the assumption that all the coal would be sourced from Indiana mines, the researchers again took the conservative path and assumed that 300 Indiana coal mining jobs would be attributed to producing coal for conversion to SNG. These jobs also produce economic ripple effects that are captured by the model.

It is extremely important to note that these assumed job creation values used in the model are the upper boundaries to the number of jobs, both operational and construction, expected to be realized in Indiana. There will be some job leakage to neighboring states. Given the location of the SNG plant, many operations workers will come from Kentucky and spend their paychecks there. Given the nature of the SNG construction and that many of the components required for the facility are highly specialized, many construction workers and the components will not be sourced in Indiana. To reiterate, the reason that the research team used the potentially overstated job additions was to produce net job and state output estimates that were conservative and unassailable.

The Three Scenarios

The model was calibrated using historical economic and energy statistics and a baseline forecast of economic growth, demographic change and energy usage. The baseline forecast is based on long-term demographic and productivity trends and no change in energy or economic policy. In other words, the baseline is the "plant-not-built" scenario. Then, after the baseline projections were established, three scenarios reflecting different policy changes were compared against the "no policy change" baseline. Those three scenarios include:

1) The SNG tax (about $110 million annually) applies to only residential customers.

2) The SNG tax applies to residential and commercial customers.

3) The SNG tax applies to all customer types—residential, commercial and industrial.

In the model, the SNG tax is applied to customers by dividing the total annual surcharge of approximately $110 million by the baseline forecast natural gas consumption for the particular year to get a MMBTU, or per-unit, tax for that customer type. Thus, the surcharge for residential customers averages about $0.75 MMBTU on an average base residential cost of a little over $10 per MMBTU. Scenario 2 applies the tax to both residential and commercial customers, with the per-unit surcharge of about $0.48 per MMBTU. For the scenario that applies the tax to all customer types, the per-unit surcharge is about $0.14 per MMBTU irrespective of the type of customer. It is important to note that the per-unit base cost of natural gas across customer types varies considerably. The base cost for industrial customers, for example, is in the range of $5.00 to $6.30 per MMBTU from 2017 to 2025. Residential customers pay a higher unit price to compensate for the extensive infrastructure required to deliver natural gas to hundreds of thousands of homes over tens of thousands of square miles.

The model also adjusts the per-unit tax each year based on the previous year's consumption. The initial per-unit tax is based on the expected consumption and the annual surcharge total, but the per-unit tax will change consumer behavior. Consumers will use less as the price increases. It is likely, therefore, that the surcharge collections for any given year will be different from the annual targeted collection. The difference, either the shortfall or the excess, is then applied to the following year as either an increase in the tax (in the case of the shortfall) or a decrease in the tax (in case of collections exceeding the targeted amount). Finally, the Consumer Protection Reserve, a sum of money to insulate consumers from high natural gas prices, is applied and completely depleted in the year 2017. In 2017, therefore, there is little effect due to the SNG loss tax.

The model works to establish a new equilibrium in the supply and demand for energy across all sectors based on the new energy policy, in this case, the three policies whereby the SNG surcharge is *directly* paid by three different combinations of customers. The term "directly" is emphasized because the less obvious but more important question is related to the economic ripple effects of the surcharge. That is: in Scenario 1, to what extent will the reduced discretionary spending of residential customers (as a result of paying more for natural gas) affect employment, worker earnings and economic growth in the state? In Scenario 3, to what extent will the reduced discretionary spending of residential customers, together with the higher input costs of commercial and industrial enterprises, affect the state's economic growth, employment and worker earnings?

Based on the residential customer demand responsiveness to changes in natural gas prices, they will buy either a lot or just a little less natural gas. Based on how commercial customers respond to a slight drop in retail sales due to the dip in discretionary spending by residential consumers and, in the case of scenarios 2 and 3, based on commercial customers' change in natural gas demand, they too will purchase less natural gas. Industrial customers may respond to an increase in a key production input like natural gas by either one or a combination of the following: increasing their output prices, reducing output quantities, reducing their workforce or reducing other costs like worker compensation. The model balances all of these behavioral changes that occur as a result of the energy price shock associated with the SNG surcharge and calculates a new equilibrium.

The final step is to compare the new equilibrium set of employment and output for each scenario against the baseline forecast. The difference between the two—the baseline versus the scenario—indicates the extent of the economic impact of the SNG surcharge. The economic impact is presented as both an average annual value and an aggregated total for all years up to and including 2025, all denominated in 2011 constant dollars.

Results

The economic effects of the SNG surcharge are not trivial.

