

# ECONOMIC IMPACT ASSESSMENT

Of the Proposed Natural Gas-to-Liquid-Fuels (GTL)  
Plant within the Pine Bluff MSA

MAY 2014

CONFIDENTIAL



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# EXECUTIVE SUMMARY

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The purpose of this analysis is to show the potential economic impact of the construction and operation of a new natural gas-to-liquid-fuels processing (GTL) plant within two geographic areas: the Pine Bluff Arkansas Metropolitan Statistical Area (MSA) and the state of Arkansas.

The construction of the GTL plant is anticipated to extend across three years and cost \$2.7 billion in building and infrastructure costs, averaging \$930 million in annual spending during the construction period. Once the GTL plant is built and at full operation, it will directly employ an estimated 225 workers. Based on these inputs, EMSI performed an economic impact analysis using its own proprietary input-output model. Following are the key highlights from this analysis:

## EFFECT ON THE PINE BLUFF MSA

- Within the Pine Bluff MSA, the construction of the GTL plant is expected to create or support 2,430 jobs and \$183 million in labor income.<sup>1</sup> Construction of the plant alone is anticipated to directly create roughly 1,860 jobs and \$166 million in labor income.
- Once fully operational, the existence of the GTL plant will create or support 350 jobs within the Pine Bluff MSA. This would represent a 7.7% increase in total regional employment in 2018, the first year of GTL plant operations. This long-term impact will also result in an annual increase of \$19 million in estimated labor income and \$100 million in gross regional product.

## EFFECT ON ARKANSAS

- Within the state of Arkansas, construction of the GTL plant is anticipated to create or support 5,250 jobs and \$333 million in annual labor income during the construction period.
- At the state level, once fully operational the GTL plant will create or support 1,370 jobs and generate \$72 million in annual labor income. Annual gross state product is also expected to increase by \$276 million.

<sup>1</sup> Labor income represents earnings paid to individuals due to work performed. The term is used to differentiate labor income from non-labor income, which represents earnings provided to government via taxes, and profits returned to business owners.

# INTRODUCTION

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Energy Security Partners intends to build a natural gas-to-liquid-fuels processing plant (GTL) in the Pine Bluff, Arkansas region. The project will commence in 2015 and conclude in 2018. The intent of this analysis is to quantify the short-term economic impacts due to the construction of the facility and the long-term economic impacts due to the operation of this facility. The two primary geographic areas analyzed for this project include the Pine Bluff Arkansas Metropolitan Statistical Area (MSA) and the state of Arkansas. The proposed GTL plant will be a state of the art clean-fuels production facility which converts natural gas into finished liquid fuels products so they may be more easily transported using existing fuels pipelines within the United States. Because of the unique nature of this business, EMSI developed customized categories for inputting sales and jobs data that best approximated the raw input needs (or production function) of a GTL plant.<sup>2</sup>

The construction of the GTL plant is anticipated to extend across three years and cost \$2.7 billion in general and infrastructure building costs, or an annual average of \$930 million. The construction will take place over three years, beginning in mid-2015 and finishing in 2018. After six more months of commissioning and optimization, the plant will begin operating at full capability, at which point it will directly employ an estimated 225 workers.

<sup>2</sup> See the appendix for more information on these customizations.

# ECONOMIC IMPACT SUMMARY

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## IMPACT ON THE PINE BLUFF MSA

Within the Pine Bluff MSA, the construction of the plant is expected to create or support 2,430 jobs and \$183 million in labor income. Construction of the plant and associated infrastructure is anticipated to directly create 1,860 jobs and \$166 million in labor income. These jobs will boost employment in the construction sector of the Pine Bluff region by 117% above forecasted employment in 2017, the mid-point of the construction project. Furthermore, the creation of these jobs will significantly enhance the Pine Bluff MSA economy, which has contracted 10% in the past fifteen years.

Once fully operational, the existence of the GTL plant will create or support 350 jobs within the Pine Bluff MSA. This would represent a 7.7% increase in total regional employment in 2018, the first year of GTL plant operations. According to EMSI's input-output model, the total jobs impact will also result in an annual increase of \$19 million in labor income.

Annual operations of the GTL plant will result in a \$100 million increase in gross regional product (GRP). GRP is equivalent to the value added, or increased market value for goods and services less the cost of inputs, for all of the region's industries. It also represents the net increase of labor and non-labor income in the regional economy.

