THE ECONOMIC IMPACT OF SUNOCO LOGISTICS' MARINER EAST PROJECTS IN PENNSYLVANIA

February 5, 2015

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ECONSULT SOLUTIONS
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EXECUTIVE SUMMARY

Sunoco Logistics (NYSE: SXL) has found new opportunities to provide services throughout Pennsylvania with increasing natural gas and natural gas liquid (NGL) production from the Marcellus shale as a way to meet market demands of residential and manufacturing needs for natural gas liquids along the East Coast. Capitalizing on its existing infrastructure, SXL will repurpose the Marcus Hook Industrial Complex (MHIC), a former oil refinery, as a storage, processing, and distribution terminal for natural gas liquids such as propane and butane. To provide this service, SXL has reversed the flow of an existing 8-inch refined products pipeline between MHIC and Delmont, Pa., added 50 miles of new pipeline between Delmont and Houston, Pa., and began shipping propane to MHIC in late 2014.[1] This project is known as Mariner East 1. Due to the large volume of NGLs being extracted from the Marcellus shale and the high demand for processing, SXL will build a second pipeline system, Mariner East 2, which will originate in Ohio and West Virginia and generally run parallel to Mariner East 1 in Pennsylvania.

The construction of both pipelines and the repurposing of MHIC will impact the economy of the region. The total potential economic impact from all construction in the Commonwealth is estimated to be $4.2 billion, supporting more than 30,100 jobs during the construction period with earnings of $1.9 billion (See Table ES.1).

TABLE ES.1 -POTENTIAL ECONOMIC IMPACT FROM CONSTRUCTION OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH OF PENNSYLVANIA

Impact Type	Commonwealth of Pennsylvania
Total Economic Impact ($ billion)	$4.2
Employment Supported	30,100
Labor Income Supported ($ billion)	$1.9

SXL's NGL operations at MHIC will contribute to the manufacturing economy throughout the state. The total potential annual economic impact in the Commonwealth from the ongoing operations of the Mariner East projects are estimated to be between $100 million and $150 million, supporting 290 to 440 jobs with earnings of $22 million to $33 million (see Table ES.2). The majority of employment and expenditure impact will be in Southeast Pennsylvania due to the ongoing operations at MHIC.

TABLE ES.2–RANGE OF POTENTIAL ANNUAL ECONOMIC IMPACT FROM OPERATIONS OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH OF PENNSYLVANIA IN 2017

Impact Type	Commonwealth of Pennsylvania
Total Economic Impact ($ million)	$100 - $150
Employment Supported	290-440
Labor Income Supported ($ million)	$22 - $33

[1] Delaware County Times, " Sunoco Begins to Move Marcellus Shale Propane to Marcus Hook," (2015)

1.0 INTRODUCTION

1.1 OVERVIEW OF SUNOCO LOGISTICS IN PA

Sunoco Logistics (SXL), based in Philadelphia, Pa., operates refined products pipelines, crude oil pipelines, a crude oil acquisition business, and marketing and terminal facilities. SXL owns substantial capital infrastructure located in and near Philadelphia, including the Marcus Hook Industrial Complex (MHIC). The approximately 800-acre facility was decommissioned as a refinery in 2011. At its height, MHIC refined 178,000 barrels of low-sulfur sweet crude oil per day, accounting for approximately 13 percent of the cumulative crude oil operating capacity of refineries on the East Coast.[2]

Ever since the refinery was decommissioned, new uses for its capital infrastructure have been explored. In 2012, a study by IHS, Inc., a consulting firm, presented new potential uses. One option explored was the use of the site as a natural gas liquids (NGL) processing facility. MHIC is equipped with dock facilities capable of accommodating trucks, rail cars, and maritime vessels and can receive and deliver products to numerous third-party pipelines. The dock and pipeline infrastructure at the MHIC facility also permits access to various markets, including: Pennsylvania and New York terminals; New York Harbor and Northern New Jersey terminals via pipelines; and Baltimore, New England, Europe, and other overseas export markets via ship.

The facility is ideal as an industrial processing and shipping hub due to its industrial capacity, including its safe and well-established marine facilities, full service docks with trained on-shore and maritime staff, and an existing industrial base and infrastructure. Currently, there are approximately 150 employees at MHIC.

1.2 EXPANDED SUNOCO LOGISTICS VENTURES

SXL is repurposing MHIC from a crude oil processing facility to an NGL facility. SXL's Mariner East 1 project will provide the service of transporting NGLs to MHIC from the Marcellus shale. SXL has reversed the flow of its existing 8-inch refined products pipeline and added 50 miles of new pipeline near Pittsburgh in order to facilitate shipments of propane and other petroleum products from Houston, Pa. to MHIC. Due to the large amount of NGLs such as propane being extracted from the Marcellus shale, and an increased demand for processing, SXL's Mariner East 2 project will build a second pipeline that will originate in Eastern Ohio, West Virginia and Western Pennsylvania. Mariner East 2 will run mostly parallel with Mariner East 1 and transport additional NGLs to MHIC. Collectively, they will be referred to as the Mariner East projects throughout the report.

[2] American Petroleum Institute, "Impacts of East Coast Refinery Closures" (2012)

In 2013, Philadelphia's Manufacturing Task Force, appointed by Mayor Michael A. Nutter, released a report that established a plan to restore Philadelphia's manufacturing sector. An essential component of this plan was to increase NGL pipeline capacity and delivery to the Greater Philadelphia region so that it can maintain a sufficient supply of NGL products and compete with the established chemical industry in the Gulf Coast region.[3] SXL's Mariner East projects are the key components to satisfying this plan and catalyzing additional manufacturing in the region.

1.3 PURPOSE OF REPORT

The purpose of this report is to estimate the economic impacts from the construction and operations of the Mariner East projects. Section 2 of this report provides a brief description of the Mariner East projects. Section 3 estimates the economic impact of their construction. The estimated economic impact from operations is presented in Section 4. Section 5 discusses additional impacts from the Mariner East projects, including the increase in propane supply produced in the Commonwealth and other upstream and downstream benefits of these projects.

1.4 ABOUT ECONSULT SOLUTIONS, INC.

This report was authored by Econsult Solutions, Inc. (ESI). ESI is a Philadelphia-based economic consulting firm. It provides businesses and public policy makers with economic consulting services in urban economics, real estate economics, transportation, public infrastructure, economic development, public policy and finance, community and neighborhood development, and planning, as well as expert witness services in support of litigation.

