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Office of Fossil Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585

December 3, 2012

Attn: Deputy Assistant Secretary Christopher Smith

Dear Mr. Smith

I am transmitting with this letter a clean copy of NERA's report on the macroeconomic impacts of LNG exports from the United States that was contracted for by the Department of Energy.

Sincerely,

W. David Montgomery
Senior Vice President

Enclosure

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Macroeconomic Impacts of LNG Exports from the United States

NERA
Economic Consulting

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1 The opinions expressed herein do not necessarily represent the views of NERA Economic Consulting or any other NERA consultant.

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List of Acronyms

AEO 2011	Annual Energy Outlook 2011
AGR	Agricultural sector
CES	Constant elasticity of substitution
COL	Coal sector
CRU	Crude oil sector
DOE/FE	U.S. Department of Energy, Office of Fossil Energy
EIA	Energy Information Administration
EIS	Energy-intensive sector
EITE	Energy-intensive trade exposed
ELE	Electricity sector
EUR	Estimated ultimate recovery
FDI	Foreign direct investment
FSU	Former Soviet Union
GAS	Natural gas sector
GDP	Gross domestic product
GIIGNL	International Group of LNG Importers
GNGM	Global Natural Gas Model
GNP	Gross national product
IEA WEO	International Energy Agency World Energy Outlook
IEO	International Energy Outlook
JCC	Japanese Customs-cleared crude
LNG	Liquefied natural gas
M_V	Motor Vehicle manufacturing sector
MAN	Other manufacturing sector
Mcf	Thousand cubic feet
MMBtu	Million British thermal units
MMTPA	Million metric tonne per annum
NAICS	North American Industry Classification System
NBP	National Balancing Point
OIL	Refining sector
SRV	Commercial sector
Tcf	Trillion cubic feet
TRK	Commercial trucking sector
TRN	Other commercial transportation sector

Scenario Naming Convention

The following is the naming convention used for all the scenarios. Lists of all the possible U.S., international, U.S. LNG export, and quota rent cases are shown below.

Generic Naming Convention:

U.S. Case_International Case_U.S. LNG Export Case_Quota Rent Case

U.S. Cases:

USREF	US Reference case
HEUR	High Shale EUR
LEUR	Low Shale EUR

International Cases:

INTREF	International Reference case
D	International Demand Shock
SD	International Supply/Demand Shock

U.S. LNG Export Cases

NX	No-Export Capacity	LS	Low/Slow	HS	High/Slow
LSS	Low/Slowest	LR	Low/Rapid	HR	High/Rapid
NC	No-Export Constraint				

Quota Rent Cases:

HEUR_SD_LSS_QR	US High Shale EUR with International Supply/Demand Shock at Low/Slowest export levels with quota rent
HEUR_SD_HR_QR	US High Shale EUR with International Supply/Demand Shock at High/Rapid export levels with quota rent

N$_{ew}$Era Baselines:

Bau_REF	No LNG export expansion case consistent with AEO 2011 Reference case
Bau_HEUR	No LNG export expansion case consistent with AEO 2011 High Shale EUR case
Bau_LEUR	No LNG export expansion case consistent with AEO 2011 Low Shale EUR case

Scenarios Analyzed by N$_{ew}$Era

USREF_D_LSS	US Reference case with International Demand Shock and lower than Low/Slowest export levels
USREF_D_LS	US Reference case with International Demand Shock and lower than Low/Slow export levels
USREF_D_LR	US Reference case with International Demand Shock and lower than Low/Rapid export levels
USREF_SD_LS	US Reference case with International Supply/Demand Shock at Low/Slow export levels
USREF_SD_LR	US Reference case with International Supply/Demand Shock at Low/Rapid export levels
USREF_SD_HS	US Reference case with International Supply/Demand Shock and lower than High/Slow export levels
USREF_SD_HR	US Reference case with International Supply/Demand Shock and lower than High/Rapid export levels
USREF_SD_NC	US Reference case with International Supply/Demand Shock and No Constraint on exports
HEUR_D_NC	US High Shale EUR with International Demand Shock and No Constraint on exports
HEUR_SD_LSS	US High Shale EUR with International Supply/Demand Shock at Low/Slowest export levels
HEUR_SD_LS	US High Shale EUR with International Supply/Demand Shock at Low/Slow export levels
HEUR_SD_LR	US High Shale EUR with International Supply/Demand Shock at Low/Rapid export levels
HEUR_SD_HS	US High Shale EUR with International Supply/Demand Shock at High/Slow export levels
HEUR_SD_HR	US High Shale EUR with International Supply/Demand Shock at High/Rapid export levels
HEUR_SD_NC	US High Shale EUR with International Supply/Demand Shock and No Constraint on exports
LEUR_SD_LSS	US Low Shale EUR with International Supply/Demand Shock at Low/Slowest export levels