## IMPACT ON ARKANSAS

Using the state of Arkansas as the economic backdrop, the economic impacts of construction are larger than those for the Pine Bluff MSA. This is due to a wider geographic area from which companies can purchase materials and hire workers. Within the state of Arkansas the construction of the GTL plant is anticipated to create or support 5,250 jobs and \$333 million in annual labor income. The creation of these jobs will boost employment in the construction sector in the state by 3.5% above forecasted employment in 2017, the mid-point of construction.

Once fully operational, the GTL plant will create or support 1,370 jobs, and \$72 million annually in labor income for the state of Arkansas. Annual gross state product is also expected to increase by \$276 million.

# DESCRIPTION OF RESULTS

Tables 1 and 2 display the economic impact of the GTL plant at two distinct phases: short-term (construction) and long-term (operation of the plant). All values in the table are in terms of an average annual economic impact. For short-term results, these values represent the average expected impact within the three year period of construction. The long-term impacts represent the expected economic impact of the GTL plant once it is fully operational.<sup>3</sup>

A brief description of the column titles used in Tables 1 and 2 will be helpful for interpretation. Output represents the anticipated amount of sales that will be generated as a result of the impact scenario. Jobs represent both full-time and part-time jobs that will be either created or supported. Earnings represent labor income generated. Value-added represents the increased market value of goods and services after accounting for the cost of inputs. It also represents the net increase of labor and non-labor income in the regional economy. Labor income represents earnings paid to individuals due to work performed and non-labor income represents earnings provided to government via taxes, and profits returned to business owners. More detailed descriptions of the column headers used in this table are contained in appendix B “glossary of terms.”

Total economic impact is generally categorized according to the following three effects: the direct effect, the indirect effect, and the induced effect. Direct effects display the output, jobs, earnings and value-added as a result of the initial economic transaction, which in this case represents the activities of the business constructing the GTL plant (short-term) and activities of the business operating the GTL plant (long-term). During the construction phase, the prime contractor will need to purchase materials and hire subcontractors to complete many aspects of this work. Furthermore, these businesses may have to purchase more materials and hire more workers to meet this increased demand for their services. The sum of these additional economic activities generated within the supply-chain of the prime construction contractor represents the “indirect effects” of the short-term scenario. Likewise, with the long-term scenario, indirect effects represent increased economic activity within the supply chain of the GTL plant, once it is fully operational. Lastly, induced effects represent how the wages paid to workers at the direct and indirect stages translate into increased household spending, which generates further economic activity.

The EMSI model generates numerical values that suggest a level of accuracy and detail. However all values in the tables below represent estimations only and should be regarded as such.

<sup>3</sup> EMSI has accounted for the amount of materials and labor that are expected to be sourced outside of the Pine Bluff MSA and the state of Arkansas. Further information on these assumptions can be found in Appendix B: “Methodology and Glossary of Terms.”

# DETAILED RESULTS

**TABLE 1: Detailed Economic Impact Results for the Pine Bluff MSA**

	-----Short-term (construction)-----				-----Long-term (operations) -----			
	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP)(\$M)	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP)(\$M)
<b>Pine Bluff MSA</b>	<b>\$395</b>	<b>2,430</b>	<b>\$183</b>	<b>\$207</b>	<b>\$481</b>	<b>350</b>	<b>\$19</b>	<b>\$100</b>
Direct	\$351	1,860	\$166	\$179	\$462*	110*	\$11*	\$88*
Indirect	\$21	230	\$7	\$13	\$5	40	\$2	\$3
Induced	\$23	340	\$10	\$15	\$14	200	\$6	\$9

Source: EMSI, Social Accounting Matrix, 2014Q2

\*Note that the direct effects for the Pine Bluff MSA are roughly 50% of those for the state of Arkansas, under the assumption that 50% of workers at the power plant will reside outside of the MSA. Induced effects also account for this assumption.