The SNG plant construction will add to Indiana's GDP and employment. From 2013 through 2016, the cumulative positive effect on state GDP is $738 million (averaging $185 million annually) and is expected to increase employment statewide on average by a net 700 jobs. Most of the job gains will be the SNG plant construction jobs and the manufacturing jobs associated with the production of materials for building the plant. The expected positive effects during the construction phase are the same across all three scenarios because the scenarios change the type of customer bearing the burden of the SNG loss tax once the plant is in operation. Once the SNG loss tax is imposed, however, the tables are turned.

The total aggregated surcharge is approximately $895 million and that is estimated to reduce the state's GDP by almost $1.9 billion when the surcharge is in effect from 2017 through 2025, averaging about $207 million annually (in constant 2011 dollars) for Scenario 1. This scenario results in the largest GDP impact because a relatively large per-unit charge is levied on consumers, draining their discretionary income. Commercial sector natural gas consumption is also tied to the residential market and, as the average Indiana consumer claws back on spending, the retail sector is expected to suffer, losing an average of 2,000 jobs annually. The net employment effects for all sectors for Scenario 1 is an annual loss of about 830 jobs on average, or, in total, nearly 7,500 jobs measured in person-years from 2017 through 2025. The job losses are greatest in the years immediately following the levy of the loss tax. Over time, the economy regains its footing and the annual job loss by 2025 is expected to be about 300.

Scenario 2 is the most likely, affecting all residential customers and nearly all but a handful of immense commercial customers. It is estimated to reduce the state's GDP by as much as $1.4 billion, or averaging over $150 million annually from 2017 through 2025. While the effect on GDP is lower than with Scenario 1 (residential only), it has a greater effect on employment, with an expected loss of jobs of about 1,800 annually from 2017 through 2025. Like Scenario 1, job losses really take hold in 2018, but unlike the residential customer only scenario, the net annual job loss in 2025 is expected to be nearly 1,950, with a hit on GDP approaching $160 million.

Scenario 3—where the tax affects all customers—is estimated to reduce the state's GDP by more than $1.2 billion, or averaging almost $135 million annually from 2017 through 2025. Here, the SNG per-unit tax is relatively small and is spread across all customer types (the largest customer type is industrial, which accounts for 79.5 percent of the state's consumption). Employee earnings across all sectors of the economy would be expected to drop nearly $2 billion through 2025. Employment, on average, is expected to be about 1,700 lower than the baseline on an annual basis, but the effect on jobs ramps up over time from 700 fewer jobs in 2017 to more than 2,150 fewer jobs in 2025.

A summary of the general economic and energy consumption effects of the three scenarios is presented in **Table 1**. Appendix A presents more detailed results, including the effects on employment and earnings by sector.

Table 1: The Economic Consequences of Three Surcharge Scenarios, 2017 to 2025

2017 to 2025 Cumulative and Percent Change Relative to the "Plant-Not-Built" Baseline	Scenario 1: Residential Only		Scenario 2: Residential and Commercial		Scenario 3: All Customer Types	
	Change	Percent	Change	Percent	Change	Percent
Total GDP (in millions)	-$1,864	-0.06%	-$1,372	-0.04%	-$1,228	-0.04%
Total earnings (in millions)	-$608	-0.03%	-$2,759	-0.12%	-$1,895	-0.08%
Total non-wage income (in millions)	-$555	-0.09%	$293	0.05%	$437	0.07%
Total income (in millions)	-$1,163	-0.04%	-$2,465	-0.08%	-$1,458	-0.05%
Commercial natural gas consumption, billion BTU	-11,545	-1.52%	-7,395	-0.97%	-1,804	-0.22%
Industrial natural gas consumption, billion BTU	6,581	0.05%	-8,459	-0.24%	-3,286	-0.14%
Residential natural gas consumption, billion BTU	-27,033	-1.96%	-17,353	-1.26%	-4,056	-0.29%

Estimating the SNG Plant Economic Ripple Effects using IMPLAN

The results that were modeled in the multi-equation, equilibrium framework included the positive employment effects associated with building and operating the new SNG facility. The SPEA model is dynamic and multi-year, coefficients are not fixed and the economic relationships are not static. This model captured the economic and employment ripple effects throughout the Hoosier state and, more significantly, captured the net results of the interaction between different sectors. Put bluntly, there are winners and losers in the construction and operation of the SNG plant. While the state was assumed to add some 800 construction jobs for four years and another 500 jobs annually in plant operations and coal mining, these jobs, one might say, come at the expense of jobs in other sectors, most notably in retail and, depending on the types of energy consumers the tax will affect, manufacturing and services. The great advance in using the multi-sector, equilibrium model is that it identifies both the winners and the losers.

