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Executive Summary

Black & Veatch (B&V) was retained by Cameron LNG, LLC to evaluate a regression analysis methodology using DOE/EIA AEO2011 sensitivity analysis to determine the price effect from exporting incremental LNG volumes. This analysis is based on the DOE/EIA's 2011 Annual Energy Outlook (AEO2011).[1]

This approach was used to take advantage of the latest market intelligence underlying the EIA's well-documented and public National Energy Modeling System (NEMS). In addition to the thoroughness of EIA's methods and documentation, AEO2011, which extends to 2035, gives a long-term view of price impacts. This approach also allows the results to be compared to those of other case studies based on supply and demand that are published in AEO2011.

Black & Veatch's fuel team has extensive experience with industry leading gas price forecasting models including NARG™, GPCM™, and SAIC/NEMS used for EIA/DOE forecasting. The lead analysts assigned to this project worked as SAIC employees in its federal services division for two years. While there, they analyzed key market drivers for the petroleum market model, oil and gas supply model, and the natural gas transportation models within NEMS. They also analyzed full cycle (extraction to market) energy efficiency curves for the oil and gas sectors (as well as for the metal and non-metal mining sectors) of NEMS.

The approach used in this study was first to use published data on case studies from AEO2011 to estimate the underlying gas supply and demand curves. The intersection of these curves (the equilibrium point) serves as a baseline. The demand curve was then shifted to the right by one Bcf/d to simulate the impact of adding one Bcf/d of liquefaction capacity operating at 100% load factor. The difference between the adjusted and baseline equilibrium points indicates the expected increase in national average delivered prices in 2009 dollars. The price impact for this case of 1.0 Bcf/d increase was determined to range from a high of $0.088/Mcf in 2025 to a low of $0.064/Mcf in 2035.

The results of this analysis, based upon the described methodology and assumptions, are reasonable to provide a general and national overview of the price effect on the average U.S. delivered price of gas resulting from a generic incremental demand of 1.0 Bcf/d attributable to LNG exports.

The result for 1.0 Bcf/d is expected to be scalable up to approximately 2.0 Bcf/d, a volume associated with a generic liquefaction facility. These results are believed to be generally accurate within the range of the sensitivity scenarios conducted by DOE, especially in 2020 when the maximum increase evaluated by DOE along the supply curve was approximately 2.0 Bcf/d. The maximum increase evaluated by DOE was approximately 7.0 Bcf/d in 2035.

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[1] U.S. Energy Information Administration, "AEO 2011 with Projections to 2035, " DOE/EIA-0383(2011), April 2011.

Methodology

B&V was retained by Cameron LNG, LLC to evaluate a regression analysis methodology using DOE/EIA AEO2011 sensitivity analysis to determine the price effect from exporting incremental LNG volumes. This methodology is summarized below.

1. Categorize the forty five (45) published scenarios & national average delivered gas price (2009$) in AEO 2011:
   a. Dominantly affect gas demand and not gas supply (Table 1),
   b. Dominantly affect gas supply but not gas demand (Table 2), or
   c. Significantly affect both gas demand and gas supply (Table 3).

The sorting process and description is provided in the Section entitled "Sorting AEO 201 Cases".

In this analysis AEO2011 case study results were used rather than actual market data. As such, the analysis is an attempt to interpret and apply the supply and demand curves underlying the model used in developing the case studies. Therefore the results should be accurate to the extent that the AEO2011 model reflects real world market behavior, over the range of the scenarios analyzed.

Normally what economists call the "identification problem" means that one cannot easily use market data to estimate supply and demand curves. However, in this special case in which only the demand curve has shifted, as in Table 1, the before and after market clearing prices and quantities can be used to estimate the supply curve. Similarly, in the special case in which only the supply curve has shifted, as in Table 2, the quantities can be used to estimate the demand curve. The data in Table 3 were not used in the analysis because they would be subject to the identification problem.[2]

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[2] *Identification problem: The problem of estimating the parameters of *structural equations when only equilibrium positions can be observed. For example, in the market for a particular good, if demand conditions vary and supply conditions do not, comparing prices and quantities at different times allows us to determine the supply equation; if supply conditions vary and demand conditions do not, we can estimate the demand equation; but if both supply and demand conditions vary, regressing quantity on price tells us nothing. The identification problem can be resolved only if either theory or the results of other studies inform us that some explanatory variables affect one side of the market but not the other.*

Source: Black, John; Hashimzade, Nigar (2009-01-22). A Dictionary of Economics (Oxford Dictionary of Economics) (p. 210). Oxford University Press. Kindle Edition.

Table 1: AEO 2011 Scenarios Selected That Impact Only the Demand Curve (2009$/Mcf, and All-Sector U.S. Demand in Bcf/d)

	2020		2025		2030		2035	
AEO2011 Case Study	Price	Demand	Price	Demand	Price	Demand	Price	Demand
High technology	$6.63	66.4	$7.52	64.2	$7.92	65.5	$8.41	66.4
Low growth	$6.89	67.5	$7.66	65.5	$7.97	66.3	$8.42	66.7
Extended policies	$6.96	68.4	$7.71	66.4	$8.05	67.0	$8.56	67.5
Decreasing costs	$7.07	68.4	$8.01	67.9	$8.43	69.9	$8.90	70.5
Low coal cost	$7.03	68.4	$8.00	67.6	$8.50	70.0	$9.15	72.0
Low renewable cost	$7.08	69.0	$8.00	68.1	$8.43	69.8	$8.89	70.4
High renewable cost	$7.19	69.0	$8.10	68.6	$8.55	71.0	$9.25	73.0
Low E15	$7.08	69.1	$8.04	68.4	$8.49	70.7	$9.13	72.4
Low EOR	$7.19	69.1	$8.03	68.4	$8.50	70.8	$9.19	72.5
Low nuclear cost	$7.13	69.2	$8.03	68.5	$8.45	70.4	$8.95	71.0
HDV fuel economy standard	$7.12	69.3	$8.01	68.5	$8.49	70.8	$9.12	72.5
Low fossil cost	$7.20	69.3	$8.08	68.8	$8.49	70.8	$9.03	71.7
3% LDV fuel economy growth	$7.10	69.3	$8.01	68.3	$8.46	70.5	$9.13	72.2
No Sunset	$7.08	69.4	$7.97	68.5	$8.40	70.2	$8.93	71.3
Reference	$7.13	69.4	$8.01	68.7	$8.48	71.0	$9.14	72.7
Frozen costs	$7.18	69.5	$8.05	68.7	$8.52	71.0	$9.22	72.9
High fossil cost	$7.16	69.5	$8.07	68.7	$8.53	71.1	$9.19	72.8
6% LDV fuel economy growth	$7.10	69.5	$8.01	68.5	$8.50	70.8	$9.12	72.9
High nuclear cost	$7.18	69.5	$8.04	68.7	$8.49	70.9	$9.17	72.6
Low oil price	$6.94	69.6	$7.67	68.6	$8.24	70.0	$8.72	72.7
Traditional low oil price	$6.94	69.6	$7.67	68.6	$8.24	70.0	$8.72	72.7
High E15	$7.18	69.6	$8.01	68.6	$8.51	70.9	$9.16	72.7
Transport mercury MACT 20	$7.15	69.8	$8.11	69.5	$8.49	71.7	$9.16	73.5
High oil price	$7.28	70.0	$8.25	69.2	$8.71	71.2	$9.30	73.5
Traditional high oil price	$7.28	70.0	$8.25	69.2	$8.71	71.2	$9.30	73.5
High coal cost	$7.22	70.0	$8.15	69.8	$8.69	72.8	$9.38	75.7
Low technology	$7.28	70.5	$8.42	70.8	$8.84	74.2	$9.53	77.3
Transport mercury MACT 5	$7.26	70.5	$8.21	70.5	$8.59	72.5	$9.25	74.8
High growth	$7.42	71.2	$8.52	71.6	$9.12	76.1	$9.48	81.2

Table 2. AEO 2011 Scenarios Selected That Impact Only the Supply Curve (2009$/Mcf, and All-Sector U.S. Demand in Bcf/d)

	2020		2025		2030		2035	
AEO2011 Case Study	**Price**	**Demand**	**Price**	**Demand**	**Price**	**Demand**	**Price**	**Demand**
Low shale recovery per well	$9.11	61.7	$10.59	61.6	$10.45	65.2	$11.39	66.1
Low shale recovery per play	$8.11	65.0	$9.45	64.0	$9.59	66.9	$10.23	69.5
Slow oil/gas technology	$7.76	66.5	$8.90	65.4	$9.46	67.7	$9.73	71.0
High OCS costs	$7.19	69.1	$8.07	68.3	$8.50	70.7	$9.19	72.3
High OCS resource	$7.10	69.2	$8.00	68.6	$8.45	71.1	$8.95	73.4
OCS access	$7.12	69.4	$8.05	68.6	$8.52	70.9	$9.18	72.4
Reference	$7.13	69.4	$8.01	68.7	$8.48	71.0	$9.14	72.7
Rapid oil/gas technology	$6.63	72.0	$7.38	71.0	$7.85	73.5	$8.51	75.2
High shale recovery per play	$6.46	73.0	$7.21	72.4	$7.62	74.9	$8.11	77.4
High shale recovery per well	$5.84	75.9	$6.50	76.1	$6.98	78.4	$7.42	81.2