EXECUTIVE SUMMARY

Approach

At the request of the U.S. Department of Energy, Office of Fossil Energy ("DOE/FE"), NERA Economic Consulting assessed the potential macroeconomic impact of liquefied natural gas ("LNG") exports using its energy-economy model (the "N_{ew}ERA" model). NERA built on the earlier U.S. Energy Information Administration ("EIA") study requested by DOE/FE by calibrating its U.S. natural gas supply model to the results of the study by EIA. The EIA study was limited to the relationship between export levels and domestic prices without considering whether or not those quantities of exports could be sold at high enough world prices to support the calculated domestic prices. The EIA study did not evaluate macroeconomic impacts.

NERA's Global Natural Gas Model ("GNGM") was used to estimate expected levels of U.S. LNG exports under several scenarios for global natural gas supply and demand.

NERA's N_{ew}ERA energy-economy model was used to determine the U.S. macroeconomic impacts resulting from those LNG exports.

Key Findings

This report contains an analysis of the impact of exports of LNG on the U.S. economy under a wide range of different assumptions about levels of exports, global market conditions, and the cost of producing natural gas in the U.S. These assumptions were combined first into a set of scenarios that explored the range of fundamental factors driving natural gas supply and demand. These market scenarios ranged from relatively normal conditions to stress cases with high costs of producing natural gas in the U.S. and exceptionally large demand for U.S. LNG exports in world markets. The economic impacts of different limits on LNG exports were examined under each of the market scenarios. Export limits were set at levels that ranged from zero to unlimited in each of the scenarios.

Across all these scenarios, the U.S. was projected to gain net economic benefits from allowing LNG exports. Moreover, for every one of the market scenarios examined, net economic benefits increased as the level of LNG exports increased. In particular, scenarios with unlimited exports always had higher net economic benefits than corresponding cases with limited exports.

In all of these cases, benefits that come from export expansion more than outweigh the losses from reduced capital and wage income to U.S. consumers, and hence LNG exports have net economic benefits in spite of higher domestic natural gas prices. This is exactly the outcome that economic theory describes when barriers to trade are removed.

Net benefits to the U.S. would be highest if the U.S. becomes able to produce large quantities of gas from shale at low cost, if world demand for natural gas increases rapidly, and if LNG supplies from other regions are limited. If the promise of shale gas is not fulfilled and costs of producing gas in the U.S. rise substantially, or if there are ample supplies of LNG from other regions to satisfy world demand, the U.S. would not export LNG. Under these conditions, allowing exports of LNG would cause no change in natural gas prices and do no harm to the overall economy.

U.S. natural gas prices increase when the U.S. exports LNG. But the global market limits how high U.S. natural gas prices can rise under pressure of LNG exports because importers will not purchase U.S. exports if U.S. wellhead price rises above the cost of competing supplies. In particular, the U.S. natural gas price does not become linked to oil prices in any of the cases examined.

Natural gas price changes attributable to LNG exports remain in a relatively narrow range across the entire range of scenarios. Natural gas price increases at the time LNG exports could begin range from zero to $0.33 (2010$/Mcf). The largest price increases that would be observed after 5 more years of potentially growing exports could range from $0.22 to $1.11 (2010$/Mcf). The higher end of the range is reached only under conditions of ample U.S. supplies and low domestic natural gas prices, with smaller price increases when U.S. supplies are more costly and domestic prices higher.

How increased LNG exports will affect different socioeconomic groups will depend on their income sources. Like other trade measures, LNG exports will cause shifts in industrial output and employment and in sources of income. Overall, both total labor compensation and income from investment are projected to decline, and income to owners of natural gas resources will increase. Different socioeconomic groups depend on different sources of income, though through retirement savings an increasingly large number of workers share in the benefits of higher income to natural resource companies whose shares they own. Nevertheless, impacts will not be positive for all groups in the economy. Households with income solely from wages or government transfers, in particular, might not participate in these benefits.

Serious competitive impacts are likely to be confined to narrow segments of industry. About 10% of U.S. manufacturing, measured by value of shipments, has both energy expenditures greater than 5% of the value of its output and serious exposure to foreign competition. Employment in industries with these characteristics is about one-half of one percent of total U.S. employment.