**TABLE 2: Detailed Economic Impact Results for Arkansas**

	-----Short-term (construction)-----				-----Long-term (operations) -----			
	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP)(\$M)	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP)(\$M)
<b>Arkansas</b>	<b>\$753</b>	<b>5,250</b>	<b>\$333</b>	<b>\$406</b>	<b>\$1,127</b>	<b>1,370</b>	<b>\$72</b>	<b>\$276</b>
Direct	\$520	2,750	\$246	\$266	\$924	230	\$22	\$176
Indirect	\$88	730	\$28	\$50	\$137	350	\$23	\$59
Induced	\$145	1,770	\$59	\$90	\$66	790	\$28	\$42

Source: EMSI, Social Accounting Matrix, 2014Q2

# APPENDIX A: DETAILED ECONOMIC IMPACT DATA

## INDUSTRY IMPACTS

Tables A.1 through A.4 display economic impacts for the Pine Bluff MSA and the state of Arkansas on an industry by industry basis. The numbers are aggregated by 2-digit North American Industrial Classification System (NAICS) groups. Dollar values have been rounded to the nearest million, and employment numbers have been rounded to the nearest integer divisible by ten.

**TABLE A.1: Short-term Effects on Broad Industry Groups within the Pine Bluff MSA**

NAICS	Title	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP)(\$M)
11	Agriculture, Forestry, Fishing and Hunting	< \$1.0	< 10	< \$1.0	< \$1.0
21	Mining, Quarrying, and Oil and Gas Extraction	< \$1.0	< 10	< \$1.0	< \$1.0
22	Utilities	\$1	< 10	< \$1.0	< \$1.0
23	Construction	\$351	1,870	\$166	\$180
31-33	Manufacturing	\$5	20	\$1	\$2
42	Wholesale Trade	\$2	10	< \$1.0	\$1
44-45	Retail Trade	\$9	140	\$4	\$6
48-49	Transportation and Warehousing	\$1	10	< \$1.0	< \$1.0
51	Information	< \$1.0	< 10	< \$1.0	< \$1.0
52	Finance and Insurance	\$4	20	< \$1.0	\$2
53	Real Estate and Rental and Leasing	\$3	20	< \$1.0	\$2
54	Professional, Scientific, and Technical Services	\$2	30	\$1	\$2
55	Management of Companies and Enterprises	< \$1.0	< 10	< \$1.0	< \$1.0
56	Administrative and Support and Waste Management and Remediation Services	\$2	50	< \$1.0	< \$1.0
61	Educational Services (Private)	< \$1.0	10	< \$1.0	< \$1.0
62	Health Care and Social Assistance	\$9	110	\$5	\$5
71	Arts, Entertainment, and Recreation	< \$1.0	< 10	< \$1.0	< \$1.0
72	Accommodation and Food Services	\$2	40	< \$1.0	\$1
81	Other Services (except Public Administration)	\$2	60	\$1	\$1
90	Government	< \$1.0	< 10	< \$1.0	< \$1.0
	<b>Total</b>	<b>\$395</b>	<b>2,430</b>	<b>\$183</b>	<b>\$207</b>

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2



**TABLE A.2:** Short-term Effects on Broad Industry Groups within Arkansas

NAICS	Title	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP) (\$M)
11	Agriculture, Forestry, Fishing and Hunting	< \$1.0	< 10	< \$1.0	< \$1.0
21	Mining, Quarrying, and Oil and Gas Extraction	\$4	20	\$1	\$3
22	Utilities	\$4	< 10	< \$1.0	\$4
23	Construction	\$526	2,840	\$249	\$269
31-33	Manufacturing	\$35	140	\$7	\$14
42	Wholesale Trade	\$10	60	\$4	\$7
44-45	Retail Trade	\$31	490	\$13	\$21
48-49	Transportation and Warehousing	\$8	60	\$3	\$4
51	Information	\$10	40	\$2	\$6
52	Finance and Insurance	\$20	110	\$5	\$12
53	Real Estate and Rental and Leasing	\$16	110	\$3	\$12
54	Professional, Scientific, and Technical Services	\$16	170	\$9	\$12
55	Management of Companies and Enterprises	\$2	< 10	< \$1.0	\$1
56	Administrative and Support and Waste Management and Remediation Services	\$7	160	\$4	\$4
61	Educational Services (Private)	\$2	60	\$1	\$1
62	Health Care and Social Assistance	\$33	400	\$18	\$20
71	Arts, Entertainment, and Recreation	\$2	50	< \$1.0	\$1
72	Accommodation and Food Services	\$12	240	\$4	\$6
81	Other Services (except Public Administration)	\$9	220	\$5	\$5
90	Government	\$5	70	\$4	\$4
	<b>Total</b>	<b>\$753</b>	<b>5,250</b>	<b>\$333</b>	<b>\$406</b>