Table 3. AEO 2011 Scenarios Selected That Impact Both Demand and Supply Curves (Excluded from Analysis) (2009$/Mcf, and All-Sector U.S. Demand in Bcf/d)

	2020		2025		2030		2035	
AEO2011 Case Study	**Price**	**Demand**	**Price**	**Demand**	**Price**	**Demand**	**Price**	**Demand**
AEO2010 Reference	$8.81	62.0	$9.13	64.6	$10.17	25.0	$11.00	68.1
Retrofit 20	$7.00	67.6	$7.95	67.8	$8.49	21.8	$9.20	73.2
Early release	$7.23	68.9	$8.08	68.4	$8.58	22.1	$9.26	72.5
Retrofit 5	$7.12	68.9	$8.27	69.9	$8.67	22.7	$9.28	75.8
No GHG concern	$7.13	69.2	$7.98	68.3	$8.40	21.9	$9.04	71.7
Low EOR - GHG price	$8.93	73.5	$10.03	74.9	$12.05	27.5	$13.12	81.2
GHG price	$8.95	73.6	$10.02	74.8	$12.05	27.5	$13.10	81.3
Retrofit 20, low gas price	$5.74	75.1	$6.36	75.7	$6.90	17.4	$7.33	81.7
Retrofit 5, low gas price	$5.81	76.6	$6.56	77.6	$7.08	18.0	$7.55	84.2

2. Run a regression analysis for the selected supply and demand scenarios

The supply curve resulting from the data in Table 1 is a positively sloping line (low supply when price is low, high supply stimulated when price is high). The 2020 supply curve price elasticity is approximately 0.7, meaning a 1.0% increase in price results in about a 0.7% increase in quantity supplied. By 2035 price elasticity is approximately 1.5 indicating that supply becomes more elastic to price.

The demand curve resulting from the data in Table 2 is a negative sloping line (low price stimulates high demand; high price results in low demand). The 2020 and 2035 demand curve price elasticity is approximately -0.5, meaning a 1.0% increase in price results in about a 0.5% reduction in quantity demanded. The demand curve price elasticity is approximately the same over this 15-year period.

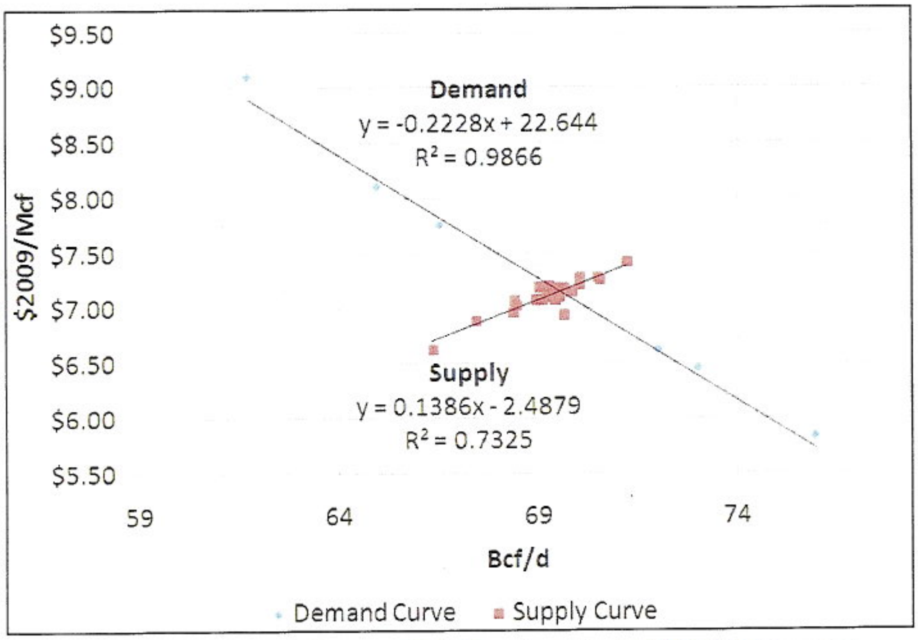

Figure 1:Demand and Supply Curves – 2020, Based on Selected AEO 2011 Scenarios

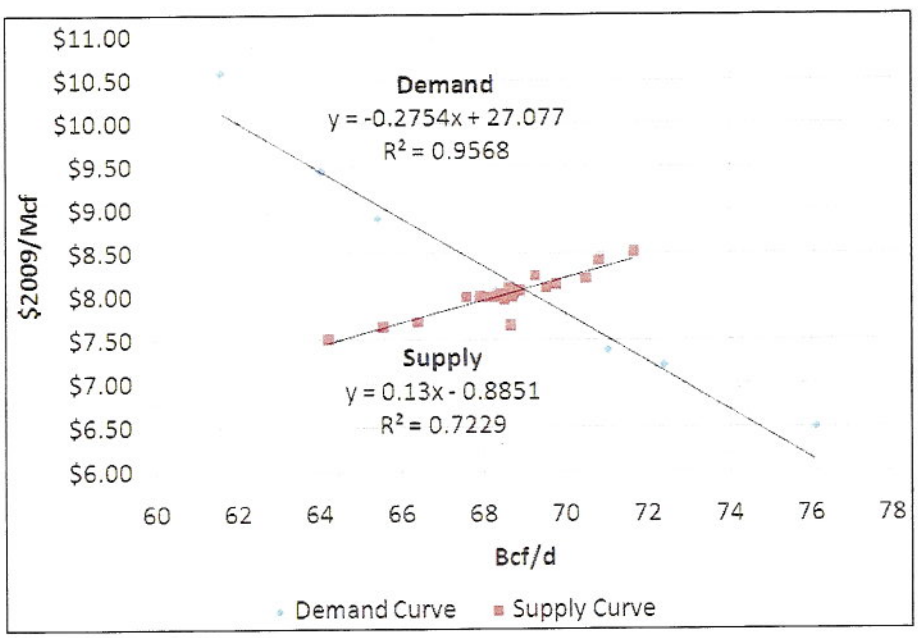

Figure 2.Demand and Supply Curves – 2025, Based on Selected AEO 2011 Scenarios

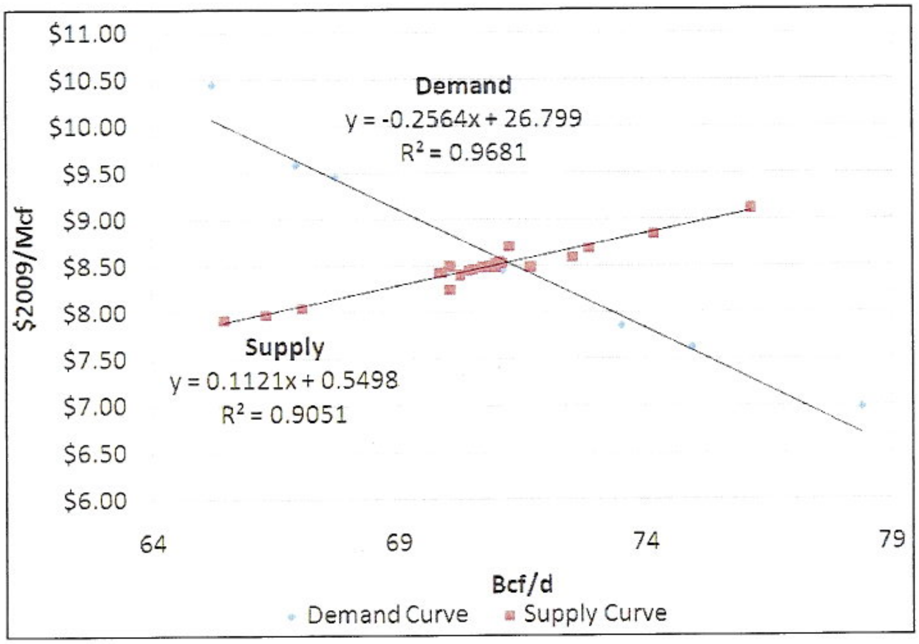

Figure 3.Demand and Supply Curves – 2030, , Based on Selected AEO 2011 Scenarios

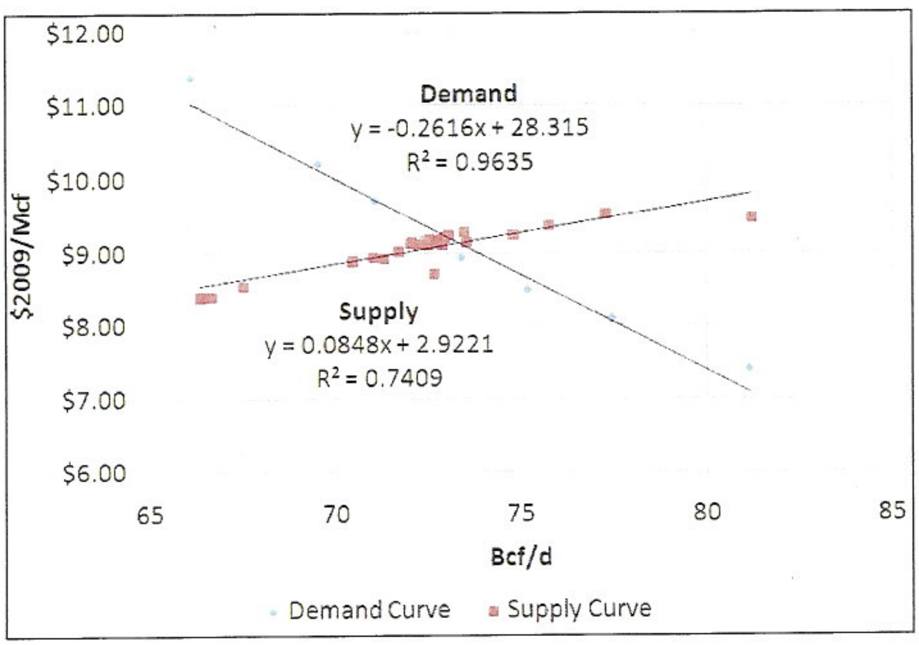

Figure 4. Demand and Supply Curves – 2035, Based on Selected AEO 2011 Scenarios

3. Where the supply curve and the demand curve intersect is the annual equilibrium point where price is balanced between demand and supply. This equilibrium price for four designated periods (Figures 1-4) is summarized below and is close to the DOE's average national delivered price (2009$) for their Reference Case.