[3] The Manufacturing Task Force of Philadelphia, "Manufacturing Growth Strategies For Philadelphia" (2013)

2.0 THE MARINER EAST PROJECTS

2.1 MARINER EAST 1

The Mariner East 1 project is a repurposing project that includes a reverse of supply flow of an existing SXL pipeline. It will change the current westward flow of refined products such as gasoline, diesel and jet fuel, to an eastward transport of propane, butane, and other NGLs from the Marcellus shale to the MHIC facility for storage, processing and distribution. A 50-mile addition to the pipeline was built, spanning from Mark West Liberty's Houston fractionation complex to an interconnection with the existing pipeline at Delmont, Pa. Mariner East 1 began shipping propane in late 2014. The new conveyance of NGLs to southern Pennsylvania should exert downward pressure on costs for many local producers and manufacturers and increase the locally available supply of propane for residential heating.[4] SXL will service the state with the transport of 70,000 barrels of propane and ethane per day through the Mariner East 1 pipeline.

2.2 MARINER EAST 2

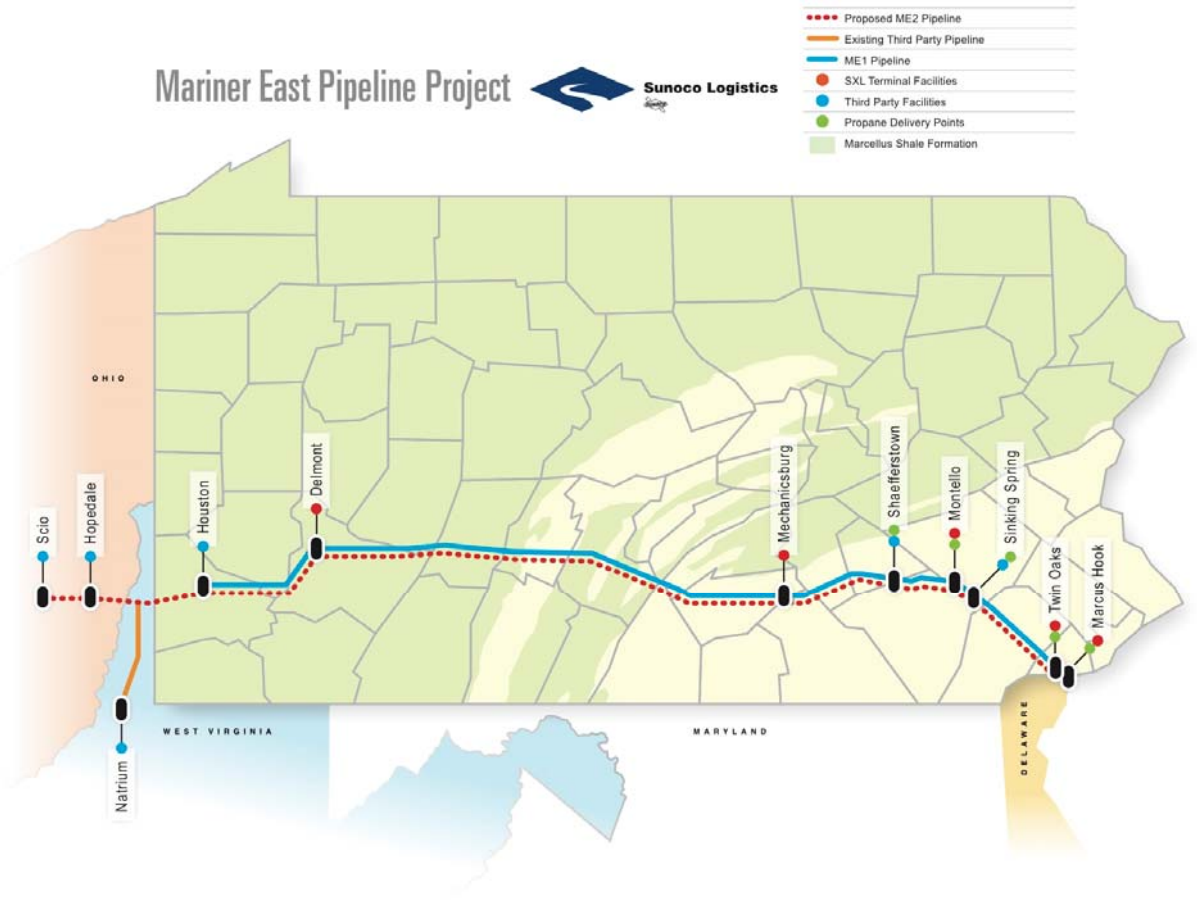
Mariner East 2 involves constructing a new pipeline capable of transporting NGLs from both the Utica shale and the Marcellus shale to MHIC. Mariner East 2 will serve as a supplement to Mariner East 1 operations, allowing for a higher volume of NGLs to be transported from the Marcellus shale to various on- loading and off- loading sites within Pennsylvania, terminating at MHIC (see Figure 2.1). The new pipeline, which will be at least 16-inches in diameter, is projected to be operational in the fourth quarter of 2016. Mariner East 2 will deliver 275,000 barrels of NGLs to Marcus Hook per day.

In total, the Mariner East projects will provide a combined 345,000 barrels per day. In preparation for the service delivery of the vast quantities of NGLs to be transported to MHIC, SXL will build two propane tanks with a 1.5 million barrel capacity, plus a 600,000-barrel butane tank and a 300,000-barrel ethane tank.[5]

[4] "SXL Partners L,P, Announces Successful Open Season for Project Mariner East", SXL Partners L.P. (2012)

[5] "Sunoco's Pipeline Plans Continue Despite Ruling", Daily Local News (2014)

FIGURE 2.1 - DIAGRAM OF THE MARINER EAST 1 AND 2 PIPELINES



Source: Sunoco Logistics (2014)

3.0 CAPITAL INFRASTRUCTURE ECONOMIC AND FISCAL IMPACTS

3.1 GEOGRAPHY OF IMPACT

The economic impact of construction and ongoing operations from the Mariner East projects were estimated within the Commonwealth of Pennsylvania. It is expected that the majority of the potential Commonwealth impacts will take place in the southeastern Pennsylvania region (the City of Philadelphia and Montgomery, Bucks, Delaware and Chester counties) due to operations at MHIC. The pipelines and new operations at MHIC are expected to create and support employment throughout the state. Direct spending is used to estimate total economic impact. To estimate the economic impact in the Commonwealth, the geographic source of the products and services supplied are used to assign spending to the impact area. Therefore, it is assumed that not all of the spending will occur in the Commonwealth, as some services and products will be purchased from out-of-state suppliers.

3.2 ECONOMIC IMPACT MODELING

The total impact resulting from initial expenditures can be modeled by constructing an input-output model. This modeling was done using IMPLAN, an industry standard input-output modeling software program. Such models are designed to estimate two sets of spillover impacts from expenditures:

- The indirect effect, which measures the multiplier effect from the purchase of goods and services from local vendors.
- The induced effect, which measures the multiplier effect from the spending of labor income by employees within a particular geography.