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2

**TABLE A.3:** Long-term Effects on Broad Industry Groups within the Pine Bluff MSA

NAICS	Title	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP) (\$M)
11	Agriculture, Forestry, Fishing and Hunting	< \$1.0	< 10	< \$1.0	< \$1.0
21	Mining, Quarrying, and Oil and Gas Extraction	< \$1.0	< 10	< \$1.0	< \$1.0
22	Utilities	\$4	10	\$1	\$4
23	Construction	< \$1.0	20	< \$1.0	< \$1.0
31-33	Manufacturing	\$468	100	\$13	\$90
42	Wholesale Trade	\$1	10	< \$1.0	< \$1.0
44-45	Retail Trade	\$1	40	< \$1.0	< \$1.0
48-49	Transportation and Warehousing	< \$1.0	< 10	< \$1.0	< \$1.0
51	Information	< \$1.0	< 10	< \$1.0	< \$1.0
52	Finance and Insurance	< \$1.0	10	< \$1.0	< \$1.0
53	Real Estate and Rental and Leasing	< \$1.0	< 10	< \$1.0	< \$1.0
54	Professional, Scientific, and Technical Services	< \$1.0	< 10	< \$1.0	< \$1.0
55	Management of Companies and Enterprises	< \$1.0	< 10	< \$1.0	< \$1.0
56	Administrative and Support and Waste Management and Remediation Services	< \$1.0	10	< \$1.0	< \$1.0
61	Educational Services (Private)	< \$1.0	< 10	< \$1.0	< \$1.0
62	Health Care and Social Assistance	\$2	50	\$1	\$1
71	Arts, Entertainment, and Recreation	< \$1.0	< 10	< \$1.0	< \$1.0
72	Accommodation and Food Services	< \$1.0	20	< \$1.0	< \$1.0
81	Other Services (except Public Administration)	< \$1.0	20	< \$1.0	< \$1.0
90	Government	< \$1.0	10	< \$1.0	< \$1.0
	<b>Total</b>	<b>\$481</b>	<b>350</b>	<b>\$19</b>	<b>\$100</b>

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2

**TABLE A.4:** Long-term Effects on Broad Industry Groups within Arkansas

NAICS	Title	Output (\$M)	Jobs	Earnings (\$M)	Value Added (GRP) (\$M)
11	Agriculture, Forestry, Fishing and Hunting	< \$1.0	< 10	< \$1.0	< \$1.0
21	Mining, Quarrying, and Oil and Gas Extraction	\$68	200	\$15	\$38
22	Utilities	\$11	30	\$2	\$10
23	Construction	\$9	110	\$4	\$4
31-33	Manufacturing	\$970	230	\$22	\$179
42	Wholesale Trade	\$7	40	\$3	\$5
44-45	Retail Trade	\$8	130	\$3	\$6
48-49	Transportation and Warehousing	\$5	30	\$2	\$2
51	Information	\$3	10	< \$1.0	\$2
52	Finance and Insurance	\$9	50	\$2	\$5
53	Real Estate and Rental and Leasing	\$6	40	\$1	\$5
54	Professional, Scientific, and Technical Services	\$4	50	\$2	\$3
55	Management of Companies and Enterprises	\$2	< 10	< \$1.0	\$1
56	Administrative and Support and Waste Management and Remediation Services	\$2	50	\$1	\$1
61	Educational Services (Private)	< \$1.0	20	< \$1.0	< \$1.0
62	Health Care and Social Assistance	\$11	130	\$6	\$7
71	Arts, Entertainment, and Recreation	< \$1.0	20	< \$1.0	< \$1.0
72	Accommodation and Food Services	\$4	80	\$1	\$2
81	Other Services (except Public Administration)	\$3	70	\$1	\$2
90	Government	\$4	70	\$3	\$4
	<b>Total</b>	<b>\$1,127</b>	<b>1,370</b>	<b>\$72</b>	<b>\$276</b>

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2

## OCCUPATIONAL IMPACTS

Tables A.5 through A.8 display economic impacts for the Pine Bluff MSA and the state of Arkansas on an occupational basis. The numbers are aggregated by 2-digit Standard Occupational Classification (SOC) groups. Dollar values have been rounded to the nearest hundred thousand, and employment numbers have been rounded to the nearest integer divisible by ten.