Table 4. Comparison of Equilibrium Price Based on Selected Methodology with DOE AEO 2011 Reference Case Average Delivered Price (2009$/Mcf)

	EQUILIBRIUM PRICE	DOE AVERAGE DELIVERED PRICE
2020	7.150	7.13
2025	8.082	8.01
2030	8.535	8.48
2035	9.138	9.14

The addition of liquefaction demand would have the effect of increasing the demand for gas without affecting the shape of the demand curve. Therefore, the estimated demand and supply curves and their equilibrium point were used to calculate that effect of increasing demand (negative slope) by 1.0 Bcf/d. This is accomplished by shifting the demand line 1.0 Bcf/d to the right while keeping the supply curve unchanged (Figure 5).

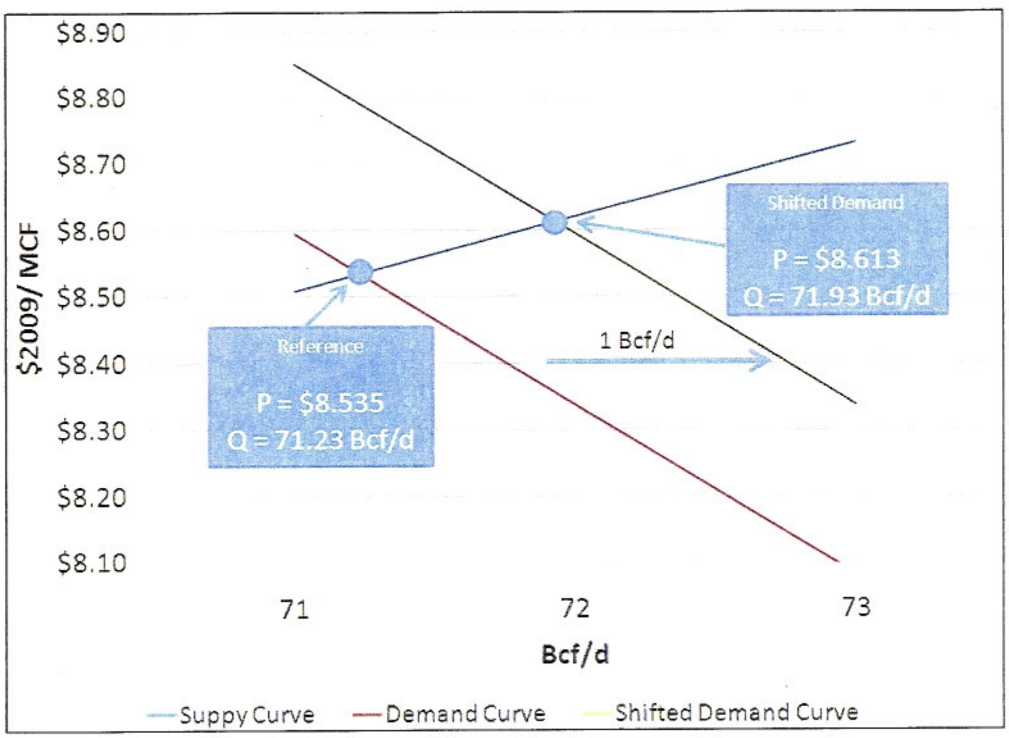

Figure 5. Shifting Demand Curve by 1.0 Bcf/d in 2030

Results

The results are shown below in Table 5 for a 1.0 Bcf/d demand curve shift.

Table 5. Price and Supply Response as Result of 1.0 Bcf/d Demand Increase

	EQUILIBRIUM PRICE RESPONSE 2009$/MCF			NET SUPPLY RESPONSE (BCF/D)		
	Equilibrium Price	Demand Shift Price	Difference	Equilibrium Demand	Demand Shift	Difference
2020	7.150	7.235	0.085	69.540	70.156	0.616
2025	8.082	8.170	0.088	68.975	69.653	0.678
2030	8.535	8.613	0.078	71.233	71.928	0.695
2035	9.138	9.202	0.064	73.305	74.060	0.755

These results indicate that a 1.0 Bcf/d change in total U.S. demand in 2020, due to new liquefaction load, would result in an estimated $0.085 increase per Mcf in U.S. average delivered gas price. This same 1.0 Bcf/d change would result in increases of $0.088 per Mcf in 2025, $0.078 per Mcf in 2030, and $0.064 per Mcf in 2035.

The results of this analysis, based upon the described methodology and assumptions, are reasonable to provide a general and national overview of the price effect on the average U.S. delivered price of gas resulting from a generic incremental demand of 1.0 Bcf/d attributable to LNG exports.

Limitations

- The results are accurate only to the extent that the DOE models used in AEO2011 reflect real world market behavior for a 1.0 Bcf/d demand increase and scalable up to about 2.0 Bcf/d related to a generic U.S. liquefaction facility.
- Some "affect demand only" points near the intersection of the demand and supply curves may also have small supply impacts, although the effect if any on the supply curve regression coefficients is believed to be minimal.
- The progressive flattening of the supply curve as indicated by their coefficients (approximately 0.14 in 2020 to 0.08 in 2035 as shown in Figures 1-4) is believed to reflect the flattening of the long run marginal cost of supply due to gains in technology efficiency and other factors incorporated in the DOE analyses.
- The results are believed to be accurate within the range of the sensitivity scenarios conducted by DOE. In 2020 the maximum increase evaluated by DOE along the supply curve was about 1.7 Bcf/d. By 2035 the maximum increase evaluated was approximately 7 Bcf/d, although there is some indication that the supply curve had begun to flatten out at a level lower than 7 Bcf/d, as can be seen in Figure 4.

Sorting AEO 2011 Cases

This section sorts the 45 cases with available gas and price data into one of three categories:

- Gas supply-only
- Combined gas supply and demand
- Gas demand-only

Two other reported cases, the AEO2010 Reference case and the 2011 Early Release case were based on other models and therefore were not used.

The supply-only cases are believed to shift the supply curve and not affect the demand curve. The equilibrium price and quantity points in these cases are used to trace out the demand curve. The demand-only cases are believed to shift only the demand curve and not affect the supply curve. The equilibrium price and quantity points in these cases are used to trace out the supply curve.

The cases believed to affect both the supply and demand curve were not used in the analysis.

GAS SUPPLY-ONLY CASES

Introduction

The gas supply-only cases are believed to make no changes to the demand for natural gas that would impact the natural gas demand curve. As the starting point, the Reference Case is applicable as both a gas demand-only case and a gas supply-only case. AEO2011 included four cases that made changes to the recovery per shale gas well and or the required number of wells in each gas play is changed.

Following is a brief description of each case for which gas price and quantity forecasts are available.

AEO 2011 Gas Supply-only Cases

Reference Case

- **Reference case:** Current laws and regulations affecting the energy sector remain unchanged and current sunset dates do not change. Economic output as measured by real GDP increases by 2.7 percent per year from 2009 through 2035. Oil prices of $125 per barrel (2009 dollars) in 2035. Capital cost of greenhouse gas intensive technologies increased by 3 percentage points.

Oil and Gas Supply Cases

- **Low Shale EUR case:** Estimated ultimately recovery (EUR) per shale gas well is assumed to be 50 percent lower than in the Reference case., increasing the per-unit cost of developing the resource.
- **High Shale EUR case:** Estimated ultimate recovery (EUR) per shale gas well is assumed to be 50 percent higher than in the Reference case, decreasing the per-unit cost of developing the resource.
- **Low Shale Recovery case:** Total unproved technically recoverable shale gas resource base is the same as in the Low Shale Estimate Ultimate Recovery case (423 trillion cubic feet), but instead of decreasing the EUR per well, the estimate of the number of wells that need to be drilled to fully recover the shale gas in each play is assumed to be 50 percent lower than in the

Reference case. This means that the per-unit cost of developing the resource is the same as in the Reference case.