LNG exports are not likely to affect the overall level of employment in the U.S. There will be some shifts in the number of workers across industries, with those industries associated with natural gas production and exports attracting workers away from other industries. In no scenario is the shift in employment out of any industry projected to be larger than normal rates of turnover of employees in those industries.

I. SUMMARY

A. What NERA Was Asked to Do

NERA Economic Consulting was asked by the DOE/FE to use its $N_{ew}ERA$ model to evaluate the macroeconomic impact of LNG exports. NERA's analysis follows on from the study of impacts of LNG exports on U.S. natural gas prices performed by the U.S. EIA "Effect of Increased Natural Gas Exports on Domestic Energy Markets," hereafter referred to as the "EIA Study."[2]

NERA's analysis addressed the same 16 scenarios for LNG exports analyzed by EIA. These scenarios incorporated different assumptions about U.S. natural gas supply and demand and different export levels as specified by DOE/FE:

- U.S. scenarios: Reference, High Demand, High Natural Gas Resource, and Low Natural Gas Resource cases.
- U.S. LNG export levels reflecting either slow or rapid increases to limits of
    - Low Level: 6 billion cubic feet per day
    - High Level: 12 billion cubic feet per day

DOE also asked NERA to examine a lower export level, with capacity rising at a slower rate to 6 billion cubic feet per day and cases with no export constraints.

The EIA study was confined to effects of specified levels of exports on natural gas prices within the U.S. EIA was not asked to estimate the price that foreign purchasers would be willing to pay for the specified quantities of exports. The EIA study, in other words, was limited to the relationship between export levels and domestic prices without, for example, considering whether or not those quantities of exports could be sold at high enough world prices to support the calculated domestic prices. Thus before carrying out its macroeconomic analysis, NERA had to estimate the export or world prices at which various quantities of U.S. LNG exports could be sold on the world market. This proved quite important in that NERA concluded that in many cases, the world natural gas market would not accept the full amount of exports assumed in the EIA scenarios at export prices high enough to cover the U.S. wellhead domestic prices calculated by the EIA.

To evaluate the feasibility of exporting the specified quantities of natural gas, NERA developed additional scenarios for global natural gas supply and demand, yielding a total of 63 scenarios when the global and U.S. scenarios were combined. NERA then used the GNGM to estimate the market-determined export price that would be received by exporters of natural gas from the United States in the combined scenarios.

NERA selected 13 of these scenarios that spanned the range of economic impacts from all the scenarios for discussion in this report and eliminated scenarios that had essentially identical

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[2] Available at: www.eia.gov/analysis/requests/fe/.

outcomes for LNG exports and prices.[3] These scenarios are described in Figure 1. NERA then analyzed impacts on the U.S. economy of these levels of exports and the resulting changes in the U.S. trade balance and in natural gas prices, supply, and demand.

Figure 1: Feasible Scenarios Analyzed in the Macroeconomic Model

U.S. Market Outlook	**Reference**		**High Shale EUR**		**Low Shale EUR**	
Int'l Market Outlook	**Demand Shock**	**Supply/ Demand Shock**	**Demand Shock**	**Supply/ Demand Shock**	**Demand Shock**	**Supply/ Demand Shock**
Export Volume/ Pace	**Scenario Name**					
Low/Slow	**USREF_D_LS**	*USREF_SD_LS*		*HEUR_SD_LS*		
Low/Rapid	**USREF_D_LR**	*USREF_SD_LR*		*HEUR_SD_LR*		
High/Slow		**USREF_SD_HS**		*HEUR_SD_HS*		
High/Rapid		**USREF_SD_HR**		*HEUR_SD_HR*		
Low/ Slowest	**USREF_D_LSS**			*HEUR_SD_LSS*		**LEUR_SD_LSS**

Scenarios in italics use DOE/FE defined export volumes.
Scenarios in bold use NERA determined export volumes.
Results for all cases are provided in Appendix C.

The three scenarios chosen for the U.S. resource outlook were the EIA Reference cases, based on the Annual Energy Outlook ("AEO") 2011, and two cases assuming different levels of estimated ultimate recovery ("EUR") from new gas shale development. Outcomes of the EIA high demand case fell between the high and low EUR cases and therefore would not have changed the range of results. The three different international outlooks were a reference case, based on the EIA International Energy Outlook ("IEO") 2011, a Demand Shock case with increased worldwide natural gas demand caused by shutdowns of some nuclear capacity, and a Supply/Demand Shock case which added to the Demand Shock a supply shock that assumed key LNG exporting regions did not increase their exports above current levels.