For the purposes of this report, economic impacts were measured at the Commonwealth's economy level. In turn, these impacts also represent increases in various tax bases for various jurisdictions, resulting in increases in tax revenues for those jurisdictions. A fiscal impact model was generated to translate these economic impacts into their commensurate tax base expansions and therefore into the generation of various tax revenues. For the purposes of this report, fiscal impacts were measured at the Commonwealth government level.[6]

[6] See Appendix A for additional detail on economic and fiscal impact methodology.

3.3 DIRECT CONSTRUCTION EXPENDITURES

It is estimated that the construction costs associated with the Mariner East projects will be approximately $3 billion in Pennsylvania. These costs are made up of engineering and architectural services, material costs, general construction, right-of-way easements and land purchase both for the pipelines and MHIC. The construction expenditures associated with the pipelines and renovations at MHIC are provided in aggregate for the construction period. The model accounts for specific spending allocation for each expenditure within the state.

Of the total pipeline and MHIC construction, it is estimated that 50 percent of engineering services will be supplied by companies within the Commonwealth.[7] For modeling purposes, it was assumed of all material purchased, 25 percent will be American steel manufactured in Pennsylvania. SXL has already purchased (from Pennsylvania manufacturers) the 50 miles of pipeline being added to the existing pipeline for Mariner East 1. In the economic impact model, all construction and contingency expenditures are allocated to be spent within the Commonwealth, as they are mostly the labor component of construction. However, the land purchase is not included in the construction expenditure model as the pure transfer of ownership does not generate an economic impact. It is the use of the land, as accounted for in the ongoing operations model, which will generate a recurring economic and fiscal impact. Combined, the construction of both pipelines and the associated MHIC renovations will cost approximately $3 billion, of which it is estimated that $2.1 billion will be spent in the Commonwealth (see Table 3.1).

TABLE 3.1 - TOTAL CONSTRUCTION EXPENDITURES FOR MARINER EAST PROJECTS IN PA ($ MILLION)

Construction	Mariner East Projects
Total Construction Expenditure	$2,983
Modeled Commonwealth Expenditure	$2,110

Source: Sunoco Logistics (2014)

3.4 CONSTRUCTION ECONOMIC IMPACT

The economic impact was modeled for all construction costs associated with the Mariner East projects by combining the economic impact from the pipelines and MHIC construction. The estimated total impacts include direct output, employment, and labor income, along with the corresponding indirect and induced impacts. In total, the construction of the Mariner East projects is estimated to generate a potential one-time economic impact of nearly $4.2 billion in the Commonwealth, supporting 30,140 full-time equivalent (FTE) jobs with earnings of $1.9 billion (see Table 3.2).

[7] Direct expenditure amounts and allocations within the Commonwealth are assumptions. Actual spending may be different.

TABLE 3.2-POTENTIAL ECONOMIC IMPACT FROM CONSTRUCTION OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH OF PENNSYLVANIA ($ MILLION)

Impact Type	Commonwealth of Pennsylvania
Direct Output	$2,110
Indirect & Induced Output	$2,050
Total Output	$4,160
Employment Supported (jobs)	30,140
Labor Income Supported	$1,890

Source: Sunoco Logistics (2014), IMPLAN (2013), Econsult Solutions (2014)

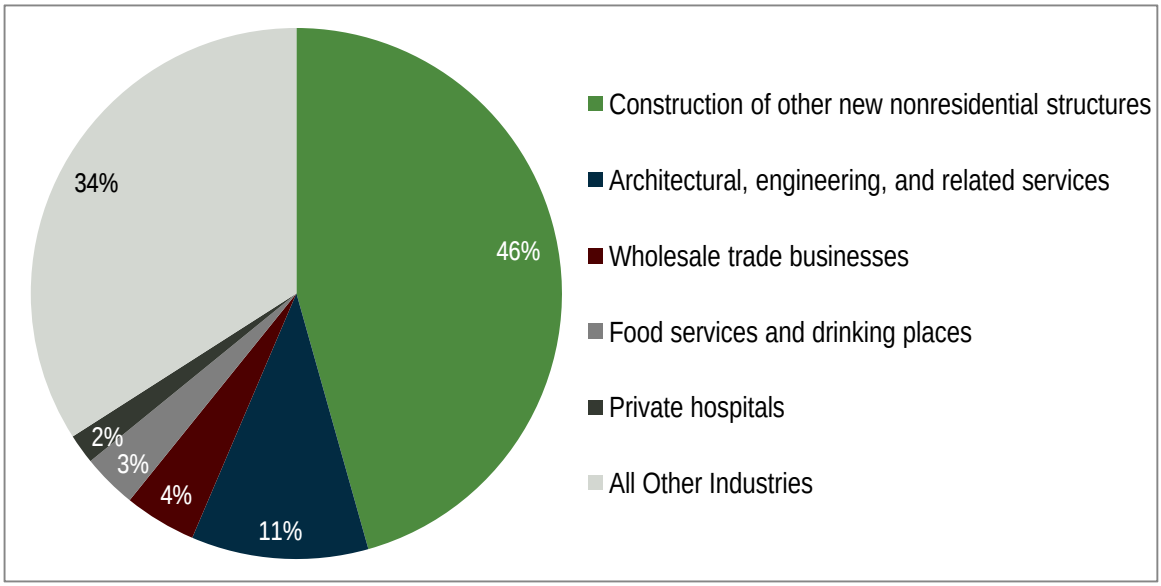
3.5 CONSTRUCTION LABOR IMPACT

TOTAL LABOR IMPACT

Upfront construction associated with the Mariner East projects will impact multiple industries across the Commonwealth. These estimated impacts will occur over the length of the construction period, which is approximately two years. The bulk of the employment generated will be in construction trades. Since construction labor duration and timing vary significantly over this type of large scale project, input-output models aggregate these various construction jobs over the full, two-year construction period.

The 30,140 FTE jobs are the sum of all the direct, indirect, and induced jobs over the full construction period. The direct investment by SXL in the construction of the Mariner East projects will also support jobs through its spillover economic impacts. Within the Commonwealth of Pennsylvania, nearly 46 percent of the employment impact, or approximately 13,750 jobs, will be in the construction industry over the construction period. The remaining 54 percent of the employment impact will occur in industries other than construction, such as architectural and engineering services, wholesale trade businesses, and food services and drinking places (see Figure 3.1).

FIGURE 3.1 - POTENTIAL TOTAL EMPLOYMENT IMPACT FROM CONSTRUCTION OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH[8]



Source: IMPLAN (2013), Econsult Solutions, Inc. (2014)

ANNUAL LABOR IMPACT

It is estimated that 30,140 direct, indirect, and induced jobs will be supported over the length of the construction period. This is equivalent to approximately 15,070 jobs each year for two years (see Table 3.3). Of these 15,070 jobs, 8,465 direct jobs will be supported annually by the construction of the pipeline and the renovations at MHIC. In addition, 6,875 of these direct jobs will be in the construction industry. Annually, the other jobs directly related to the Mariner East project construction include an estimated 1,100 architectural and engineering jobs, 440 wholesale trade business jobs, and 50 professional, scientific, and technical services jobs (see Figure 3.2). The 6,605 indirect and induced jobs will be supported through the construction project's spillover economic impacts in various industries.