- **High Shale Recovery case:** Total unproved technically recoverable shale gas resource base is the same as in the High Shale Estimated Ultimate Recovery case (1,230 trillion cubic feet), but instead of increasing the EUR per well, the estimate of the number of wells that need to be drilled to fully recover the shale gas in each play is assumed to be 50 percent higher than in the Reference case. This means that the per-unit cost of developing the resource is the same as in the Reference case.
- **Slow Oil and Gas Technology case**: Parameters representing the effects of technological progress on production rates, exploration and development costs, and success rates for conventional and unconventional oil and natural gas drilling are 50 percent less optimistic than those in the Reference case.
- **Rapid Oil and Gas Technology case:** Parameters representing the effects of technological progress on production rates, exploration and development costs, and success rates for conventional and unconventional oil and natural gas drilling in the Reference case are improved by 50 percent.
- **Reduced OCS Access case:** No new oil or gas lease sales occur in the Eastern Gulf of Mexico, Pacific, Atlantic, and Alaska OCS through 2035.
- **High OCS Resource case:** Oil and natural gas resources in undeveloped areas of the OCS (namely the Pacific, Eastern Gulf of Mexico, Atlantic, and Alaska) are assumed to be 3 times higher than in the Reference case.
- **High OCS Costs case:** Costs of exploration and development of oil and natural gas resources in the OCS are assumed to be 30 percent higher than in the Reference case.

COMBINED GAS DEMAND AND SUPPLY CASES

Introduction

Combined cases are believed to have at least some impact on both the natural gas supply curve and the natural gas demand curve.

- In the electricity sector the cases combine retrofit cases, which impact the gas demand curve through fuel substitution, with lower gas prices, which implies a shifted supply curve.
- The oil and gas supply cases modify the supply of oil, which impacts the gas demand curve through fuel substitution and the costs or access to gas, which modifies the gas supply curve.
- The greenhouse (GHG) scenarios impact the relative costs of other energy sources, which impacts the gas demand curve, and the cost of gas directly through carbon taxes, which impacts the gas supply curve.

Following is a brief description of each case for which gas price and quantity forecasts are available.

AEO 2011 Combined Cases

Electricity Sector Cases

- **Retrofit Required 5 case:** Represents stringent requirements for reductions in airborne emissions from coal-fired power plants. Investments in retrofits are assumed to be recovered over a 5-year period.
- **Retrofit Required 20 case:** Same requirements as above, but investments in retrofits are assumed to be recovered over a 20-year period.
- **Low Gas Price Retrofit Required 5 case:** Identical to the Retrofit Required 5 case but adds an assumption of increased availability domestic shale availability and utilization rate, as in the High Shale EUR case.
- **Low Gas Price Retrofit Required 20 case:** Identical to the Low Gas Price Retrofit Required 5 case, but investments in retrofits are assumed to be recovered over a 20-year period.

Cross-cutting Integrated Cases

- **GHG Price Economywide case:** Economy-wide carbon allowance greenhouse gas (GHG) price is examined.
- **No GHG Concern case:** Run without any adjustment for concern about potential greenhouse gas (GHG) regulations.
- **Low EOR - GHG Price Economywide case:** *Low Lo*C Low Combines the assumptions of the low enhanced oil recover (EOR) and the green house gas price economywide cases. Enhanced oil recoveryCO2 availability is reduced and a carbon price exists that provides incentives for emitters to install carbon capture capabilities.

GAS DEMAND-ONLY CASES

Introduction

The gas demand-only cases are believed to make no changes to the price or availability of natural gas that would impact the natural gas supply curve. Once all cases that impact on the gas supply curve have been removed the remaining cases should impact only the demand curve, although in some cases that impact may be small. As the starting point, the Reference Case is applicable as both a gas demand-only case and a gas supply-only case.

Following is a brief description of each case for which gas price and quantity forecasts are available.

AEO 2011 Gas Demand-only Cases

Reference Case

- **Reference case:** Current laws and regulations affecting the energy sector remain unchanged and current sunset dates for laws do not change. Economic output as measured by real GDP increases by 2.7 percent per year from 2009 through 2035. Oil prices of $125 per barrel (2009 dollars) in 2035. Capital cost of greenhouse gas intensive technologies increased by 3 percentage points.

Macroeconomic Growth Cases

- **Low Economic Growth case:** *E*conomic output as measured by real GDP increases by 2.1 percent per year from 2009 through 2035.

- **High Economic Growth case:** Economic output as measured by real GDP grows at 3.2 percent per year from 2009 through 2035.

Oil Price Cases

- **High Oil Price case:** World oil prices reach about $200 per barrel (2009 dollars) in 2035.
- **Low Oil Price case (primary low price case):** world crude oil prices are only $50 per barrel (2009 dollars) in 2035.
- **Traditional High Oil Price case:** OPEC countries are assumed to reduce their production from the current rate.
- **Traditional Low Oil Price case:** OPEC countries increase their conventional oil production to obtain a 52-percent share of total world liquids production.

Industrial Sector Cases

- **Frozen Plant Capital Cost case:** Holds the energy efficiency of new plant and equipment constant at the 2010 level over the projection period.
- **Decreasing Plant Capital Cost case:** Earlier availability, lower costs, and higher efficiency for more advanced equipment and a more rapid rate of improvement in the recovery of biomass byproducts from industrial processes.

Transportation Sector Cases

- **CAFE 3% Growth case**: Examines the impact of increasing corporate average fuel economy (CAFE) fuel economy standards by 3% annually through 2025.
- **CAFE 6% Growth case**: Examines the impact of increasing corporate average fuel economy (CAFE) fuel economy standards by 6% annually through 2025.
- **Heavy-Duty Vehicle Fuel Economy Standards case:** Simulates the expected fuel economy impact of the fuel economy standards for heavy-duty vehicles for model years 2014 through 2018.

Electricity Sector Cases

- **Low Nuclear Cost case:** Reflects a 20-percent reduction in the capital and operating costs for advanced nuclear technology in 2011, falling to 40 percent below the Reference case in 2035.
- **High Nuclear Cost case:** Capital costs for advanced nuclear technology remain fixed at the 2011 levels.
- **Low Fossil Technology Cost case:** Capital costs and operating costs for all coal- and natural-gas-fired generating technologies start 20 percent lower than Reference case levels and fall to 40 percent lower than Reference case levels in 2035.
- **High Fossil Technology Cost case:** Capital costs for all coal- and natural-gas-fired generating technologies remain fixed at the 2011.
- **Transport Rule Mercury MACT 5 case:** Air Transport Rule limits on SO2 and NOx and a 90-percent mercury MACT (maximum achievable control technology) are enacted. A 5-year recovery period for investments in environmental control projects is assumed.
- **Transport Rule Mercury MACT 20 case:** Same rules as above, but a 20-year recovery period for investments in environmental control projects is assumed.

Renewable Fuels Cases

- **Low Renewable Technology Cost case:** Levelized costs of energy resources for generating technologies using renewable resources are assumed to start at 20 percent below Reference case assumptions in 2011 and decline to 40 percent below the Reference case costs for the same resources in 2035.

- **High Renewable Technology Cost case:** Capital costs, operating and maintenance costs, and performance levels for wind, solar, biomass, geothermal, and renewable liquid fuel technologies are assumed to remain constant at 2011 levels through 2035.

Coal Market Cases

- **Low Coal Cost case:** Average annual growth rates for coal mining productivity are higher than those in the Reference case and are applied at the supply curve level.
- **High Coal Cost case:** Average annual productivity growth rates for coal mining are lower than those in the Reference case.

Cross-Cutting Integrated Cases

- **Integrated Low Technology case:** *C*ombines the assumptions from the Residential, Commercial, and Industrial 2010 Technology cases and the Electricity High Fossil Technology Cost, High Renewable Technology Cost, and High Nuclear Cost cases.
- **Integrated High Technology case:** *C*ombines the assumptions from the Residential, Commercial, and Industrial High Technology cases and the Electricity Low Fossil Technology Cost, Low Renewable Technology Cost, and Low Nuclear Cost cases.
- **Low EOR case:** Industrial CO2 available from coal-to-liquids and biomass to liquids plants is reduced by 50 percent from the Reference case due to low enhanced oil recovery (EOR).
- **No Sunset case:** Selected policies with sunset provisions like the PTC, ITC, and tax credits for energy-efficient residential, commercial, industrial, refinery, and renewables equipment in the buildings and industrial sectors will be extended indefinitely rather than allowed to sunset.
- **Extended Policies case:** Existing policies are extended as in the No Sunset Case, plus new standards and tax credits are added or extended.
- **Low E15 Penetration case:** Infrastructure and regulatory barriers to 15% ethanol (E15) adoption are more pronounced, and penetration of E15 in all demand regions grows at a slower rate.
- **High E15 Penetration case:** 15% ethanol (E15) adoption occurs at a faster rate and reaches a higher overall level than in the Reference case.