**TABLE A.5: Short-term Effects on Broad Occupational Groups within the Pine Bluff MSA**

<b>SOC</b>	<b>Title</b>	<b>New Jobs</b>	<b>New Earnings (\$ K)</b>
47-2061	Construction Laborers	340	\$20,300
49-9052	Telecommunications Line Installers and Repairers	220	\$9,300
49-9051	Electrical Power-Line Installers and Repairers	150	\$20,500
47-1011	First-Line supervisors/managers of Construction Trades and Extraction Workers	130	\$13,900
47-2031	Carpenters	90	\$4,200
47-2073	Operating Engineers and Other Construction Equipment Operators	80	\$9,000
47-2111	Electricians	60	\$6,000
43-9061	Office Clerks, General	50	\$1,500
49-1011	First-Line supervisors/managers of Mechanics, Installers, and Repairers	50	\$4,600
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	50	\$1,400
11-1021	General and Operations Managers	50	\$5,200
43-3031	Bookkeeping, Accounting, and Auditing Clerks	30	\$1,000
41-2031	Retail Salespersons	30	\$600
53-3032	Heavy and Tractor-Trailer Truck Drivers	30	\$1,200
47-2152	Plumbers, Pipefitters, and Steamfitters	20	\$1,500
41-2011	Cashiers	20	\$300
49-9098	Helpers--Installation, Maintenance, and Repair Workers	20	\$700
47-2221	Structural Iron and Steel Workers	20	\$1,600
13-2011	Accountants and Auditors	10	\$900
47-2231	Solar Photovoltaic Installers	10	\$400
41-1011	First-Line supervisors/managers of Retail Sales Workers	10	\$300
49-2021	Radio, Cellular, and Tower Equipment Installers and Repairs	10	\$700
49-3042	Mobile Heavy Equipment Mechanics, Except Engines	10	\$600
13-1051	Cost Estimators	10	\$1,200
51-4121	Welders, Cutters, Solderers, and Brazers	10	\$800

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2

**TABLE A.6: Short-term Effects on Broad Occupational Groups within Arkansas**

<b>SOC</b>	<b>Title</b>	<b>New Jobs</b>	<b>New Earnings (\$ K)</b>
47-2061	Construction Laborers	1,350	\$67,000
47-1011	First-Line supervisors/managers of Construction Trades and Extraction Workers	490	\$47,000
11-9021	Construction Managers	350	\$23,300
47-2031	Carpenters	310	\$15,400
47-2073	Operating Engineers and Other Construction Equipment Operators	290	\$24,700
49-9051	Electrical Power-Line Installers and Repairers	290	\$39,800
49-9052	Telecommunications Line Installers and Repairers	250	\$23,000
41-2031	Retail Salespersons	170	\$3,400
43-9061	Office Clerks, General	160	\$5,300
47-2111	Electricians	140	\$13,200
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	130	\$4,900
49-1011	First-Line supervisors/managers of Mechanics, Installers, and Repairers	130	\$11,800
53-3032	Heavy and Tractor-Trailer Truck Drivers	120	\$6,400
11-1021	General and Operations Managers	110	\$15,100
41-2011	Cashiers	90	\$1,500
47-2221	Structural Iron and Steel Workers	90	\$8,300
49-9098	Helpers--Installation, Maintenance, and Repair Workers	80	\$3,400
41-1011	First-Line supervisors/managers of Retail Sales Workers	80	\$2,100
47-2152	Plumbers, Pipefitters, and Steamfitters	80	\$6,600
43-3031	Bookkeeping, Accounting, and Auditing Clerks	70	\$3,200
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	60	\$1,100
35-3031	Waiters and Waitresses	60	\$800
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	60	\$1,900
41-9022	Real Estate Sales Agents	60	\$1,000
35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	60	\$700