NERA concluded that in many cases the world natural gas market would not accept the full amount of exports specified by FE in the EIA scenarios at prices high enough to cover the U.S. wellhead price projected by EIA. In particular, NERA found that there would be no U.S. exports in the International Reference case with U.S. Reference case conditions. In the U.S. Reference case with an International Demand Shock, exports were projected but in quantities below any of the export limits. In these cases, NERA replaced the export levels specified by DOE/FE and prices estimated by EIA with lower levels of exports (and, *a fortiori* prices) estimated by GNGM

[3] The scenarios not presented in this report had nearly identical macroeconomic impacts to those that are included, so that the number of scenarios discussed could be reduced to make the exposition clearer and less duplicative.

that are indicated in bold black in Figure 1. For sensitivity analysis, NERA also examined cases projecting zero exports and also cases with no limit placed on exports.

B. Key Assumptions

All the scenarios were derived from the AEO 2011, and incorporated the assumptions about energy and environmental policies, baseline coal, oil and natural gas prices, economic and energy demand growth, and technology availability and cost in the corresponding AEO cases.

The global LNG market was treated as a largely competitive market with one dominant supplier, Qatar, whose decisions about exports were assumed to be fixed no matter what the level of U.S. exports. U.S. exports compete with those from the other suppliers, who are assumed to behave as competitors and adjust their exports in light of the price they are offered. In this market, LNG exports from the U.S. necessarily lower the price received by U.S. exporters below levels that might be calculated based on current prices or prices projected without U.S exports, and in particular U.S. natural gas prices do not become linked to world oil prices.

It is outside the scope of this study to analyze alternative responses by other LNG suppliers in order to determine what would be in their best economic interest or how they might behave strategically to maximize their gains. This would require a different kind of model that addresses imperfect competition in global LNG markets and could explain the apparent ability of some large exporters to charge some importing countries at prices higher than the cost of production plus transportation.

Key assumptions in analyzing U.S. economic impacts were as follows: prices for natural gas used for LNG production were based on the U.S. wellhead price plus a percentage markup, the LNG tolling fee was based on a return of capital to the developer, and financing of investment was assumed to originate from U.S. sources. In order to remain consistent with the EIA analysis, the N$_{ew}$ERA model was calibrated to give the same results for natural gas prices as EIA at the same levels of LNG exports so that the parameters governing natural gas supply and demand in N$_{ew}$ERA were consistent with EIA's NEMS model.

Results are reported in 5-year intervals starting in 2015. These calendar years should not be interpreted literally but represent intervals after exports begin. Thus if the U.S. does not begin LNG exports until 2016 or later, one year should be added to the dates for each year that exports commence after 2015.

Like other general equilibrium models, N$_{ew}$ERA is a model of long run economic growth such that in any given year, prices, employment, or economic activity might fluctuate above or below projected levels. It is used in this study not to give unconditional forecasts of natural gas prices, but to indicate how, under different conditions, different decisions about levels of exports would affect the performance of the economy. In this kind of comparison, computable general equilibrium models generally give consistent and robust results.

Consistent with its equilibrium nature, N$_{ew}$ERA does not address questions of how rapidly the economy will recover from the recession and generally assumes that aggregate unemployment rates remain the same in all cases. As is discussed below, N_{ew}ERA does estimate changes in worker compensation in total and by industry that can serve as an indicator of pressure on labor markets and displacement of workers due to some industries growing more quickly and others less quickly than assumed in the baseline.

C. Key Results

1. Impacts of LNG Exports on U.S. Natural Gas Prices

In its analysis of global markets, NERA found that the U.S. would only be able to market LNG successfully with higher global demand or lower U.S. costs of production than in the Reference cases. The market limits how high U.S. natural gas prices can rise under pressure of LNG exports because importers will not purchase U.S. exports if the U.S. wellhead price rises above the cost of competing supplies. In particular, the U.S. natural gas price does not become linked to oil prices in any of the cases examined.

2. Macroeconomic Impacts of LNG Exports are Positive in All Cases

In all of the scenarios analyzed in this study, NERA found that the U.S. would experience net economic benefits from increased LNG exports.[4] Only three of the cases analyzed with the global model had U.S. exports greater than the 12Bcf/d maximum exports allowed in the cases analyzed by EIA. These were the USREF_SD, the HEUR_D and the HEUR_SD cases. NERA estimated economic impacts for these three cases with no constraint on exports, and found that even with exports reaching levels greater than 12 Bcf/d and associated higher prices than in the constrained cases, there were net economic benefits from allowing unlimited exports in all cases.