APPENDIX D

Economic Impact Assessment

LNG Exports from Cameron Terminal

Cameron LNG, LLC

December 2011

Contents

Table of Figures

1. Introduction

The objective of this analysis is to provide an assessment of the economic impact that the production and export of liquefied natural gas (LNG) from Cameron LNG would have on the U.S. economy, including:

- Improved national balance of trade
- Increase in national output
- Increase in employment
- Increase in employee wages

Key assumptions include:

- The Cameron LNG liquefaction plant will make use of existing facilities at the site, including marine facilities, loading and unloading facilities, storage tanks and control buildings.
- LNG exports will average 12 mtpa of LNG (approximately 1.7 Bcfd) over the plant's 20-year project life,[1] with an additional 0.2 Bcfd required for its operation.[2]
- The liquefaction plant is assumed to be operational from 2017 to 2036.

This analysis is derived from the latest publicly available forecasts, data and analyses. These include: (1) energy prices from the Energy Information Administration's 2011 Annual Energy Outlook (AEO2011), (2) employment and other economic statistics from the 2007 Economic Census by the U.S. Census Bureau, and (3) multipliers developed by the Bureau of Economic Analysis (BEA) from its Regional Input-Output Modeling System (RIMS II)[3].

2. Summary

Key findings of this analysis include:

- U.S. balance of trade over the project's lifetime will be improved by $166 billion in 2011 dollars for LNG priced at 50% of oil parity to $265 billion in 2011 dollars for LNG priced at 90% of oil parity.

- U.S. national output is expected to increase $253 billion to $403 billion in 2011 dollars over the project life.

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[1] For purposes of this analysis the project operating life is assumed to be the same as the anticipated 20 year export license.

[2] Actual liquefaction volumes and related economic impacts may vary depending on customer requirements in response to relative world gas prices.

[3] RIMS II multipliers produced for Cameron LNG, LLC by the Regional Product Division of the Bureau of Economic Analysis on 10/16/2011.

- Direct employment in the gas industry is expected to increase by approximately 2,900 jobs during the peak 12-month construction period and by 98,000 job-years over the project life.
- Total employment in the U.S. economy, including the gas industry, is expected to increase by an estimated 63,000 job-years over the 48-month construction period and 53,000 jobs per year over the 20-year period of plant operation, totaling almost 1.1 million job-years over the project's lifetime.
- Total economy-wide wage gains are estimated to average $717 million per year in 2007 dollars during the 48-month period of plant construction, and $2.1 billion per year in 2007 dollars during the period of plant operation. The total economy-wide wage gain impact over the project's life is estimated to be $45 billion in 2007 dollars.

3. Analysis

The following are details related to the development of these key findings.

a) Improved National Balance of Trade

The improvement in U.S. balance of trade resulting from Cameron LNG's liquefaction and LNG exports was examined as an important component of economic goals.[4] As illustrated in Chart 1, the seemingly unsustainable U.S. trade deficit has been a lingering problem, with petroleum product imports becoming an increasingly important factor. LNG exports from a liquefaction plant at Cameron LNG can contribute toward offsetting petroleum product imports and helping reduce the overall trade deficit.

[4] When combined with other U.S. LNG export facilities one result may be reduced world-wide LNG prices, which would in turn increase LNG demand, particularly through conversion from coal for economic and environmental reasons. This may reduce the balance of trade impacts towards the lower end of the 50% to 90% of oil price parity price range considered here.

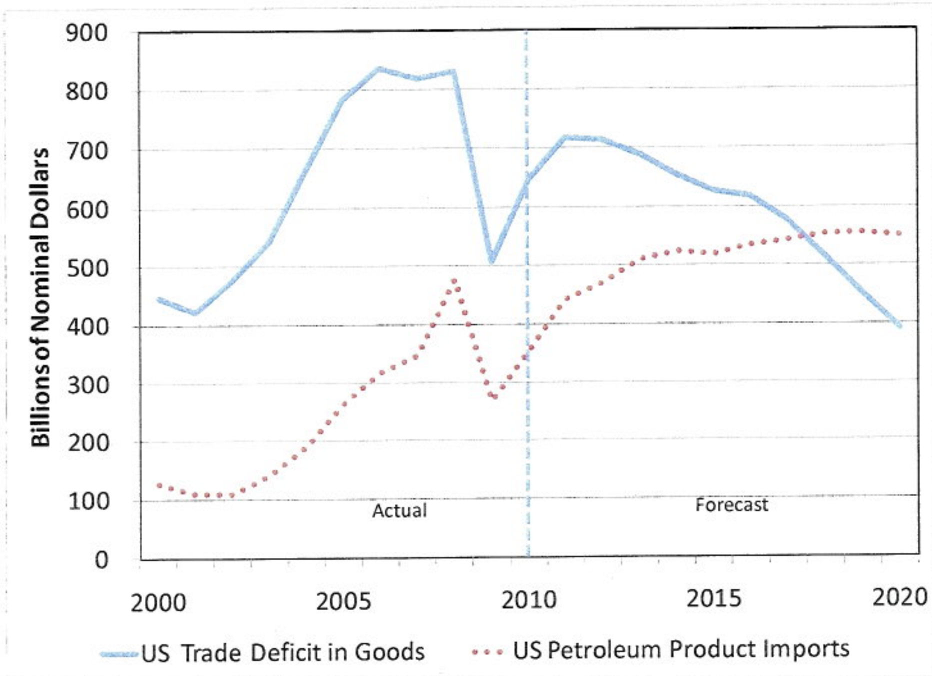

Chart 1: Trade Deficit and Petroleum Product Imports with Forecasts by IHS Global Insight[5]

Since the full output of the liquefaction plant will be exported, the total sale price of the LNG will appear as an improvement in the U.S. balance of trade (not considering shipping costs). In addition, oil and condensate (C&C) and NGL recovered during natural gas production will largely be used in the U.S. market and displace imports, also contributing toward an improved balance of trade. The total cumulative improvement in U.S. balance of trade over the project's 20-year life is estimated to be between $166 billion to $265 billion in 2011 dollars, depending on the sales price of LNG. The mid-range

[5] Historic data from the US Bureau of Economic Analysis. August 2011 forecasts by IHS Global Insight used with permission.

estimate over the life of the project is $215 billion, as shown in

	Improvement in Balance of Trade (Billions of $2011)	Increased US Output (Billions of $2011)	Increase in Number of Jobs	Wages Gains (billions $2007)
2013	$0.00	$1.90	15,854	$0.7
2014	$0.00	$1.90	15,854	$0.7
2015	$0.00	$1.90	15,854	$0.7
2016	$0.00	$1.90	15,854	$0.7
2017	$9.23	$14.06	43,559	$1.8
2018	$9.48	$14.44	44,739	$1.8
2019	$9.72	$14.81	45,872	$1.9
2020	$9.95	$15.15	46,931	$1.9
2021	$10.16	$15.47	47,925	$2.0
2022	$10.34	$15.74	48,758	$2.0
2023	$10.51	$16.01	49,597	$2.0
2024	$10.68	$16.26	50,372	$2.1
2025	$10.83	$16.49	51,093	$2.1
2026	$10.97	$16.71	51,760	$2.1
2027	$11.09	$16.89	52,321	$2.2
2028	$11.19	$17.04	52,773	$2.2
2029	$11.27	$17.16	53,157	$2.2
2030	$11.33	$17.26	53,461	$2.2
2031	$11.38	$17.32	53,663	$2.2
2032	$11.40	$17.36	53,766	$2.2
2033	$11.42	$17.39	53,879	$2.2
2034	$11.44	$17.42	53,962	$2.2
2035	$11.47	$17.46	54,088	$2.2
2036	$11.49	$17.49	54,186	$2.2
Total	$215	$336	1,079,278	$44.8

Figure A- 3.

The 2011 to 2035 oil price reference case forecast contained in the AEO2011 is the basis for the estimate, with increases in oil prices after 2035 extrapolated at approximately 0.15% per year in real dollars, as detailed in Figure A- 1 in the Appendix. Depending on market conditions and market region, LNG export prices are expected to range between 50% and 90% of the equivalent amount of oil on an energy basis (i.e., 50% to 90% of oil parity). In Northeast Asia, the common historical long-term contract price is 86% of oil price parity.[6] In Europe, oil-indexed gas prices have historically been lower, averaging 65% to 70% of oil price parity.[7]

Chart 2 illustrates the annual improvement in balance of trade, assuming a price of exported LNG at 70% of oil price parity.