Another modeling approach uses input-output (I-O) relationships to estimate the effects of an economic event like a plant opening or closing, or an entity like a university or firm. The IMPLAN model uses fixed coefficients and static economic relationships for one-year snapshots. Despite these limitations, IMPLAN is one of the leading software, data and modeling packages that uses the I-O framework to estimate economic ripple effects of an economic event or entity. IMPLAN and other I-O models have the advantage of providing economic effects at a relatively high level of industry detail and the results can specify which ripple effects are due to the supply chain (indirect effects) and due to worker's paychecks (induced effects).

The IMPLAN model requires person years in order to estimate the total employment and output impact of the construction and, moreover, requires a year-by-year value of the number of full-time construction workers. Although the typical construction project headcount starts small, ramps up to peak and tails off, the IBRC used 800 full-time jobs for each of the four years in the construction phase from 2013 through 2016 in order to generate the most generous employment impact estimates. Giving the high job impact claims the benefit of the doubt, there will be 3,200 person-year jobs directly involved in construction. Along the supply chain—the producers of rebar, concrete and piping, for example—there will be an additional "indirect" 1,200 person-year jobs and all those new paychecks will be responsible for an additional "induced" 1,760 person-year jobs in the worker communities—for example, auto mechanics, bait shops, doctor's offices and short-order cooks. All told, the construction of the plant is estimated to support more than 6,160 person-year jobs in the state.

Once the plant is producing SNG, the plant operations and mining Indiana coal will also add jobs. The precise number of jobs during the operation phase is an open question because it is not certain whether Indiana coal will be competitively priced. That said, using the regional purchase proportions of the IMPLAN model, and assuming that the plant will employ 200 direct full-time workers, the SNG plant supply chain is expected to produce 430 indirect jobs, mostly in coal mining, with an additional 515 jobs induced in the workers' communities. In total, there will be an estimated 1,145 jobs attributed to the presence of the SNG plant. (The additional 300 mining workers that the SPEA model included would, in the IMPLAN framework, double count the new mining jobs because the entire point of the IMPLAN modeling approach is to count the new jobs in the supply chain. Coal is the dominant commodity in the supply chain for SNG.)

These IMPLAN-generated estimates are the upper limits to the number of jobs, both operational and construction, that are expected to be realized due to the SNG plant. There are several reasons for this, but the most important are: 1) given the location of the plant, there will be a greater than average number of jobs—both construction and operating—that escape into neighboring Kentucky, and 2) many of the components required for the SNG facility are highly specialized and will not be sourced in the state. Based on typical construction projects, the IMPLAN model uses average regional purchase proportions of components sourced in-state. For the typical industrial plant, the proportion of equipment and construction materials expected to be sourced in Indiana is 0.33. An SNG plant is not a typical construction project and the proportion of economic activity based in Indiana will be, most likely, lower than 0.33. Without a detailed budget of construction components, a more exact estimate of the economic ripple effects in the region surrounding Rockport and the state is not possible, but it is unlikely that the 7,700 person-year jobs for the construction and the 1,145 jobs annually for the operation of the plant will be realized.

The economic effects are not evenly distributed across sectors. Retail employment, for example, is the sector hard hit in both Scenarios 1 and 2, while manufacturing bears a disproportionate share of the employment loss in both Scenarios 2 and 3. However, there are a few positive impacts. For example, earnings in the mining sector are expected to be $50 million greater annually and mining employment is expected to be 350 greater, on average, annually for Scenario 2. **Table 2** presents a snapshot of the employment effects by economic sector in 2025 to show that the effects are not evenly distributed. (2025 is a representative year to show the effects by industry super-sector.)

Table 2: Employment Effects for Three Surcharge Scenarios by Super-Sector, 2025 Snapshot

2025 Employment Change Relative to the Baseline	Scenario 1: Residential Only		Scenario 2: Residential and Commercial		Scenario 3: All Customer Types	
	Jobs	Percent	Jobs	Percent	Jobs	Percent
Construction employment	187	0.05%	53	0.01%	-920	-0.24%
Farming employment	-62	-0.18%	-357	-1.02%	167	0.47%
Finance, insurance, and real estate employment	62	0.02%	784	0.26%	-110	-0.04%
Government employment	97	0.02%	714	0.14%	-288	-0.06%
Manufacturing employment	185	0.02%	-2,569	-0.34%	-1,684	-0.22%
Mining employment	297	5.06%	369	6.28%	362	6.17%
Retail employment	-2,003	-0.60%	-1,324	-0.40%	177	0.05%
Services employment	624	0.03%	129	0.01%	13	0.00%
Transportation and utilities employment	274	0.13%	237	0.12%	139	0.07%
Wholesale employment	53	0.04%	17	0.01%	-12	-0.01%
Total employment	**-285**	**-0.01%**	**-1,949**	**-0.04%**	**-2,156**	**-0.05%**