Across the scenarios, U.S. economic welfare consistently increases as the volume of natural gas exports increased. This includes scenarios in which there are unlimited exports. The reason for this is that even though domestic natural gas prices are pulled up by LNG exports, the value of those exports also rises so that there is a net gain for the U.S. economy measured by a broad metric of economic welfare (Figure 2) or by more common measures such as real household income or real GDP. Although there are costs to consumers of higher energy prices and lower consumption and producers incur higher costs to supply the additional natural gas for export, these costs are more than offset by increases in export revenues along with a wealth transfer from overseas received in the form of payments for liquefaction services. The net result is an increase in U.S. households' real income and welfare.[5]

Net benefits to the U.S. economy could be larger if U.S. businesses were to take more of a merchant role. Based on business models now being proposed, this study assumes that foreign

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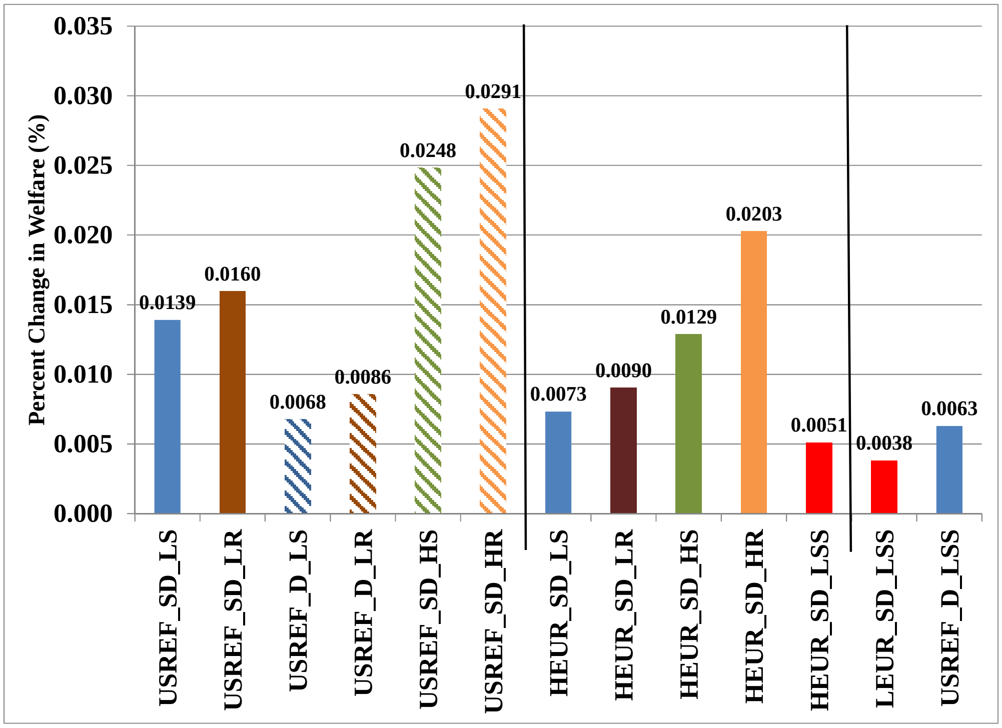
4 NERA did not run the EIA High Growth case because the results would be similar to the REF case.

5 In this report, the measure of welfare is technically known as the "equivalent variation" and it is the amount of income that a household would be willing to give up in the case without LNG exports in order to achieve the benefits of LNG exports. It is measured in present value terms, and therefore captures in a single number benefits and costs that might vary year by year over the period.

purchasers take title to LNG when it is loaded at a United States port, so that any profits that could be made by transporting and selling in importing countries accrue to foreign entities. In the cases where exports are constrained to maximum permitted levels, this business model sacrifices additional value from LNG exports that could accrue to the United States.