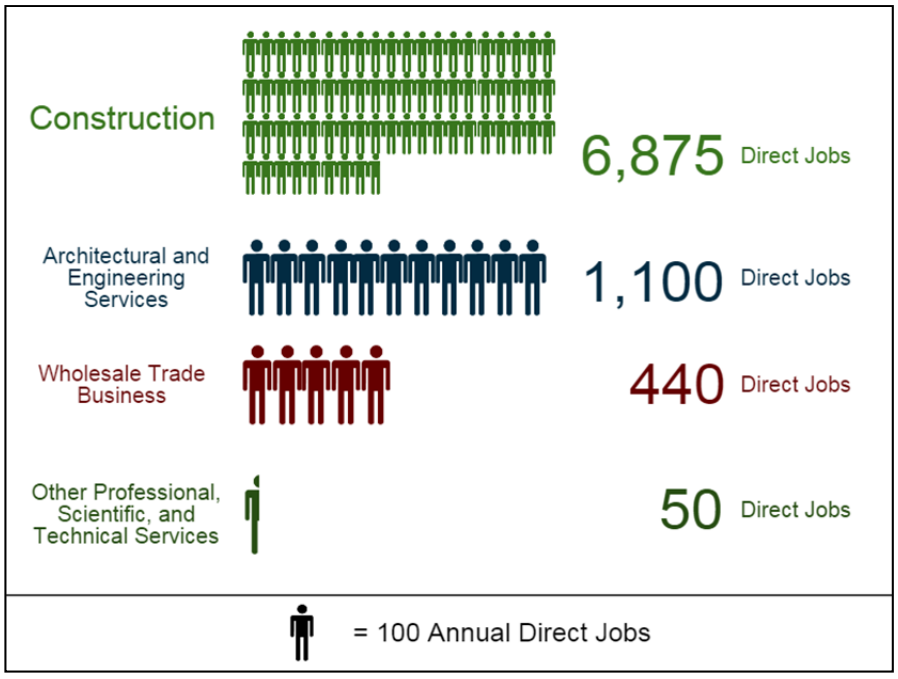
[8] The figure includes direct, indirect, and induced employment.

TABLE 3.3 –POTENTIAL ESTIMATEDANNUAL EMPLOYMENT IMPACT FROM CONSTRUCTION OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH OF PENNSYLVANIA ($ MILLION)

Industry	Annual Direct Jobs	Annual Indirect and Induced Jobs	Total Annual Jobs
Construction	6,875	0	6,875
Architectural, engineering, and related services	1,100	530	1,630
Wholesale trade businesses	440	220	660
\All other miscellaneous professional, scientific, and technical services	50	30	80
Food services and drinking places	0	500	500
Private hospitals	0	275	275
All other industries[9]	0	5,050	5,050
Total Annual Jobs Supported	8,465	6,605	15,070

Source: Sunoco Logistics (2014), IMPLAN (2013), Econsult Solutions, Inc. (2014)

FIGURE 3.2 –POTENTIAL ESTIMATED ANNUAL DIRECT EMPLOYMENT IMPACT FROM CONSTRUCTION OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH



The figure represents total direct jobs supported during each year.

Source: Sunoco Logistics (2014), IMPLAN (2013), Econsult Solutions, Inc. (2014)

[9] "All other industries" include (but are not limited to): Offices of physicians, dentists, and other health practitioners, employment services, real estate establishments, food and beverage retail stores, and nursing care facilities.

3.6 FISCAL IMPACT FROM CONSTRUCTION OF THE MARINER EAST PROJECTS

Construction expenditures for the Mariner East projects will generate one-time tax revenues for the Commonwealth throughout the construction period. The organizational structure and industry segment of SXL determines its fiscal responsibility. The construction of the Mariner East projects will potentially generate an estimated $23 million in personal income tax (PIT) to the Commonwealth over the length of the construction period (see Table 3.4). SXL estimates that it will remit $1.8 million in sales tax to the Commonwealth during the construction period. In addition, the induced and indirect activities of its vendors and employees will generate a secondary fiscal impact, creating sources of PIT, sales and use tax, and business taxes. It is estimated that a potential $62 million in total tax revenues will go to the Commonwealth during the construction period of the Mariner East projects (see Table 3.4).

TABLE 3.4 - POTENTIAL ONE-TIME FISCAL IMPACT DURING THE CONSTRUCTION OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH ($ MILLION)

Tax Type	Direct	Indirect and Induced	Total
Personal Income	$23	$15	$38
Sales & Use	$1.8	$18	$20
Business	N/A[10]	$4	$4
Total	$25	$37	$62

Source: Sunoco Logistics (2014), Econsult Solutions (2014)

[10] SXL pays a utility gross receipts tax and a public utility realty tax to the Commonwealth every year, though this was not estimated in this report. SXL currently pays approximately $1.14 million in these two taxes for the Mariner projects.

4.0 ONGOING ECONOMIC IMPACT

4.1 DIRECT OPERATION EXPENDITURES

In addition to the one-time economic impact from construction, service delivery by the Mariner East projects will generate annual ongoing economic impacts within the Commonwealth. With construction anticipated to be completed in 2016, SXL provided estimated operational costs for 2017, the first full calendar year of operations. The costs to maintain uninterrupted service delivery by the Mariner East projects are largely made up of labor, contract services, utilities, and maintenance. All MHIC operations occur in the Commonwealth except for materials purchased. ESI assumed in the model that approximately a quarter of all materials purchased for MHIC will be purchased from Commonwealth suppliers. Based on information supplied by SXL, ESI estimated that overall operating costs will be between $60 million to $90 million annually beginning in 2017. Because the operating expenditures are only preliminary estimates for 2017, they are provided as ranges to account for possible adjustments over the next two years (see Table 4.1).