The SNG plant, at the time of the project's conception, was to use Indiana coal and save Indiana customers money on their energy bill. Everybody wins. With the drop in conventional natural gas prices, the SNG plant and the projected losses that Indiana consumers will absorb, creates winners and losers. The winners are workers in coal mining and SNG production. The losers are workers predominately in retail and manufacturing, as **Table 2** shows. In broad strokes, one might say that mining and SNG production jobs come at the expense of jobs in other sectors.

Table 3 presents the net impact of the SNG plant—a positive for the state while the facility is being constructed—and the subsequent negative effects of elevated natural gas prices during plant operation for each of the three scenarios from 2013 through 2025.

Table 3: Net Cumulative Change from 2013 to 2025 in GDP and Employment

2013 to 2025 **Net Cumulative Change Relative to the "Plant-Not-Built" Baseline**	**Change in GDP** (in millions of 2011 dollars)	**Change in Employment** (person-years)
Scenario 1: Residential only	-$1,125	-4,660
Scenario 2: Residential and commercial	-$634	-13,630
Scenario 3: All customer types	-$489	-12,490

Additional tables presenting the cumulative effects for all three scenarios over the entire 2013 through 2025 time period, together with additional effects by sector, are presented in Appendix A.

Conclusion

This report presents the expected employment, earnings and economic output effects associated with the higher cost substitute natural gas. Because SNG will be more expensive than conventional natural gas, Indiana consumers will be assessed a surcharge. The SNG surcharge—which acts like a tax on consumers of natural gas—is estimated to have a material effect on the Hoosier economy.

At the time on the project's conception, the precipitous drop in conventional gas prices was not foreseen. Even as the agreement with Indiana Gasification was being sealed, natural gas prices were on the decline. The adoption of new natural gas extraction methods have resulted in a surge in supply and a steep drop in prices. Independent projections of future natural gas market prices through 2025 suggest that IFA will incur heavy losses under the contracted pricing scheme. Between 2017 and 2025, these losses will total approximately $1.1 billion (current dollars) or about $895 million in constant 2011 dollars.

In round numbers, the annual SNG tax on Indiana customers will total about $110 million. If applied to only residential customers, the drop in annual GDP when the plant is in operation is expected to be $207 million annually and employment will drop by an average 830 (including the jobs gained by workers operating the SNG plant). The net estimated cumulative effects over the entire planning horizon, 2013 through 2025, that combines the benefits of the plant construction with the negative impact of the surcharge, is a loss of 4,460 person-year jobs and a GDP decline of a little over $1.1 billion.

The scenario that applies the SNG tax to residential and commercial customers is estimated to reduce the state's GDP by as much as $1.4 billion—averaging about $150 million annually from 2017 through 2025. Employment, on an annual average, is expected to be about 1,800 lower than the "plant-not-built" baseline. The net estimated cumulative effects for this, the more likely scenario, from 2013 through 2025, that includes the benefits of the plant construction as well as the negative effects of the tax, is a loss of 13,360 person-year jobs and a GDP decline of over $600 million.

If the tax is applied to all customers alike, the average annual drop in GDP is expected to be $136 million and employment will drop by more than 1,700 even when the expected job gains by workers operating the SNG plant and mining the coal for gasification are included. The net estimated cumulative effects for this scenario, over the entire planning horizon of 2013 through 2025, that combines the benefits of the plant construction as well as the negative effects of the tax, is a loss of 12,490 person-years jobs and a GDP decline of nearly $500 million.

At the time of its conception, the SNG plant was a win-win for all Hoosiers. However, as natural gas prices have fallen and are expected to remain low for the foreseeable future, the SNG plant and the projected losses for which Indiana consumers will have to pay, creates winners and losers. The winners are workers in coal mining and SNG production. The losers are workers predominately in retail and manufacturing. It is not a stretch to say that coal mining and SNG production jobs come at the expense of jobs in other sectors.