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2

**TABLE A.7: Long-term Effects on Broad Occupational Groups within the Pine Bluff MSA**

<b>SOC</b>	<b>Title</b>	<b>New Jobs</b>	<b>New Earnings (\$ K)</b>
41-2031	Retail Salespersons	40	\$800
47-1011	First-Line supervisors/managers of Construction Trades and Extraction Workers	30	\$1,800
43-9061	Office Clerks, General	30	\$800
53-3032	Heavy and Tractor-Trailer Truck Drivers	30	\$1,500
47-2061	Construction Laborers	20	\$700
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	20	\$800
41-2011	Cashiers	20	\$400
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	20	\$400
11-1021	General and Operations Managers	20	\$2,700
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	20	\$2,300
41-9022	Real Estate Sales Agents	20	\$300
41-1011	First-Line supervisors/managers of Retail Sales Workers	20	\$500
35-3031	Waiters and Waitresses	20	\$200
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	20	\$600
43-3031	Bookkeeping, Accounting, and Auditing Clerks	20	\$700
13-2011	Accountants and Auditors	20	\$1,300
35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	20	\$200
29-1141	Registered Nurses	20	\$1,100
51-1011	First-Line supervisors/managers of Production and Operating Workers	20	\$1,700
49-9041	Industrial Machinery Mechanics	20	\$1,600
47-2031	Carpenters	20	\$400
53-7073	Wellhead Pumpers	10	\$1,300
31-1014	Nursing Assistants	10	\$300
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	10	\$800
41-4012	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	10	\$1,300

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2

**TABLE A.8:** Long-term Effects on Broad Occupational Groups within Arkansas

<b>SOC</b>	<b>Title</b>	<b>New Jobs</b>	<b>New Earnings (\$ K)</b>
11-9141	Property, Real Estate, and Community Association Managers	40	\$1,500
41-2031	Retail Salespersons	40	\$800
47-1011	First-Line supervisors/managers of Construction Trades and Extraction Workers	30	\$1,800
11-9199	Managers, All Other	30	\$1,600
43-9061	Office Clerks, General	30	\$800
53-3032	Heavy and Tractor-Trailer Truck Drivers	30	\$1,500
47-2061	Construction Laborers	20	\$700
43-6014	Secretaries and Administrative Assistants, Except Legal, Medical, and Executive	20	\$800
11-1021	General and Operations Managers	20	\$2,800
41-2011	Cashiers	20	\$400
37-2011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	20	\$400
51-8093	Petroleum Pump System Operators, Refinery Operators, and Gaugers	20	\$2,300
41-9022	Real Estate Sales Agents	20	\$300
41-1011	First-Line supervisors/managers of Retail Sales Workers	20	\$500
35-3031	Waiters and Waitresses	20	\$200
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	20	\$600
43-3031	Bookkeeping, Accounting, and Auditing Clerks	20	\$700
13-2011	Accountants and Auditors	20	\$1,300
35-3021	Combined Food Preparation and Serving Workers, Including Fast Food	20	\$200
29-1141	Registered Nurses	20	\$1,100
51-1011	First-Line supervisors/managers of Production and Operating Workers	20	\$1,700
49-9041	Industrial Machinery Mechanics	20	\$1,600
47-2031	Carpenters	20	\$400
31-1014	Nursing Assistants	10	\$300
53-7073	Wellhead Pumpers	10	\$1,300

Source: EMSI, Social Accounting Matrix and EMSI "Complete Employment" 2014Q2

# APPENDIX B: METHODOLOGY AND GLOSSARY OF TERMS

## METHODOLOGY

This report indicates the estimated economic impact of the GTL plant at two distinct phases: short-term (construction) and long-term (operation of the plant). All economic impact values are in terms of an average annual economic impact. For short-term results, these values represent the average expected impact within the three year period of construction. Depending on the actual construction process, these figures could be higher or lower in any given year. Please also note that EMSI is not making any predictions regarding the actual unique headcount of construction workers. In some cases, workers will be needed in years one, two and three, while some other workers may only be needed in year one and other workers will be needed in years two and three. The long-term impacts represent the expected economic impact of the GTL plant once it is fully operational. These impacts are anticipated to remain stable for the foreseeable future as long as the staffing needs of the plant have neither increased nor decreased.