Figure 2: Percentage Change in Welfare (%)[6]



3. Sources of Income Would Shift

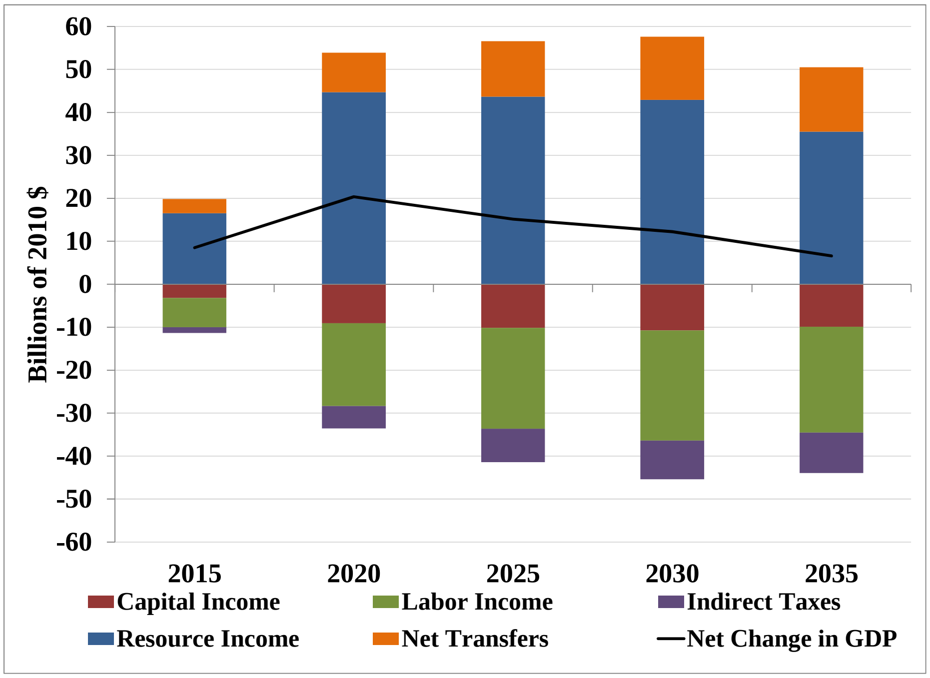
At the same time that LNG exports create higher income in total in the U.S., they shift the composition of income so that both wage income and income from capital investment are reduced. Our measure of total income is GDP measured from the income side, that is, by adding up income from labor, capital and natural resources and adjusting for taxes and transfers. Expansion of LNG exports has two major effects on income: it raises energy costs and, in the process, depresses both real wages and the return on capital in all other industries, but it also creates two additional sources of income. First, additional income comes in the form of higher export revenues and wealth transfers from incremental LNG exports at higher prices paid by overseas purchasers. Second, U.S. households also benefit from higher natural gas resource income or rents. These benefits distinctly differentiate market-driven expansion of LNG exports from actions that only raise domestic prices without creating additional sources of income. The benefits that come from export expansion more than outweigh the losses from reduced capital and wage income to U.S. consumers, and hence LNG exports have net economic benefits in spite

6 Welfare is calculated as a single number that represents in present value terms the amount that households are made better (worse) off over the entire time horizon from 2015 to 2035.

of higher natural gas prices. This is exactly the outcome that economic theory describes when barriers to trade are removed.

Figure 3 illustrates these shifts in income components for the USREF_SD_HR scenario, though the pattern is the same in all. First, Figure 3 shows that GDP increases in all years in this case, as it does in other cases (see Appendix C). Labor and investment income are reduced by about $10 billion in 2015 and $45 billion in 2030, offset by increases in resource income to natural gas producers and property owners and by net transfers that represent that improvement in the U.S. trade balance due to exporting a more valuable product (natural gas). Note that these are positive but, on the scale of the entire economy, very small net effects.

Figure 3: Change in Income Components and Total GDP in USREF_SD_HR (Billions of 2010$)



4. Some Groups and Industries Will Experience Negative Effects of LNG Exports

Different socioeconomic groups depend on different sources of income, though through retirement savings an increasingly large number of workers will share in the benefits of higher income to natural resource companies whose shares they own. Nevertheless, impacts will not be positive for all groups in the economy. Households with income solely from wages or transfers, in particular, will not participate in these benefits.

Higher natural gas prices in 2015 can also be expected to have negative effects on output and employment, particularly in sectors that make intensive use of natural gas, while other sectors not so affected could experience gains. There would clearly be greater activity and employment in natural gas production and transportation and in construction of liquefaction facilities. Figure

4 shows changes in total wage income for the natural gas sector and for other key sectors[7] of the economy in 2015. Overall, declines in output in other sectors are accompanied by similar reductions in worker compensation in those sectors, indicating that there will be some shifting of labor between different industries. However, even in the year of peak impacts the largest change in wage income by industry is no more than 1%, and even if all of this decline were attributable to lower employment relative to the baseline, no sector analyzed in this study would experience reductions in employment more rapid than normal turnover. In fact, most of the changes in real worker compensation are likely to take the form of lower than expected real wage growth, due to the increase in natural gas prices relative to nominal wage growth.