Appendix A: Detailed Results

Table A-1: SNG Loss Tax Borne by Residential Customers Only

Scenario 1: Residential Only

Year	SNG Surcharge per MMBTU	Corresponding Percent Increase in Residential Natural Gas Price over Baseline
2017	$0.04	0.40%
2018	$0.78	8.21%
2019	$0.76	7.87%
2020	$0.67	6.90%
2021	$0.81	7.99%
2022	$0.77	7.38%
2023	$0.77	7.22%
2024	$0.73	6.72%
2025	$0.68	6.23%

Table A-2: SNG Loss Tax Borne by Residential and Commercial Customers

Scenario 2: Residential and Commercial

Year	SNG Surcharge per MMBTU	Corresponding Percent Increase in Residential Natural Gas Price over Baseline	Corresponding Percent Increase in Commercial Natural Gas Price over Baseline
2017	$0.02	0.26%	0.30%
2018	$0.51	5.34%	6.11%
2019	$0.48	5.01%	5.73%
2020	$0.44	4.47%	5.12%
2021	$0.51	5.08%	5.80%
2022	$0.50	4.74%	5.40%
2023	$0.49	4.57%	5.21%
2024	$0.47	4.30%	4.90%
2025	$0.43	3.94%	4.49%

Table A-3: SNG Loss Tax Borne by All Customer Types

Scenario 3: All Customer Types

Year	SNG Surcharge per MMBTU	Corresponding Percent Increase in Residential Natural Gas Price over Baseline	Corresponding Percent Increase in Commercial Natural Gas Price over Baseline	Corresponding Percent Increase in Industrial Natural Gas Price over Baseline
2017	$0.01	0.08%	0.09%	0.15%
2018	$0.15	1.64%	1.87%	3.07%
2019	$0.14	1.46%	1.67%	2.73%
2020	$0.13	1.34%	1.54%	2.49%
2021	$0.15	1.45%	1.66%	2.65%
2022	$0.14	1.37%	1.56%	2.45%
2023	$0.14	1.27%	1.45%	2.25%
2024	$0.13	1.23%	1.39%	2.15%
2025	$0.12	1.08%	1.23%	1.88%

Table A-4: Comparing the Effects of the SNG Loss Tax Applied to Three Sets of Users, 2025 Snapshot

2025 Change Relative to the "Plant-Not-Built" Baseline	Scenario 1: Residential Only		Scenario 2: Residential and Commercial		Scenario 3: All Customer Types	
	Change	Percent	Change	Percent	Change	Percent
GDP per capita (2011 dollars)	-$24	-0.04%	-$23	-0.04%	-$15	-0.03%
Average income per capita (2011 dollars)	-$13	-0.03%	-$40	-0.08%	-$30	-0.06%
Average annual wage (2011 dollars)	-$2	0.00%	-$46	-0.08%	-$43	-0.07%
Total employment	-285	-0.01%	-1,949	-0.04%	-2,156	-0.05%

Table A-5: Comparison of the Cumulative Earnings Effects of the Three Scenarios during SNG Plant Operations, 2013 to 2025

2013 to 2025 Cumulative Change Relative to the "Plant-Not-Built" Baseline	Scenario 1: Residential Only		Scenario 2: Residential and Commercial		Scenario 3: All Customer Types	
	Change	Percent	Change	Percent	Change	Percent
Construction earnings	$100,409,899	0.05%	-$53,706,816	-0.02%	-$291,234,902	-0.13%
Farming earnings	$0	0.00%	$0	0.00%	$0	0.00%
Finance, insurance, and real estate earnings	-$54,730,215	-0.03%	-$1,042,663,684	-0.49%	-$413,467,696	-0.20%
Government earnings	$42,433,837	0.01%	$188,380,322	0.06%	-$85,218,537	-0.03%
Manufacturing earnings	$359,753,442	0.05%	-$1,132,068,715	-0.15%	-$294,703,834	-0.04%
Mining earnings	$373,145,188	3.67%	$486,121,463	4.78%	$439,259,268	4.32%
Retail earnings	-$547,952,597	-0.49%	-$347,446,074	-0.31%	-$122,550,471	-0.11%
Services earnings	-$318,258,663	-0.02%	-$345,676,219	-0.02%	-$642,682,174	-0.04%
Transportation and utilities earnings	$91,003,164	0.08%	$133,323,592	0.12%	$224,653,558	0.21%
Wholesale earnings	$19,633,705	0.01%	$28,337,494	0.02%	-$35,614,837	-0.03%
Total earnings	**$65,437,757**	**0.00%**	**-$2,085,398,645**	**-0.06%**	**-$1,221,559,628**	**-0.04%**

Figure A-1: The Detailed Effects of the SNG Loss Tax Applied to Residential Users Only, 2025 Snapshot

Figure A-2: The Detailed Effects of the SNG Loss Tax Applied to Residential and Commercial Users, 2025 Snapshot