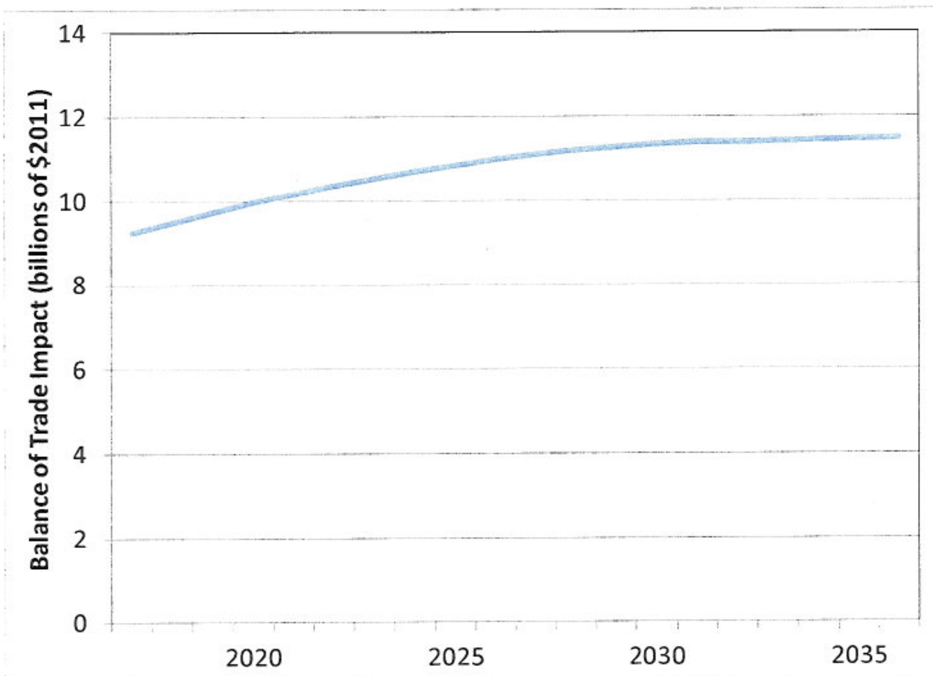

Chart 2: Balance of Trade Impact of Cameron Facility

b) Increase in National Output

Direct Output Impact of Cameron LNG Liquefaction Plant Construction

During construction, the direct output impact of the Cameron LNG liquefaction plant will equal the construction cost, which, for the limited purposes of this analysis, is estimated to be $4.2 billion, assuming a 12 mtpa plant and a cost of $350 per tonne of LNG capacity per annum.

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[6] Energy Charter Secretariat, "Developments in LNG Trade and Pricing," pg. 33, 2009, based on the common multiplier per MMBtu of gas of 0.1485 times the price of crude oil per barrel.

[7] Oxford Institute for Energy Studies, "LNG Trade-flows in the Atlantic Basin: Trends and Discontinuities," figures 18 and 19, March 2010.

Economy-wide Output Impacts

The final demand output multiplier for construction is 1.8106, which is applied to the plant construction cost of $4.2 billion to result in a total output impact of $7.6 billion spread over the 48-month construction period.

With all the LNG output exported, the impact of output on the gas industry during the period of plant operation will equal the balance of trade benefits in addition to the impacts on the gas pipeline sector and on the Cameron LNG facility. The direct output impact on the gas extraction industry is estimated to be between $166 billion and $265 billion in 2011 dollars over the life of the project, matching the trade balance improvements shown in

	Improvement in Balance of Trade (Billions of $2011)	Increased US Output (Billions of $2011)	Increase in Number of Jobs	Wages Gains (billions $2007)
2013	$0.00	$1.90	15,854	$0.7
2014	$0.00	$1.90	15,854	$0.7
2015	$0.00	$1.90	15,854	$0.7
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2029	$11.27	$17.16	53,157	$2.2
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2033	$11.42	$17.39	53,879	$2.2
2034	$11.44	$17.42	53,962	$2.2
2035	$11.47	$17.46	54,088	$2.2
2036	$11.49	$17.49	54,186	$2.2
Total	$215	$336	1,079,278	$44.8

Figure A- 3.

The final demand output multiplier for the oil and gas extraction sector is 1.5228, which results in a total economy-wide impact on output ranging from $253 billion to $403 billion in 2011 dollars over the period of plant operation.

As shown in

	Improvement in Balance of Trade (Billions of $2011)	Increased US Output (Billions of $2011)	Increase in Number of Jobs	Wages Gains (billions $2007)
2013	$0.00	$1.90	15,854	$0.7
2014	$0.00	$1.90	15,854	$0.7
2015	$0.00	$1.90	15,854	$0.7
2016	$0.00	$1.90	15,854	$0.7
2017	$9.23	$14.06	43,559	$1.8
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2021	$10.16	$15.47	47,925	$2.0
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2023	$10.51	$16.01	49,597	$2.0
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2035	$11.47	$17.46	54,088	$2.2
2036	$11.49	$17.49	54,186	$2.2
Total	$215	$336	1,079,278	$44.8

Figure A- 3, the total mid-range estimate is $328 billion over the life of the project, including the periods of construction and operation.

c) Increase in Employment

The resulting increase in employment includes direct and identified employment changes in addition to indirect effects on the economy captured through employment multipliers. The BEA developed a method for estimating regional input-output (I-O) multipliers using its Regional Industrial Multiplier

System (RIMS).[8] To aid in this analysis, Cameron LNG, LLC purchased a customized set of multipliers from the BEA for a region in Louisiana that includes the parishes of Allen, Beauregard, Calcasieu, Cameron and Jefferson Davis.[9]

Gas Industry Only Employment Impacts

The employment impacts of the Cameron LNG liquefaction facility can generally be divided in two: impacts during construction and impacts during operation.

Figure A- 2 in the Appendix illustrates a typical work force schedule for a liquefaction plant similar to the one proposed for Cameron LNG. The employment average over the peak 12-month construction period is approximately 2,900 jobs, and total employment on-site over the full 48-month construction period, including the periods of project ramp-up and final commissioning, is estimated to be 5,209 job-years.[10]

During plant operation, the primary direct impact on employment is expected to be in the exploration, production, gathering, processing and transmission of natural gas. Other direct jobs in the natural gas industry will be in the operation of the Cameron LNG liquefaction facility. According to the 2007 Economic Census, there were 150,443 jobs in oil and gas extraction (NAICS code 211). The reported product shipments indicate that 65.3% of the energy value was for natural gas, so the number of jobs was reduced to 98,262, which is 65.3% of 150,443. An additional 24,519 jobs in gas pipelines (NAICS code 4862) brings the total number of jobs to 122,781. This number divided by the average gas production of 51.6 Bcfd, as reported in the Economic Census,[11] results in an average of 2,400 natural gas industry jobs per Bcfd of produced natural gas. Based on this, a 1.9 Bcfd input plant would produce 4,600 jobs.

Given the incremental Cameron LNG operations employment of 65, the direct natural gas industry impact of a 1.9 Bcfd input plant is 98,000 cumulative job-years over the project's lifetime.[12]

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[8] U.S. Department of Commerce, "Regional Multipliers – A User Handbook for the Regional Input-Output Modeling System (RIMS II)," Third Edition, March 1997.

[9] Multipliers vary somewhat from region to region, and may differ from those of the Lake Charles area depending on the sources of the gas delivered to the Cameron facility.

[10] Cameron's construction employment forecast is based on full-time equivalent (FTE) employees, while the employment multipliers are based on the total of full- and part-time jobs. This suggests that the resulting job impacts estimates are conservatively low.

[11] Dry gas production in 2007 is reported by the EIA to have averaged 52.8 Bcfd. However, the somewhat lower value reported in the 2007 Economic Census is used here for internal consistency.

[12] Calculation detail: 5,209 job-years during construction plus 4,700 jobs per year over the period of operation (4,600 oil and gas extraction jobs plus 65 Cameron LNG jobs) equals 98,000 job-years after rounding.

Economy-wide Employment Impacts

The BEA describes two primary approaches for estimating economy-wide employment impacts. The first approach applies a multiplier to the number of jobs created in the industry sector directly affected. The second approach applies a final demand multiplier to the dollar output of the industry sector directly affected. In theory, these approaches should produce similar results. However, the large investment per construction employee and the large increase in expected LNG prices in relation to gas prices at the time of the 2007 Economic Census ($5.11 per Mcf) causes a significant difference between the results based on direct employment and the results based on output value or purchases. The approach using a final demand multiplier was selected as better reflecting the ultimate impact on the U.S. economy, including the direct and indirect impacts from equipment manufacturing and from increased investments in the economy resulting from export and reduced import revenues.

During Construction

The final demand employment multiplier for construction, as developed by the BEA for the region that includes Cameron LNG, is 15.0994 jobs per million dollars of output. This results in direct and indirect employment impacts of 63,000 job-years when applied to the plant construction cost of $4.2 billion. As a check on the reasonableness of this result, it is noted that the multiplier of 15.0994 jobs per million dollars of output means that each $66,000 of plant construction creates one job for one year somewhere in the U.S. economy.

During Plant Operation

The final regional demand employment multiplier is 4.7172 jobs per million dollars of output value in the oil and gas extraction sector (i.e., $211,000 per job in the U.S. economy) . Assuming LNG at 70% of crude oil parity in 2030 (see Figure A- 1), the average net export value is $11.3 billion. Therefore, the economy-wide impact results in approximately 53,000 jobs. This approach may be inaccurate to the extent that the added value of the LNG is invested in ways that vary from input-output flows in 2008. However, it is to be noted that the final-demand employment multiplier of 4.7172 for the oil and gas extraction sector is one of the lowest of 62 sectors, which have a median multiplier of 10.6 jobs per million dollars of output. This suggests that if future investment patterns vary from those of the past, the effect is likely to increase the impact beyond 53,000 full- and part-time economy-wide jobs resulting from the 1.9 Bcfd input plant.