The specific industries anticipated to receive the direct economic impacts were selected by EMSI based on an expert economic understanding of NAICS codes and previous experience with projects of this nature. For the short-term (construction) scenario, the industries include Industrial Building Construction; Oil & Gas Pipeline & Related Structure Construction; Power & Communication Line & Related Structures Construction; Highway, Street, & Bridge Construction; Other Heavy & Civil Engineering Construction; Structural Steel & Precast Concrete Contractors; and Site Preparation Contractors. For the long-term (operations) scenario, industries were selected by Energy Security Partners and vetted by EMSI. The industries include Other Electric Power Generation, Petroleum Refineries, All Other Petroleum & Coal Product Manufacturing, and Industrial Gas Manufacturing.

Several of the values referred to in this report may require further explanation. Output represents the anticipated amount of sales that will be generated as a result of the impact scenario. These values should not be interpreted as sales or revenue forecasts for the natural gas plant or for any of the other businesses associated with this scenario. They are displayed because input-output models use output as the primary metric for determining inter-regional trade flows. Therefore output forms the backbone upon which all other values (jobs, earnings and value-added) are based. Jobs represent both full-time and part-time jobs (not full-time equivalents) that will be either created or supported by the scenario. Earnings represent labor income generated as a result of the scenario. These figures include wages/salaries of



workers along with any supplementary income in terms of health insurance, benefits, etc. This value therefore is more representative of total labor cost from a firm's point of view, than take home pay from a worker's point of view. Value-added represents the increased market value of goods and services after accounting for the cost of inputs. The sum of all industry's value-added is equal to the region's gross regional product, making value-added the single more useful and comprehensive metric for measuring economic impact.

It would not be reasonable to assume that all materials purchased and all workers hired to build and operate the plant will be purchased within the Pine Bluff MSA, or even within the State of Arkansas. Out-of-region spending for raw materials, supplies and services (or "leakage") has been accounted for in the model using EMSI's own regional purchase coefficients (RPCs). These RPCs provide reasonable estimates for the degree of supplies and services that are likely available for a business to purchase from other companies within the region. After accounting for leakage the actual amount of net output generated in the construction phase is considerable less than the actual cost of construction. This is why direct output within the Pine Bluff MSA and the State of Arkansas is lower than the average annual cost of construction (\$933M per year) mentioned in the introduction of the report.

Similarly, EMSI has accounted for the amount of labor expected to be hired from within the Pine Bluff MSA and within the state of Arkansas. Prior to arriving at some reasonable assumptions, EMSI studied the availability of construction laborers within these regions, and received input from Energy Security Partners regarding labor migration patterns for other large scale industrial production projects. The assumed percent of construction laborers who will reside within the Pine Bluff MSA during construction is 72%, and the assumed percent who will reside in the state of Arkansas is 90%. Without intensive study of the region's labor shed, it is difficult to determine precise numbers regarding in migration of laborers. But it is important to note that this assumption only affects the induced effects, which is a relatively small proportion of overall construction impacts. A custom adjustment has also been applied to the direct effects in the long-term scenario. Through consultation with Energy Security Partners it was determined that it is reasonable to expect that 50% of long-term operating workers at the GTL plant will reside outside of the Pine Bluff MSA. Therefore, the direct effects in the long-term scenario (Table 1) are exactly half of those for the state of Arkansas (Table 2).

## GLOSSARY OF KEY TERMS

<b>Direct effect</b>	displays the output, jobs, earnings and value-added as a result of the initial economic transaction
<b>Indirect effect</b>	the sum of additional economic activities generated within the supply-chain of the directly affected industries
<b>Induced effect</b>	represents how the wages paid to workers at the direct and indirect stages translate into increased household spending, which generates further economic activity.

**Output**

the anticipated amount of new sales that will be generated as a result of the impact scenario. These values are displayed because input-output models use output as the primary metric for determining inter-regional trade flows. Therefore these values are the backbone upon which all other values (jobs, earnings and value-added) are built.

**Value-added**

represents the increased market value of goods and services after accounting for the cost of inputs. The sum of all industries' value-added is equal to the region's gross regional product, making value-added the single more useful and comprehensive metric for measuring economic impact.

# APPENDIX C: EMSI'S INPUT/OUTPUT MODEL

The input-output model used in the study was developed by Economic Modeling Specialists Int. (EMSI). The model uses a similar statistical approach to input-output as both IMPLAN and RIMS II. The distinguishing difference is that the EMSI model uses a higher number of available industries compared to other models, which allows EMSI multipliers to better reflect local, sub-regional, and regional economic changes. The indirect/induced jobs estimated are hypothetical in nature based on generally accepted supply chain and increased spending effects.