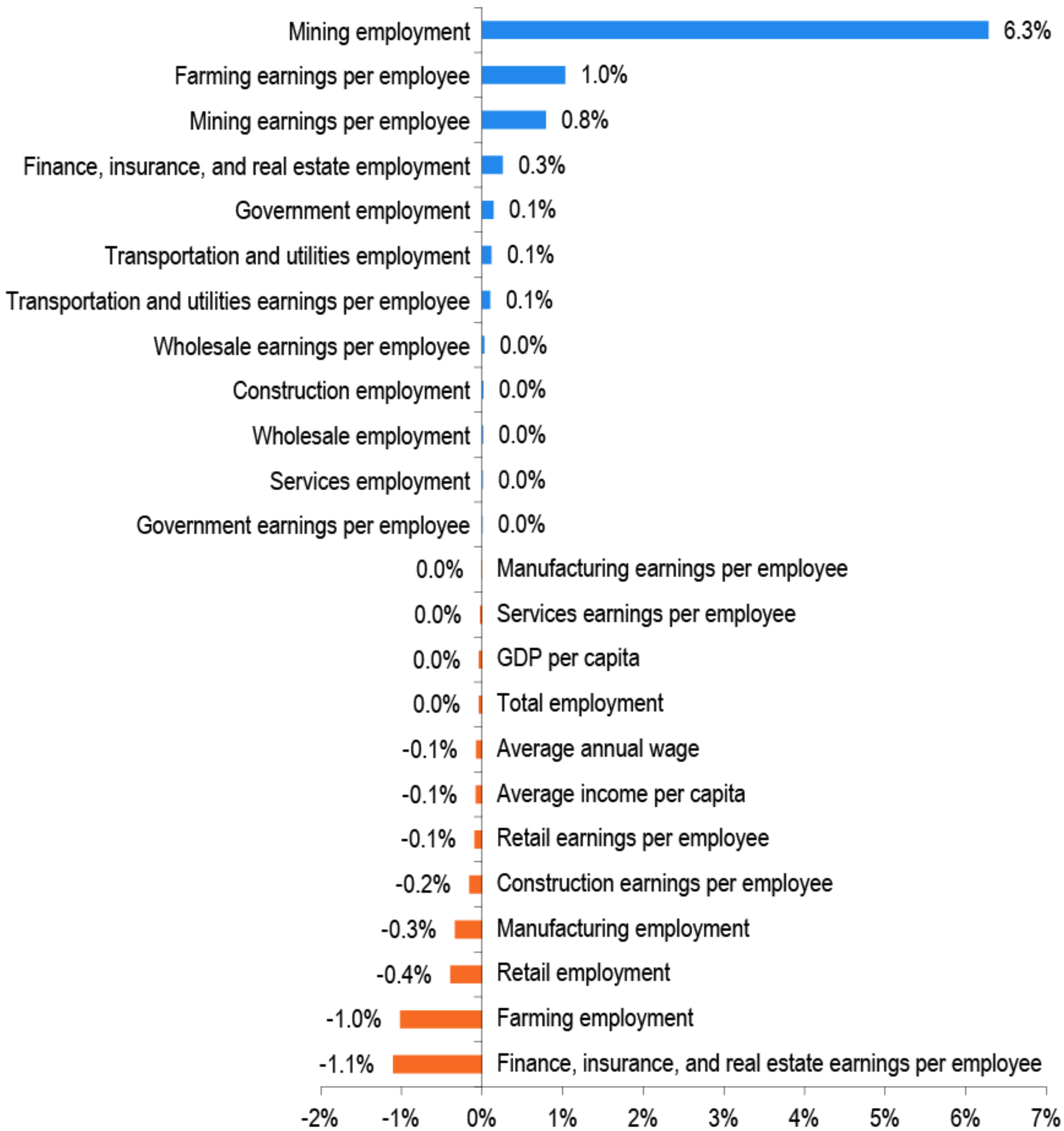
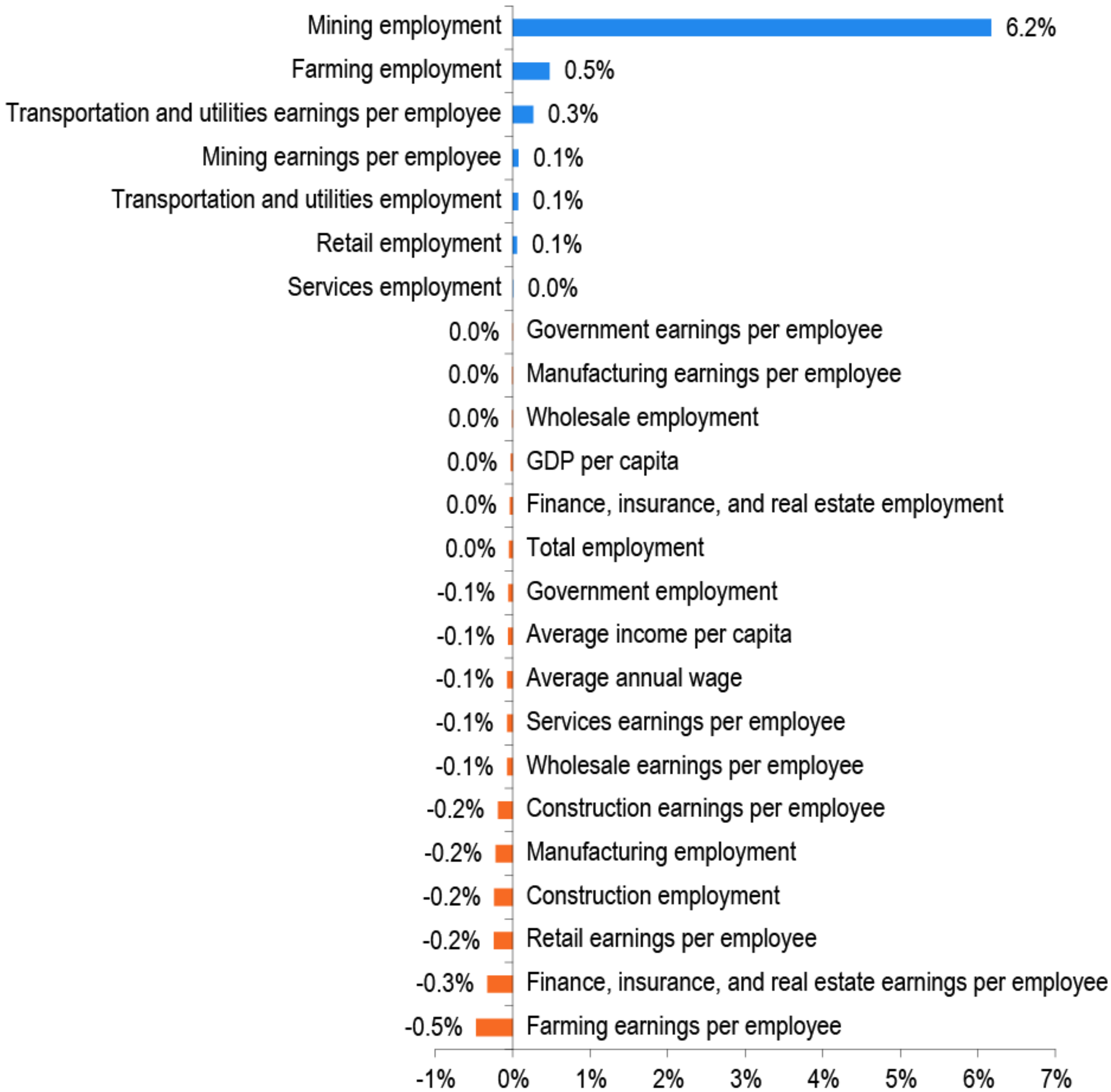