Figure 4: Change in Total Wage Income by Industry in 2015 (%)

	AGR	EIS	ELE	GAS	M_V	MAN	OIL	SRV
USREF_SD_LS	-0.12	-0.13	-0.06	0.88	-0.10	-0.08	0.01	0.00
USREF_SD_LR	-0.22	-0.28	-0.18	2.54	-0.24	-0.19	0.01	-0.04
USREF_D_LS	-0.08	-0.10	-0.06	0.87	-0.08	-0.07	0.00	-0.01
USREF_D_LR	-0.18	-0.23	-0.16	2.35	-0.21	-0.16	0.00	-0.05
USREF_SD_HS	-0.15	-0.18	-0.06	0.88	-0.11	-0.10	0.01	0.00
USREF_SD_HR	-0.27	-0.33	-0.18	2.54	-0.26	-0.22	0.01	-0.03
USREF_D_LSS	-0.06	-0.07	-0.03	0.43	-0.05	-0.04	0.00	0.00
HEUR_SD_LS	-0.10	-0.11	-0.05	0.71	-0.09	-0.07	0.01	0.00
HEUR_SD_LR	-0.19	-0.23	-0.16	2.04	-0.22	-0.16	0.00	-0.04
HEUR_SD_HS	-0.12	-0.14	-0.05	0.71	-0.09	-0.08	0.01	0.00
HEUR_SD_HR	-0.25	-0.30	-0.16	2.05	-0.25	-0.20	0.01	-0.02
HEUR_SD_LSS	-0.06	-0.07	-0.02	0.35	-0.04	-0.04	0.00	0.00
LEUR_SD_LSS	-0.02	-0.02	0.00	0.00	0.00	-0.01	0.00	0.01

5. Peak Natural Gas Export Levels, Specified by DOE/FE for the EIA Study, and Resulting Price Increases Are Not Likely

The export volumes selected by DOE/FE for the EIA Study define the maximum exports allowed in each scenario for the NERA macroeconomic analysis. Based on its analysis of global natural gas supply and demand under different assumptions, NERA projected achievable levels of exports for each scenario. The NERA scenarios that find a lower level of exports than the limits specified by DOE are shown in Figure 5. The cells in italics (red) indicate the years in which the

[7] Other key sectors of the economy include: AGR – Agriculture, EIS-Energy Intensive Sectors, ELE-Electricity, GAS-Natural gas, M_V-Motor Vehicle, MAN-Manufacturing, OIL-Refined Petroleum Products, and SRV-Services.

limit on exports is binding.[8] All scenarios hit the export limits in 2015 except the NERA export volume case with Low/Rapid exports.

Figure 5: NERA Export Volumes (Tcf)

NERA Export Volumes	2015	2020	2025	2030	2035
USREF_D_LS	***0.37***	0.98	1.43	1.19	***2.19***
USREF_D_LR	1.02	0.98	1.43	1.19	1.37
USREF_SD_HS	***0.37***	2.19	3.93	***4.38***	***4.38***
USREF_SD_HR	***1.1***	***2.92***	3.93	***4.38***	***4.38***
USREF_D_LSS	***0.18***	0.98	1.43	1.19	1.37

As seen in Figure 6, in no case does the U.S. wellhead price increase by more than $1.09/Mcf due to market-determined levels of exports. Even in cases in which no limits were placed on exports, competition between the U.S. and competing suppliers of LNG exports and buyer resistance limits increases in both U.S. LNG exports and U.S. natural gas prices.