EMSI uses nearly 90 government (federal and state) data sources and creates an integrated dataset that balances accuracy with up-to-date relevance. Thousands of education, workforce, and economic development professionals currently use EMSI's input-output model for regional economic analysis and planning. Even though EMSI's input-output model approach is slightly different from the procedures used by IMPLAN and RIMS II, the job impacts estimates are very comparable.

EMSI's input-output model framework is as follows:

First EMSI created a national Z matrix for about 1,125 industry sectors using Bureau of Economic Analysis "make" and "use" tables from the annual and benchmark input-output accounts. This matrix estimates the total amount of purchases each industry makes from other industries.

$$\mathbf{Z} = \mathbf{VQ}^{-1}\mathbf{U}$$

where  $\mathbf{V}$  is the industry "make" table,  $\mathbf{Q}^{-1}$  is a vector of total gross commodity output, and  $\mathbf{U}$  is the industry "use" table.

The Z matrix is then normalized to generate an A matrix. This A matrix shows the inter-industry linkages in terms of percentages of purchases.

This aggregate national level A matrix is then regionalized using Stevens' Regional Purchase Coefficients (RPCs) and the Location Quotient (LQ) of value-added sales.

Then, based on this matrix, EMSI establishes an inter-industry sales multipliers matrix (B Matrix) for all the industries in the region using the Leontief inverse approach.

$$\mathbf{B} = (\mathbf{I} - \mathbf{A})^{-1}$$

Where  $\mathbf{I}$  is identity matrix.

When an exogenous change is applied to any industry  $i$  in the model—for example addi-

tional investment ( $Y_i$ )—it creates changes (additional sales) to that particular industry and also through the sales multiplier (B matrix) to the related industries as well in the region. These additional sales, generated in that particular industry, are used to create direct jobs and earnings. The additional sales, generated to the related industries, are used to create indirect/induced jobs and earnings for that particular investment using sales-to-job and sales-to-earnings ratios.

$$\xi = \varphi Y_i$$

Where  $Y_i$  is the vector of new investment (we have values only for the  $i^{\text{th}}$  industry and zeros for all other industries),  $\varphi$  is a vector of output-to-input ratio in all the industries, and  $\xi$  is a vector of additional sales generated in the  $i^{\text{th}}$  industry due to the new investment in that industry.

$$\varphi = B\xi$$

Where  $\varphi$  is the vector that gives extra sales generated in all the industries in that region due to additional investment in the  $i^{\text{th}}$  industry.

Finally, we can get the additional jobs (earnings) created for an investment by multiplying it (element-by-element) with a vector of jobs-to-sales ratio (earnings-to-sales ratio).

## JOBS

**Total Jobs**  $J = \lambda\varphi$

Where  $\lambda$  is the vector of jobs to sales ratio for all the industries and  $J$  is the vector of additional jobs created in each industry in the region due to the new investment.

**Indirect/Induced Jobs**  $J_{n-i} = \lambda_{n-i} \times \varphi_{n-i}$  (conversely,  $J_{n-i} = J - J_i$ )

Where  $n$  is the total number of industries and  $J_{n-i}$  additional jobs created other than  $i^{\text{th}}$  industry (indirect jobs) due to investment in  $i^{\text{th}}$  industry.

## EARNINGS

**Total Earnings**  $E = \omega\varphi$

Where  $\omega$  is the vector of earnings-to-sales ratio for all the industries and  $E$  is the vector of additional earnings created in each industry in the region due to the new investment.

**Indirect/Induced Earnings**  $E_{n-i} = \omega_{n-i} \times \varphi_{n-i}$  (conversely,  $E_{n-i} = E - E_i$ )

Where  $n$  is the total number of 6-digit NAICS industries and  $E_{n-i}$  is the additional earnings created other than  $i^{\text{th}}$  industry (indirect earnings) due to investment in  $i^{\text{th}}$  industry.

EMSI's indirect/induced job creation estimations in its input-output model are based on widely accepted economic theory and the use of current government data sources. EMSI goes through a rigorous process to ensure that its data and input-output model estimations are accurate, up-to-date, and as clear as possible for regional stakeholders.