TABLE 4.1 – RANGE OF ESTIMATED ANNUAL OPERATING EXPENDITURES FOR THE MARINER EAST PROJECTS IN 2017 ($ MILLION)

Operation Expenditure Categories	Lower-End Expenditure Estimates	Upper-End Expenditure Estimates
Payroll Distribution	$8.0	$12.0
Benefits	$1.0	$1.5
Contract Services	$2.6	$3.9
Operating Supplies	$0.2	$0.3
Maintenance Materials	$0.8	$1.3
Maintenance	$4.8	$7.2
Utilities	$41.6	$62.4
Employee Related	<$0.1	<$0.1
Other	$0.9	$1.3
Total	$60.0	$90.0

Source: Sunoco Logistics (2014)

4.2 ONGOING ECONOMIC IMPACT

SXL's annual operating expenditures will generate recurring economic impacts in the statewide economy. The potential impacts associated with the operations of the pipeline and MHIC will depend on the direct operations expenditures, which are currently preliminary, and therefore are provided as ranges. Estimates that are shown as ranges demonstrate the difference in impact of $60 million in annual operating costs or $90 million in annual operating costs. In 2017, after the completion of the Mariner East projects' construction, the operations are estimated to generate a potential annual economic impact of $97 million to $146 million, supporting 290 to 440 FTE jobs with earnings of $22 to $33 million each year in the Commonwealth (see Table 4.2).

TABLE 4.2 -POTENTIAL ANNUAL ECONOMIC IMPACT FROM OPERATIONS OF THE MARINER EAST PROJECTS IN THE COMMONWEALTH OF PENNSYLVANIA ($ MILLION)

Impact Type	Lower -End Impact Estimate	Upper-End Impact Estimate
Direct Output	$60	$90
Indirect & Induced Output	$37	$56
Total Output	$97	$146
Employment Supported[11]	290	440
Labor Income Supported	$22	$33

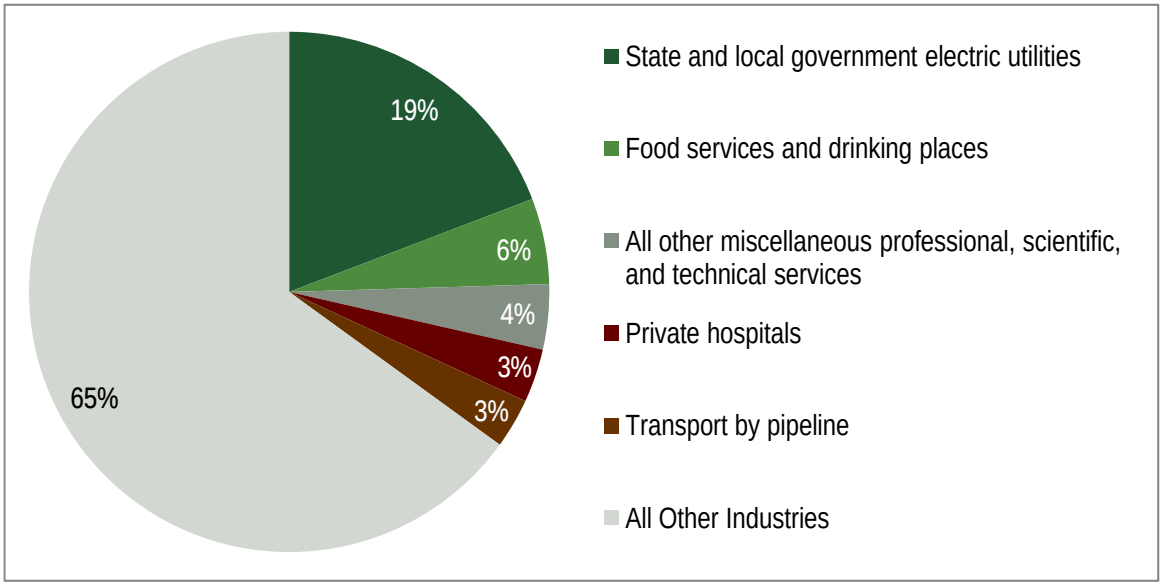
Source: Sunoco Logistics (2014), IMPLAN (2013), Econsult Solutions (2014)

4.3 ONGOING OPERATIONS EXPENDITURE AND JOB DISTRIBUTION

Ongoing service delivery by the Mariner East Projects will affect several different industries. Statewide, approximately 19 percent of the expenditure and job impact will be in state and local government electric utilities (see Figure 4.1). Other industries that will be boosted by the Mariner East projects operations include transportation by pipeline, petroleum refineries, food and drinking establishments, and real estate establishments.

[11] SXL currently estimates that approximately 110 direct jobs will be required for ongoing operations of the Mariner East projects in the Commonwealth with a majority of those jobs in the greater Philadelphia region. The balance of estimated jobs will be potentially supported by the induced and indirect economic activity attributable to the ongoing operations.

FIGURE 4.1 - POTENTIAL EMPLOYMENT IMPACT FROM OPERATIONS IN THE COMMONWEALTH



Source: IMPLAN (2013), Econsult Solutions (2014)

4.4 FISCAL IMPACT FROM ONGOING OPERATIONS

Operations of the Mariner East projects will generate recurring annual tax revenues for the Commonwealth. Similar to the fiscal impact from construction, the largest impact will potentially be in the Commonwealth's PIT. Again, the organizational structure and industry segment determine the taxes that SXL must directly pay. Therefore, sales and use tax and business taxes were estimated from the activities of the induced and indirect economic impacts only. The potential fiscal impacts associated with the operations of the pipeline and MHIC will depend on the direct operations expenditures, which are currently preliminary, and therefore are provided as a range. Estimates, shown as ranges, demonstrate the difference in impact of $60 million in annual operating costs or $90 million in annual operating costs. It is estimated that between $0.8 million and $1.2 million will be generated annually in total tax revenues to the Commonwealth as a result of the Mariner East projects (see Table 4.3).

TABLE 4.3 - POTENTIAL FISCAL IMPACT FROM THE OPERATION OF THE MARINER EAST PROJECTS IN 2017 IN THE COMMONWEALTH (IN THOUSANDS OF $)

Tax Type	Direct	Indirect and Induced	Total
Personal Income	$190 - $290	$255 - $380	$445 - $670
Sales & Use	N/A	$305 - $460	$305 - $460
Business	N/A	$75 - $110	$75 - $110
Total	$190 - $290	$635 - $950	$825 – $1,240