Discussion

One study, which covers all 50 states and most business sectors, addressed the issue of multipliers, and found that foreign export employment multipliers are significantly greater than domestic multipliers. As a result the impacts may be more than estimated here. Specifically, the study notes that:

> This article attempts to show that foreign exports have a more dramatic impact on a state's employment than do domestic exports. Empirical testing revealed that in the aggregate the foreign export employment multiplier was almost five times larger than the domestic export multiplier.[13]

Another relevant analysis is the finding by the U.S. Department of Agriculture that each $1 billion of U.S. agricultural exports in 2009 required 8,400 U.S. workers engaged in both direct and indirect supporting activities.[14] When this multiplier is applied to the $11.3 billion LNG export estimate of the Cameron LNG facility, the result is an economy-wide impact of approximately 95,000 jobs.

The U.S. International Trade Administration also examined the impact of exports on jobs and found that in 2008, 10.3 million U.S. jobs were supported by exports, with each $165,000 of exports resulting in one U.S. job. For a 1.9 Bcfd plant, using this multiplier would result in an economy-wide impact of 69,000 jobs.[15]

Finally, a recent study by Wood Mackenzie for the American Petroleum Institute[16] focused on the job impacts resulting from increased oil and gas production in the U.S., finding that 1.4 million jobs could be created by 2030. Adjusting that finding to the size of the Cameron facility would result in an increase of 46,000 jobs.[17]

Considering the available evidence, the estimated impact on economy-wide employment during plant operation is, reasonably and perhaps conservatively, 53,000 jobs in 2030, assuming LNG pricing at 70% of oil price parity in 2030.

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[13] Elaine Webster, Mathis and Zech, "The Case for State-Level Export Promotion Assistance: A Comparison of Foreign and Domestic Export Employment Multipliers," Economic Development Quarterly, Sage Publications, Aug 1, 1990.

[14] USDA Economic Research Service, "Agricultural Trade Multipliers: Effects of Trade on the U.S. Economy," 2009.

[15] U.S. Department of Commerce, International Trade Administration, "Exports Support American Jobs," International Trade Research Report no. 1, April 2010.

[16] Wood Mackenzie, prepared for the American Petroleum Institute, "U.S. Supply Forecast and Potential Jobs and Economic Impacts (2012-2030)," Sep 7, 2011.

[17] Calculation: Convert 10,371 mboed of increased production to 58.1 Bcfd of gas equivalent. Adjust 1.403 million jobs by the ratio of 1.9 Bcfd at the Cameron facility to 58.1 Bcfd.

Total employment impact over the life of the plant, including construction, is estimated to be 1.1 million job-years, as shown in

	Improvement in Balance of Trade (Billions of $2011)	Increased US Output (Billions of $2011)	Increase in Number of Jobs	Wages Gains (billions $2007)
2013	$0.00	$1.90	15,854	$0.7
2014	$0.00	$1.90	15,854	$0.7
2015	$0.00	$1.90	15,854	$0.7
2016	$0.00	$1.90	15,854	$0.7
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2019	$9.72	$14.81	45,872	$1.9
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2021	$10.16	$15.47	47,925	$2.0
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2023	$10.51	$16.01	49,597	$2.0
2024	$10.68	$16.26	50,372	$2.1
2025	$10.83	$16.49	51,093	$2.1
2026	$10.97	$16.71	51,760	$2.1
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2028	$11.19	$17.04	52,773	$2.2
2029	$11.27	$17.16	53,157	$2.2
2030	$11.33	$17.26	53,461	$2.2
2031	$11.38	$17.32	53,663	$2.2
2032	$11.40	$17.36	53,766	$2.2
2033	$11.42	$17.39	53,879	$2.2
2034	$11.44	$17.42	53,962	$2.2
2035	$11.47	$17.46	54,088	$2.2
2036	$11.49	$17.49	54,186	$2.2
Total	$215	$336	1,079,278	$44.8

Figure A- 3.

Chart 3 illustrates the resulting incremental job impacts over the periods of Cameron plant construction (2013 through 2016) and operation (2017 through 2036).

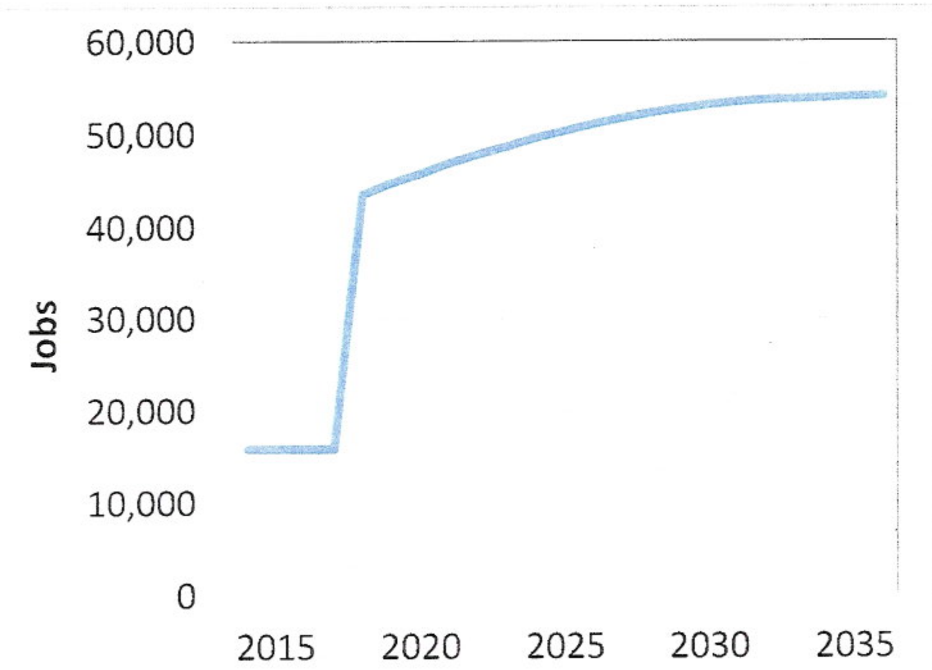

Chart 3: Economy-wide Job Impact of Cameron Facility

d) Increase in Employee Wages

Gas Industry Only Wage Impacts

Based on the 2007 Economic Census, employee wages in the combined oil and gas extraction and gas pipeline sectors totaled $8.4 billion. Based on the 122,781 employees in the sector, this averages $68,029 per employee, and $162 million per Bcfd based on the 51.6 Bcfd of gas production reported by the Economic Census. Therefore, for 1.9 Bcfd, the wage impact equals $307 million per year in 2007 dollars for direct wages in the oil and gas extraction and gas pipeline sectors.

Economy-wide Wage Impacts

Economy-wide employee wage impacts make use of the employment estimates, assuming that wages during construction are equal to the national average for construction, as reported in the 2007 Economic Census, and wages during plant operation are equal to the national average for all industries. Average economy-wide wages during construction are estimated at $717 million per year, and average economy-wide wages over the period of operation are estimated at $2.1 billion per year. The total economy-wide wage impact over the life of the project is estimated at $45 billion, as shown in

	Improvement in Balance of Trade (Billions of $2011)	Increased US Output (Billions of $2011)	Increase in Number of Jobs	Wages Gains (billions $2007)
2013	$0.00	$1.90	15,854	$0.7
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2036	$11.49	$17.49	54,186	$2.2
Total	$215	$336	1,079,278	$44.8

Figure A- 3.

4. Yearly Summary

Estimated impacts are reported in

	Improvement in Balance of Trade (Billions of $2011)	Increased US Output (Billions of $2011)	Increase in Number of Jobs	Wages Gains (billions $2007)
2013	$0.00	$1.90	15,854	$0.7
2014	$0.00	$1.90	15,854	$0.7
2015	$0.00	$1.90	15,854	$0.7
2016	$0.00	$1.90	15,854	$0.7
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2018	$9.48	$14.44	44,739	$1.8
2019	$9.72	$14.81	45,872	$1.9
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2024	$10.68	$16.26	50,372	$2.1
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Total	$215	$336	1,079,278	$44.8

Figure A- 3 in the Appendix.