Figure A-3: The Detailed Effects of the SNG Loss Tax Applied to All User Types, 2025 Snapshot



Appendix B: Model Specifics

The Indiana model consists of a series of econometrically estimated relationships describing the state economy, with an emphasis on the connection between energy demand, energy prices and economic activity. The econometric model depicts the relations between energy costs and economic activity at the state level. The current version of the model contains approximately 85 individual equations linking natural gas, motor gas, and electricity across four end-use categories—residential, commercial, transportation and industrial. There are also 10 economic sectors that respond to changes in energy sources and prices differently, namely construction, farming, FIRE (finance, insurance and real estate), government, manufacturing, mining, retail trade, wholesale trade, transportation and utilities, and other services (that includes health care delivery, business services, entertainment, hospitality, etc.). Standard economic indicators are used for these sectors, including employment and earnings.

There are a number of variables that come from outside the model, including national gross domestic product, national employment by sector, birth and death rates, and energy prices for motor gas, natural gas, and electricity. In addition, climate-related energy consumption factors such as heating and cooling degree days, average temperatures, and temperature variances are included.

The equations are solved simultaneously to provide an equilibrium outcome for the system and then dynamic economic or policy changes can be traced through the state economy. The outcome of the model's ability to translate energy price changes and other energy demand or supply scenarios into forecasted impacts on the state's economy is a framework for evaluating these energy alternatives with respect to their impact on state and regional employment, output, wages, personal income, unemployment, and population change.