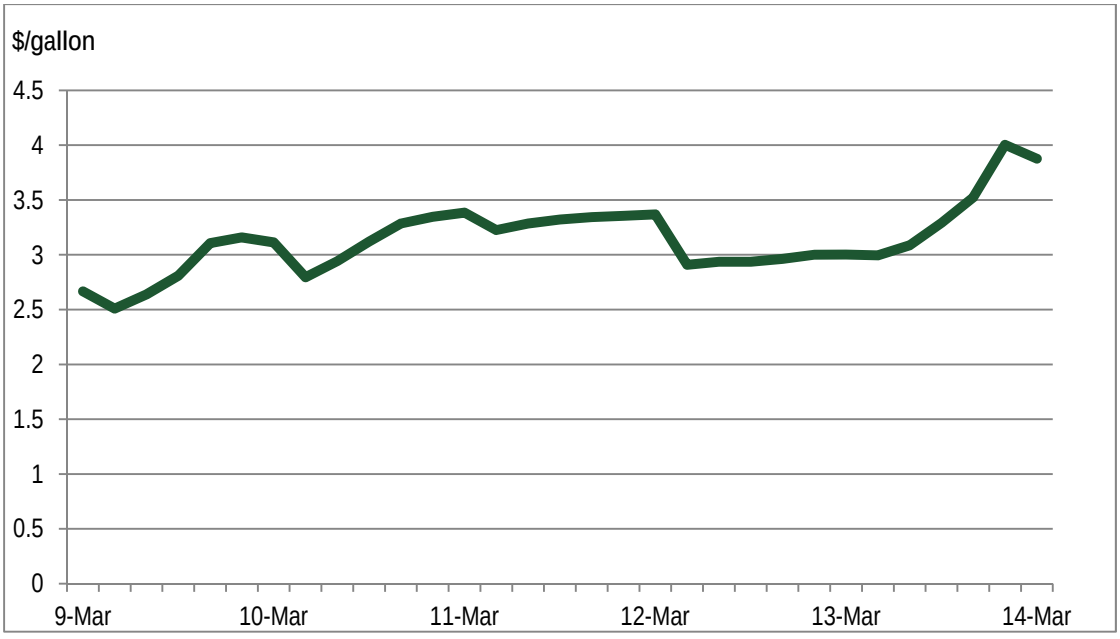
Source: Econsult Solutions (2014), IMPLAN (2014)

5.0 ADDITIONAL ECONOMIC IMPACTS

5.1 REGIONAL PROPANE SUPPLY

Drilling at the Marcellus and Utica shale areas not only yields natural gas (methane), but also natural gas liquids such as propane. Propane is most commonly used for residential central heating, with higher demand in the winter. Most of the propane used in the region is shipped in from the Gulf Coast and Midwest. The cost of transportation, of which distance is a factor, is also incorporated into the price of propane, which can be greater for customers in the Northeast as compared to customers closer to the two larger national supply regions. With the winter of 2013-2014 being especially harsh for the Northeast, demand for propane increased dramatically while the supply plummeted, accounting for a 33 percent price increase from approximately $3 per gallon to $4 per gallon (see Figure 5.1). More than 30 states declared emergencies and loosened trucking regulations to ease propane deliveries from the Gulf Coast and other areas where the propane was being processed from natural gas.

FIGURE 5.1 – ANNUAL EAST COAST PROPANE PRICES (2009-2014)



Source: U.S. Energy Information Administration (2014)

By providing transportation service of propane in Pennsylvania, the Mariner East projects could alleviate the financial stress felt by both residential and commercial consumers during the peak heating season. Although part of the price increase for propane in the winter of 2013-2014 is attributed to the record-high exportation that occurred, it can mostly be associated with restrictive

supply. The additional barrels of propane delivered each day to MHIC would boost the region's reserves, easing supply constraints during the peak heating season.

The development of the propane industry in Pennsylvania could potentially have sizable economic benefits for local producers and consumers who take advantage of the services provided by the Mariner East projects as either a factor of production or as a consumer good. The cultivation of a Pennsylvania propane industry requires a steady supply of propane, which can be provided by the Marcellus and Utica shales. The Mariner East projects will make the transport of propane in Pennsylvania more efficient, reduce transportation costs, and could potentially help stabilize the retail price of propane in Pennsylvania.

5.2 UPSTREAM AND DOWNSTREAM EFFECTS

The service of transporting and processing NGLs from the Marcellus and Utica shales provided by SXL will have an economic impact on the manufacturing industry in southeastern Pennsylvania. The Mariner East projects will increase the locally available domestic supply of propane to residential and commercial consumers in the region. It will impact the stability of the NGL supply in the region, potentially allowing for new and expanded manufacturing opportunities along the East Coast. In addition to solidifying the plans for the new service delivery by the Mariner East projects, SXL is currently evaluating other service opportunities in the region.

In 2012, IHS Inc., a consulting firm, analyzed potential re-development options for MHIC after its crude oil refinery operations ceased in 2011 and attempts to find other companies to continue refinery operations were unsuccessful. The industrial capacity at MHIC and its regional economic contributions were too great to leave idle. The study explored energy and chemical product-based reuse options and evaluated each in terms of restoring well-paying and skilled jobs, the capital investment required, and how they could complement local industry and the regional economy. The seven different re-use options analyzed included:

- Site for NGL processing and fractionation
- Natural gas-to-liquids production and storage facility
- Liquid natural gas liquefaction and export terminal
- Refined petroleum products import terminal
- Expansion of existing natural gas driven power generation assets
- Ethane cracking and derivatives
- Propane dehydrogenation

By-products of NGL processing can be used in domestic manufacturing. By providing the service that will increase the regional supply, costs to local producers may be lower and increase the competitiveness of those firms nationally and internationally. The manufacturing industry uses NGLs to produce a variety of derivatives and products that are inputs for multiple manufacturing sectors. The increase in the regional propane supplies lowers costs to regional manufacturers,

and increased production could also increase employment opportunities in industries that use propane as inputs. A recent PricewaterhouseCoopers report on the potential impact of shale gas on U.S. manufacturing stated that, by 2025, shale gas could add more than one million workers to the U.S. manufacturing industry and allow U.S. manufacturers to lower their raw materials and energy costs by as much as $11.6 billion annually.[12] With the service provided by SXL through the Mariner East projects, Pennsylvania is positioned to become a large supplier of NGLs and attract businesses that not only use the NGLs in their production, but that support the operations of MHIC.

Another potential market for the increased supply of NGLs is the exportation of NGLs to Europe for use by its petrochemical and manufacturing companies. MHIC will become the NGL terminal with the closest location and easiest access to the European petrochemical and manufacturing markets. The potential for increased international export not only boosts the profile of Pennsylvania, but continues to increase the importance of the U.S. natural gas industry globally. The Marcellus and Utica shales are expected to continue to provide opportunities for future energy and chemical product use in Pennsylvania and, therefore, SXL's regional transition from crude oil refiner to provider of NGL transport and processing services could expand beyond the Mariner East projects.

5.3 MARITIME INDUSTRY BENEFITS

MHIC was a major driver of maritime activity when it was a refined products terminal. At its height in 2007, 185 ships and 40 barges made vessel calls into Marcus Hook and transported 183 million barrels of crude oil (see Table 5.1). The reduction in maritime activity due to the closing of the refinery operations at MHIC is often overlooked, but it was a generator of economic activity in its own right as it was very labor intensive. The maritime shipping industry not only required a crew for each crude oil tanker vessel call, but additional crews manned smaller vessels at the port of arrival, making numerous trips back and forth from tankers carrying crude oil with them, allowing the tanker to dock by making it lighter. Therefore, direct maritime employment not only included the crews manning ships transporting the crude oil, but those of the boats engaged in the lightering process that allows the transport ships to dock.