5. Technical Terms

BBL: barrel containing 42 gallons of liquid

Bcfd: billion cubic feet of gas per day

Btu: British thermal units

C&C: crude oil and condensate

LNG: liquified natural gas

Mboed: million barrels of oil equivalent per day

Mcf: thousand cubic feet of gas

MTPA: million metric tonne per annum

NAICS: North American Industry Classification System

NGL: natural gas liquids

Tcf: trillion cubic feet of gas

Appendix

	Price of Imported Crude Oil ($/bbl)		Value of Incidental Oil+NGL Production ($Billions)		LNG sold at 50% of Oil Parity ($Billions)		LNG sold at 70% of Oil Parity ($Billions)		LNG sold at 90% of Oil Parity ($Billions)		Balance of Trade Impact (50% of Oil Parity) ($Billions)		Balance of Trade Impact (70% of Oil Parity) ($Billions)		Balance of Trade Impact (90% of Oil Parity) ($Billions)	
	2009$	Nominal	2011$	Nominal	2011$	Nominal	2011$	Nominal	2011$	Nominal	2011$	Nominal	2011$	Nominal	2011$	Nominal
2011	80.3	82.1														
2012	80.7	83.4														
2013	82.9	87.1														
2014	85.1	91.0														
2015	86.8	94.8														
2016	89.0	99.0														
2017	91.6	104.0	1.8	2.0	5.3	5.7	7.4	8.0	9.5	10.3	7.1	7.7	9.2	10.0	11.3	12.3
2018	94.0	109.1	1.9	2.1	5.4	6.0	7.6	8.4	9.8	10.8	7.3	8.1	9.5	10.5	11.7	12.9
2019	96.4	114.2	1.9	2.2	5.6	6.3	7.8	8.8	10.0	11.3	7.5	8.4	9.7	11.0	11.9	13.5
2020	98.6	119.2	2.0	2.3	5.7	6.5	8.0	9.2	10.2	11.8	7.7	8.8	9.9	11.4	12.2	14.1
2021	100.7	124.0	2.0	2.4	5.8	6.8	8.1	9.5	10.5	12.3	7.8	9.2	10.2	11.9	12.5	14.6
2022	102.5	128.5	2.1	2.5	5.9	7.1	8.3	9.9	10.6	12.7	8.0	9.5	10.3	12.3	12.7	15.2
2023	104.3	133.0	2.1	2.5	6.0	7.3	8.4	10.2	10.8	13.1	8.1	9.8	10.5	12.8	12.9	15.7
2024	105.9	137.6	2.1	2.6	6.1	7.6	8.6	10.6	11.0	13.6	8.2	10.2	10.7	13.2	13.1	16.2
2025	107.4	142.1	2.2	2.7	6.2	7.8	8.7	10.9	11.2	14.0	8.4	10.5	10.8	13.6	13.3	16.8
2026	108.8	146.5	2.2	2.8	6.3	8.0	8.8	11.3	11.3	14.5	8.5	10.8	11.0	14.1	13.5	17.3
2027	110.0	150.9	2.2	2.9	6.3	8.3	8.9	11.6	11.4	14.9	8.6	11.2	11.1	14.5	13.6	17.8
2028	110.9	155.0	2.2	3.0	6.4	8.5	9.0	11.9	11.5	15.3	8.6	11.5	11.2	14.9	13.7	18.3
2029	111.7	159.1	2.2	3.0	6.4	8.7	9.0	12.2	11.6	15.7	8.7	11.8	11.3	15.3	13.8	18.8
2030	112.4	162.9	2.3	3.1	6.5	8.9	9.1	12.5	11.7	16.1	8.7	12.1	11.3	15.6	13.9	19.2
2031	112.8	166.6	2.3	3.2	6.5	9.1	9.1	12.8	11.7	16.5	8.8	12.3	11.4	16.0	14.0	19.6
2032	113.0	170.1	2.3	3.3	6.5	9.3	9.1	13.1	11.7	16.8	8.8	12.6	11.4	16.3	14.0	20.1
2033	113.3	173.8	2.3	3.3	6.5	9.5	9.1	13.4	11.8	17.2	8.8	12.9	11.4	16.7	14.0	20.5
2034	113.4	177.5	2.3	3.4	6.5	9.7	9.2	13.6	11.8	17.5	8.8	13.1	11.4	17.0	14.1	20.9
2035	113.7	181.4	2.3	3.5	6.6	10.0	9.2	13.9	11.8	17.9	8.8	13.4	11.5	17.4	14.1	21.4
2036	113.9	185.4	2.3	3.5	6.6	10.2	9.2	14.2	11.8	18.3	8.9	13.7	11.5	17.8	14.1	21.9
Total			43	56	123	161	172	226	222	291	166	218	215	282	265	347

Figure A- 1: Balance of Trade Impact

Assumptions:

- Natural gas heating value = 1030 Btu/cf
- Oil to gas conversion = 5.82 Mcf per barrel
- Average NGL yield for non-associated gas = 35 bbl/MMcf
- Average crude oil and condensate (C&C) yield for non-associated gas = 9 bbl/MMcf
- Total incidental NGL + C&C production = (35 + 9) x 1,900 MMcf/d = 84,000 bbl/day
- NGL pricing = 50% of Brent oil parity

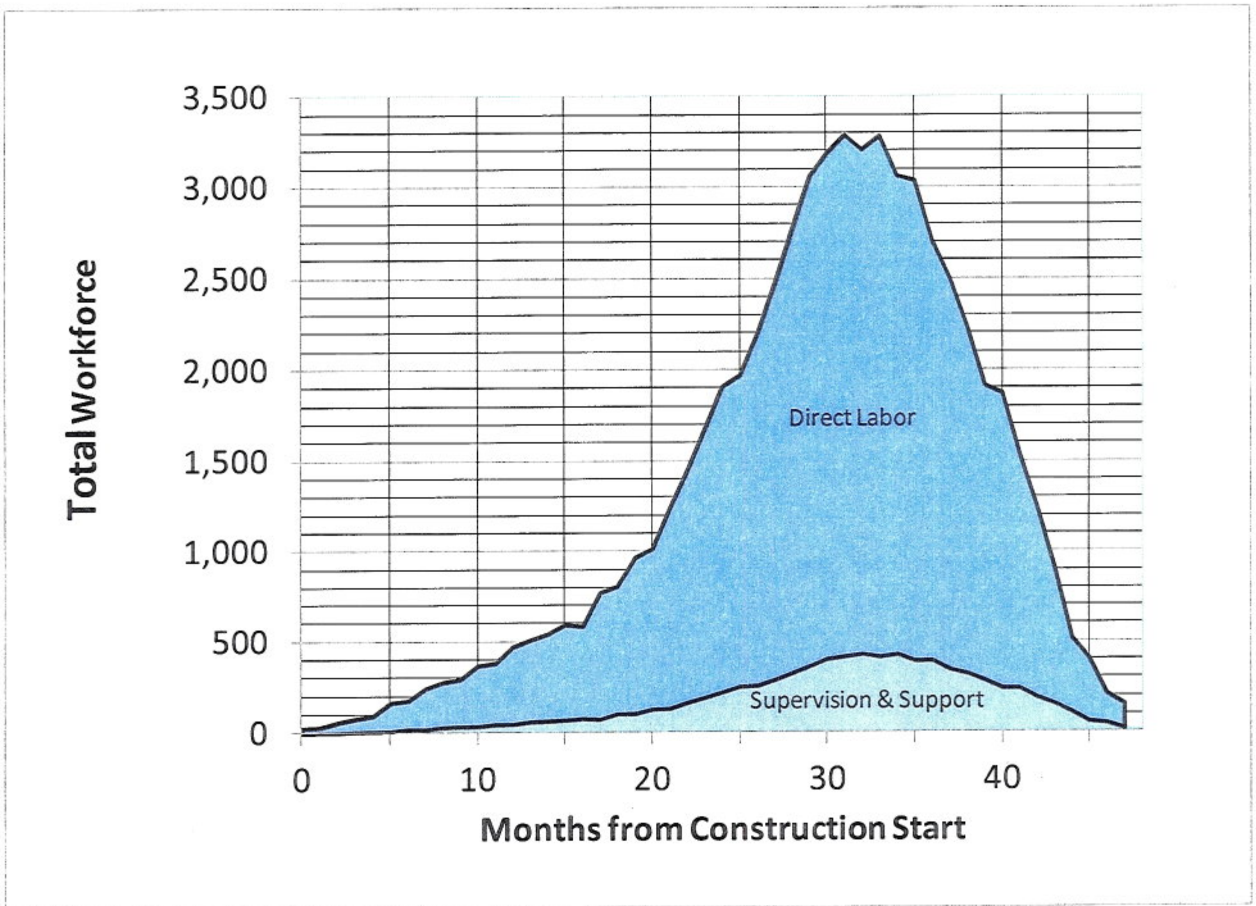

Figure A- 2: Estimated Cameron Construction Employment Schedule

	Improvement in Balance of Trade (Billions of $2011)	Increased US Output (Billions of $2011)	Increase in Number of Jobs	Wages Gains (billions $2007)
2013	$0.00	$1.90	15,854	$0.7
2014	$0.00	$1.90	15,854	$0.7
2015	$0.00	$1.90	15,854	$0.7
2016	$0.00	$1.90	15,854	$0.7
2017	$9.23	$14.06	43,559	$1.8
2018	$9.48	$14.44	44,739	$1.8
2019	$9.72	$14.81	45,872	$1.9
2020	$9.95	$15.15	46,931	$1.9
2021	$10.16	$15.47	47,925	$2.0
2022	$10.34	$15.74	48,758	$2.0
2023	$10.51	$16.01	49,597	$2.0
2024	$10.68	$16.26	50,372	$2.1
2025	$10.83	$16.49	51,093	$2.1
2026	$10.97	$16.71	51,760	$2.1
2027	$11.09	$16.89	52,321	$2.2
2028	$11.19	$17.04	52,773	$2.2
2029	$11.27	$17.16	53,157	$2.2
2030	$11.33	$17.26	53,461	$2.2
2031	$11.38	$17.32	53,663	$2.2
2032	$11.40	$17.36	53,766	$2.2
2033	$11.42	$17.39	53,879	$2.2
2034	$11.44	$17.42	53,962	$2.2
2035	$11.47	$17.46	54,088	$2.2
2036	$11.49	$17.49	54,186	$2.2
Total	$215	$336	1,079,278	$44.8

Figure A- 3: Economy-wide Economic Impacts – Yearly Detail