All policy analysis is fundamentally about comparison, i.e., examining the effects of a policy, program, law or other initiative relative to a case without the initiative. The effect of any given policy initiative depends critically on the economic, political, technical and physical environment in which it is adopted. A substantial part of disagreement about policies stems from lack of agreement about what the future will look like without the policy. Thus, it is just as important to carefully define the future scenario without the policy as it is to define the scenario with the policy.

We have developed two types of scenarios: the reference or baseline scenario and the energy policy scenarios. The policy scenarios emphasize different energy policies. The policy scenarios are then compared to the reference scenarios on important dimensions, in particular state GDP, employment, personal income, and energy expenditures and consumption. The analysis extends to 2025, currently the latest year for which the NYMEX provides natural gas futures prices.

The reference or baseline scenario might be called "business-as-usual." Under this reference scenario, we considered a future that looks much like the present: stable energy prices, steady growth rate in the economy as determined by national GDP growth and stock price growth, and a stable manufacturing growth base.

The policy scenarios consider three strategies to apply the SNG surcharge: 1) the SNG tax applies to only residential customers, 2) the SNG tax applies to residential and commercial customers and 3) the SNG tax is applied to all customer types—residential, commercial and industrial.

Appendix C: IMPLAN Economic Impact Modeling Software

MIG, Inc. (formerly the Minnesota IMPLAN Group) is the company responsible for developing IMPLAN data and software. Using classic input-output analysis, IMPLAN can be used to measure the economic effects of an economic event, such as a factory closing or a new plant opening, or the size of the economic footprint of an economic entity like a production facility, headquarters or university.

The Economic Theory behind IMPLAN

IMPLAN is built on a mathematical input-output (I-O) model that expresses relationships between sectors of the economy in a chosen geographic location. In expressing the flow of dollars through a regional economy, the input-output model assumes fixed relationships between producers and their suppliers based on demand. It also omits any dollars spent outside of the regional economy—say, by producers who import raw goods from another area, or by employees who commute and do their household spending elsewhere.

The idea behind input-output modeling is that the inter-industry relationships within a region largely determine how that economy will respond to economic changes. In an I-O model, the increase in demand for a certain product or service causes a multiplier effect, layers of effect that come in a chain reaction. Increased demand for a product affects the producer of the product, the producer's employees, the producer's suppliers, the supplier's employees, and so on—ultimately generating a total effect in the economy that is greater than the initial change in demand. Say demand for Andersen Windows' wood window products increases. Sales grow, so Andersen has to hire more people, and the company may buy more from local vendors, and those vendors in turn have to hire more people … who in turn buy more groceries. The ratio of that overall effect to the initial change is called a regional multiplier and can be expressed like this:

(Direct Effect + Indirect Effects + Induced Effects) / (Direct Effect) = Multiplier

Multipliers are industry and region specific. Each industry has a unique output multiplier, because each industry has a different pattern of purchases from firms inside and outside of the regional economy. (The output multiplier is in turn used to calculate income and employment multipliers.)

Estimating a multiplier is not the end goal of IMPLAN users. Most wish to estimate other numbers and get the answers to the following questions: How many jobs will this new firm produce? How much will the local economy be affected by this plant closing? What will the effects be of an increase in product demand? Based on those user choices, IMPLAN software constructs "social accounts" to measure the flow of dollars from purchasers to producers within the region. The data in those social accounts will set up the precise equations needed to finally answer those questions users have—about the impact of a new company, a plant closing or greater product demand—and yield the answers.

IMPLAN constructs its input-output model using aggregated production, employment and trade data from local, regional and national sources, such as the U.S. Census Bureau's annual *County Business Patterns* report and the U.S. Bureau of Labor Statistics' annual report called *Covered Employment and Wages*. In addition to gathering enormous amounts of data from government sources, the company also estimates some data where they haven't been reported at the level of detail needed (county-level production data, for instance), or where detail is omitted in government reports to protect the confidentiality of individual companies whose data would be easily recognized due to a sparse population of businesses in the area.

IMPLAN's accessibility and ease of use also make it a target of criticism by some economists, who charge that in the wrong hands, the software—or any input-output model—will produce inflated results at best, and at worst, completely ridiculous projections. Anyone can point and click their way to an outcome without fully understanding the economics in which the tool is grounded and without knowing how to look at data sets with a nuanced eye. The IBRC has two analysts that have attended advanced training in the use of the IMPLAN modeling software. The estimates that the IBRC analysts generate are pressure-tested and triple-checked to ensure that they are accurate and reflect the most trustworthy application of the modeling software. In all instances, the most conservative estimation assumptions and procedures are used to produce the IMPLAN results.