When crude oil refinery operations were completely shuttered, there was limited export of propane and butane from MHIC. In 2013, there were only 10 ship calls transporting 1.35 million barrels of propane and butane from MHIC. It is estimated that in 2016, even before the construction of the Mariner East projects is completed, there will be a dramatic increase in ship calls to 144, transporting 19.4 million barrels of NGLs.

[12] "Shale Gas: Reshaping the US Chemicals Industry", PricewaterhouseCoopers LLP (2012)

TABLE 5.1 – HISTORICAL AND PROSPECTIVE VESSEL ACTIVITY INTO MARCUS HOOK (2002 –2016)

Year	Number of Ship Calls	Barrels Transported by Ship (Millions)	Number of Barge Calls	Barrels Transported by Barge (Millions)	Crude Oil Totals (Millions)	LPGs, Propane, & Butane Totals (Millions)
2007	185	171	40	12	183	0
2008	180	166	40	12	178	0
2009	168	155	24	7	162	0
2010	125	116	20	6	122	0
2011	99	92	12	4	96	0
2012	26	24	12	4	28	0
2013	10	0	0	0	0	1
2014	34	0	0	0	0	5
2015	98	0	0	0	0	13
2016	144	0	0	0	0	19
Totals	1,069	724	148	45	769	38

Source: SXL (2014)

6.0 CONCLUSION

The services provided by the Mariner East projects will have a substantial economic impact within the Commonwealth. Construction is estimated to generate a potential one-time statewide economic impact of $4.2 billion and ongoing operations are estimated to generate a potential statewide annual economic impact of $100 million to $150 million. Construction jobs will be created and jobs will be brought back to MHIC to support operations. The repurposing of MHIC from a crude oil refinery to an NGL storage, transport, and processing facility is a stark turnaround from what was, for a short while, a shuttered reminder of past manufacturing regional importance and lost jobs.

NGLs are an important input in manufacturing regionally and worldwide. The new service delivery will permit businesses in the state to have easier access to NGL inputs. Additional business and job opportunities may become available in the state due to the stabilized regional supply of NGL. The Commonwealth is poised to regain some of its prominence as a manufacturing hub by adapting to the available supply and proximity of NGLs from the Marcellus shale.

Beyond the boundaries of the Commonwealth, the Mariner East projects can be a supplier of NGLs to European markets. It has a greater advantage due to proximity and maritime access over other large NGL centers in the country.

The Mariner East projects will increase the regional supply of propane to heat homes in the Northeast. A regional supply of propane can help stabilize winter supplies and prices that are sensitive to extreme weather and transportation distances that have, in the past, placed financial stress and anxiety on many homes due to lack of propane availability during very cold winters.

The service of transporting NGLs from the Marcellus shale and the ability to store, process and export it from MHIC will create economic opportunities for the state in terms of economic impact, jobs, manufacturing importance, and residential heating supply.

APPENDIXA – ECONOMIC AND FISCAL IMPACT MODEL THEORY

A.1 History

The theory behind input-output modeling stretches as far back as the mid-17th century, when Sir William Petty described the interconnectedness of "production, distribution, and wealth disposal." While Perry can be credited with noticing links between economies, input-output modeling did not begin to take true form until the mid-18th century, when French physician François Quesnay created the Tableau Économique. His work detailed how a landowner spends his earnings on goods from farms and merchants, who in turn spend their money on a host of goods and services. Over the course of the century, an algebraic framework was added by Achille-Nicholas Isnard. Robert Torrens and Léon Walras refined the model by establishing the connections between profits and production.

The modern input-output system can be attributed to Wassily Leontief. In his thesis, "The Economy as a Circular Flow" (1928), he outlined the economy as an integrated system of linear equations relating inputs and outputs. This framework soon gained popularity and became a widely accepted analytical tool. In 1936, Leontief produced the first input-output analysis of the U.S. Leontief's work became the U.S. Department of Commerce's Bureau of Economic Analysis's (BEA) standard benchmark for U.S. production in the 1950s. Leontief received a Nobel Prize for his work in 1973.

In 1976 the USDA Forest Service became required to submit five-year management plans to the federal government concerning the socio-economic effects of resource use. Through extensive surveying, the impacts of each industry could be determined at local levels. This directly resulted in the creation of IMPLAN software for measuring economic impacts. By the late 1980s, the University of Minnesota began to offer the software to a wider audience. Seeing the need to update economic databases and improve the existing software, the Minnesota IMPLAN Group (MIG) was formed in 1993. Using a similar methodology to the USDA Forest Service, MIG was able to provide a quality input-output modeling software to a wider range of users with frequent database updates.

A.2 Application

The use and application of multipliers are fairly basic and intuitive. Multipliers, in their most basic form, are the result of an algebraic analysis expressing how two inputs are interconnected in the production of an output. The result of the equation generates a multiplier that is broken down into direct, indirect, and induced effects. In a generalized example: if the multiplier for good "X" to

good "Y" is 3, then the direct of good "X" on "Y" is 1, with indirect and induced effects of 2. Essentially, every unit of good "X" supports 2 units of good "Y".

When implemented on a large complex scale, such as that of the U.S. economy or any subsection of it, multiplier effects across industries can be complicated. However, the same general concept comes into play. Each industry has largely different and varied inputs into other industries. The quantity of the output is largely decided by the scale and efficiency of the industries involved. As a result, the sum of those inputs equates to an output product plus a value added/component. By arranging these inputs and outputs by industry in a matrix and performing some algebra to find the Leontief inverse matrix, each industry's effect on final demand can be estimated. Additionally, the direct, indirect, and induced effects can also be determined. Direct effects include direct purchases for production, indirect effects include expenses during production, and induced effects concern the expenditures of employees directly involved with production. Using building construction as an example, the direct effects would include materials, brick, steel, and mortar, the indirect effects would involve the steel fabrication, concrete mixing, and the induced effects would consider the construction workers purchases from their wages. While impacts vary in size, each industry has rippling effects throughout the economy. By using an input-output model, these effects can be more accurately quantified and explained.

IMPLAN is one of several popular choices for regional input-output modeling. Each system has its own nuances in establishing proper location coefficients. IMPLAN uses a location quotient to determine its regional purchase coefficient (RPC). This represents the proportion of demand for a good that is filled locally. This assessment helps determine the multiplier for the localized region. Additionally, IMPLAN also accounts for inter-institutional transfers (eg. firms to households, households to the government, etc…) through its social account matrix (SAM) multipliers. IMPLAN takes the multipliers and divides them into 440 industry categories in accordance to the North American Industrial Classification System (NAICS) codes. A comprehensive breakdown of a region's multipliers by industry can be shown.

Despite the usefulness of input-output modeling, there are some shortcomings to the system. Notably, input-output models ignore economies of scale. Input-output models assume that costs and inputs remain proportionate through different levels of production. Further, multipliers are not generally updated on a timely basis Most multipliers are prone to be outdated with the current economy. If the multipliers are sourced from a year of a recession economy, the multipliers may not accurately represent the flows from an economic boom period. Additionally, the multipliers may not capture sudden legal or technological changes, which may improve or decrease efficiency in the production process. Regardless, I-O models still serve as the standard in the estimation of local and regional impacts.

A.3 Economic Impact Model

The methodology and input-output model used in this economic impact analysis are considered standard for estimating such expenditure impacts, and the results are typically recognized as reasonable and plausible effects, based on the assumptions (including data) used to generate the

impacts. In general, one can say that any economic activity can be described in terms of the total output generated from every dollar of direct output. If an industry in a given region sells $1 million of its goods, there is a direct infusion of $1 million into the region. These are referred to as *direct output*.

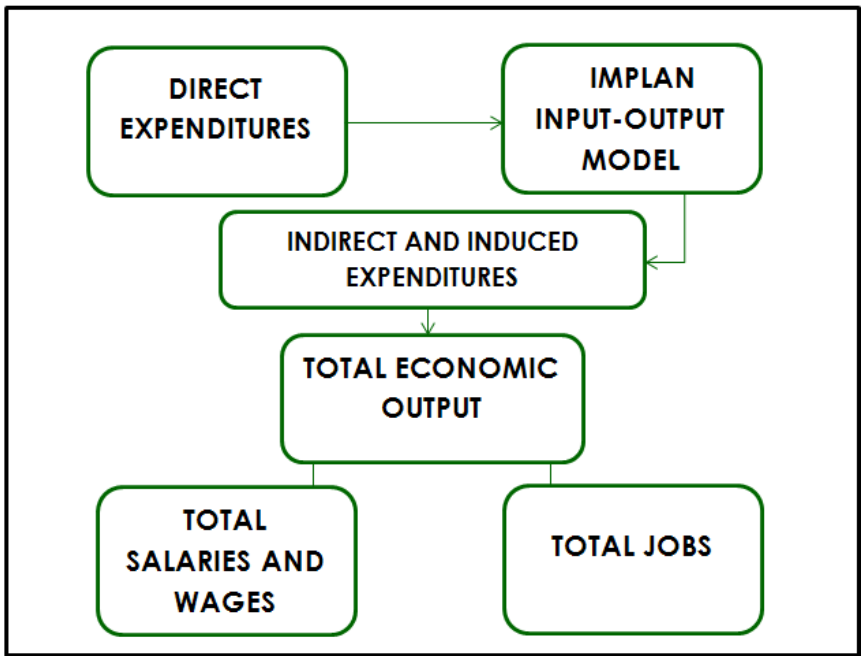
However, the economic impact on the region does not stop with that initial direct expenditure. Regional suppliers to that industry have also been called upon to increase their production to meet the needs of the industry to produce the $1 million in goods sold. Further, suppliers of these same suppliers must also increase production to meet their increased needs as well. These are referred to as *indirect output*. In addition, these direct and indirect outputs require workers, and these workers must be paid for their labor. These wages and salaries will, in turn, be spent in part on goods and services produced locally, engendering another round of impacts. These are referred to as *induced expenditures*.

Direct outputs are fed into a model constructed by Econsult Solutions and based on IMPLAN data. The model then produces a calculation of the total expenditure effect on the regional economy. This total effect includes the initial direct expenditure effect, as well as the ripple effects described, and the indirect and induced expenditure effects.

Part of the total expenditure effect is actually the increase in total wages and salaries (usually referred to as labor income), which the model can separate from the expenditure estimates. Direct payroll estimates are fed into the "household' industry of the input-output model. Impacts of this industry are estimated using the personal consumption expenditure breakdown of the national input-output table and are adjusted to account for regional consumption spending and leakages from personal taxes and savings. The direct, indirect, and induced labor income represent a component of the total economic impact attributable to wages and salaries. Finally, the model calculates the total expenditures affecting the various industries and translates this estimate into an estimate of the total labor (or jobs) required to produce this output.

In short, the input-output model estimates the total economic activity in a region that can be attributed to the direct demand for the goods or services of various industries. This type of approach is used to estimate the total economic activity attributable to the expenditures associated with various types of spending in the region (see Figure A.1 and Table A.1).

Figure A.1 – Flowchart of Input-Output Methodology for Estimating Economic Impact



Source: Econsult Solutions, Inc. (2013)

Table A.1 – Glossary of Terms for Input-Output Models

Multiplier Effect – the notion that initial outlays have a ripple effect on a local economy, to the extent that direct output leads to indirect and induced output.

Economic Impacts – total expenditures, employment, and labor income generated.

Fiscal Impacts – local and/or state tax revenues generated.

Direct Output – initial outlays usually associated with the project or activity being modeled; examples: one-time upfront construction and related expenditures associated with a new or renovated facility, annual expenditures associated with ongoing facility maintenance and/or operating activity.

Direct Employment – the full-time equivalent jobs associated with the direct output.

Direct Labor income – the salaries and wages earned by employees, contractors, and proprietors as part of the direct output.

Indirect Output – indirect and induced outlays resulting from the direct output; examples: vendors increasing production to meet new demand associated with the direct output, workers spending direct labor income on various purchases within the local economy.

Indirect Employment – the full time equivalent jobs associated with the indirect output.

Indirect Labor income – the salaries and wages earned by employees, contractors, and proprietors as part of the indirect output.

Total Output – the sum total of direct output and indirect output.

Total Employment – the sum total of direct employment and indirect employment.

Total Labor income – the sum total of direct labor income and indirect labor income.

Source: Econsult Solutions (2013)

A.4 Fiscal Impact Model

The IMPLAN model provides estimates of the economic impact of a new project or program on the regional economy. It does provide only a rough estimate of the combined fiscal impact of the increased economic activity on state and local governments. Consequently, Econsult has constructed a model that takes the output from the IMPLAN model and generates detailed estimates of the increases in state and local tax collections that arise from the new project. Those revenues are in fact a part of the total economic impact of a new project that is often ignored in conventional economic impact analyses.

The IMPLAN model provides estimates of direct, indirect, and induced expenditures, labor income, and employment within the defined region. The Econsult fiscal impact model combines

the IMPLAN output with the relevant tax types and tax bases associated with the jurisdiction or jurisdictions for which fiscal impact is being modeled. Specifically, the estimated labor income supported by the direct, indirect, and induced expenditures generated by the model are used to apportion the net increase in the relevant tax bases and, therefore, in those tax revenue categories. The resulting estimates represent the projected tax revenue gains to the jurisdiction or jurisdictions as a result of the increased business activity and its attendant indirect and induced effects.

A.5 Sources

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