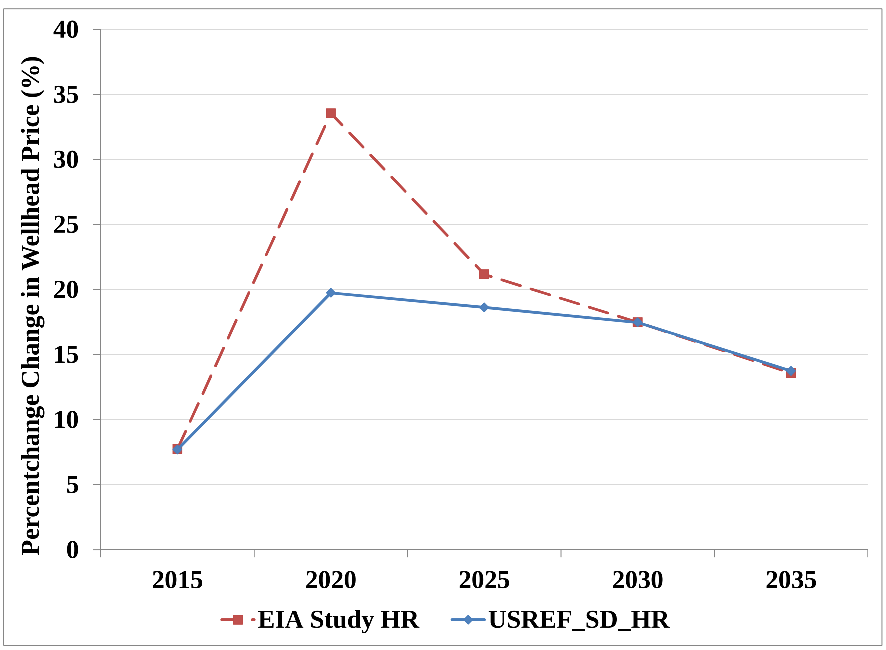
To match the characterization of U.S. supply and demand for natural gas in EIA's NEMS model, NERA calibrated its macroeconomic model so that for the same level of LNG exports as assumed in the EIA Study, the NERA model reproduced the prices projected by EIA. Thus natural gas price responses were similar in scenarios where NERA export volumes were at the EIA export volumes. However, the current study determined that the high export limits were not economic in the U.S. Reference case and that in these scenarios there would be lower exports than assumed by EIA. Because the current study estimated lower export volumes than were specified by FE for the EIA study, U.S. natural gas prices do not reach the highest levels projected by EIA (see Figure 7).

[8] The U.S. LNG export capacity binds when the market equilibrium level of exports as determined by the model exceeds the maximum LNG export capacity assumed in that scenario.

Figure 6: Prices and Export Levels in Representative Scenarios for Year 2035

U.S. Scenarios	International Scenarios	Quota Scenarios	U.S. Wellhead Price (2010$/Mcf)	U.S. Export (Tcf)	Price Relative to Reference case (2010$/Mcf)
USREF	INTREF	NX	$6.41		
USREF	INTREF	NC	$6.41	0	$0.00
USREF	D	HR	$6.66	1.37	$0.25
USREF	D	NC	$6.66	1.37	$0.25
USREF	SD	HR	$7.24	4.38	$0.83
USREF	SD	NC	$7.50	5.75	$1.09
HEUR	INTREF	NX	$4.88		
HEUR	INTREF	LR	$5.16	2.19	$0.28
HEUR	INTREF	NC	$5.31	3.38	$0.43
HEUR	D	NC	$5.60	5.61	$0.72
HEUR	SD	LSS	$5.16	2.19	$0.28
HEUR	SD	NC	$5.97	8.39	$1.09
LEUR	INTREF	NX	$8.70		
LEUR	INTREF	NC	$8.70	0	$0.00
LEUR	D	NC	$8.70	0	$0.00
LEUR	SD	NC	$8.86	0.52	$0.16

Figure 7: Comparison of EIA and NERA Maximum Wellhead Price Increases



The reason is simple and implies no disagreement between this report and EIA's - the analysis of world supply and demand indicates that at the highest wellhead prices estimated by EIA, world demand for U.S. exports would fall far short of the levels of exports assumed in the EIA Study.

In none of the scenarios analyzed in this study do U.S. wellhead prices become linked to oil prices in the sense of rising to oil price parity, even if the U.S. is exporting to regions where natural gas prices are linked to oil. The reason is that costs of liquefaction, transportation, and regasification keep U.S. prices well below those in importing regions.

6. Serious Competitive Impacts are Likely to be Confined to Narrow Segments of Industry

About 10% of U.S. manufacturing, measured by value of shipments, has energy expenditures greater than 5% of the value of its output and serious exposure to foreign competition. Employment in industries with these characteristics is one-half of one percent of total U.S. employment. These energy-intensive, trade-exposed industries for the most part process raw natural resources into bulk commodities. Value added in these industries as a percentage of value of shipments is about one-half of what it is in the remainder of manufacturing. In no scenario are energy-intensive industries as a whole projected to have a loss in employment or output greater than 1% in any year, which is less than normal rates of turnover of employees in the relevant industries.

7. Even with Unlimited Exports, There Would Be Net Economic Benefits to the U.S.

NERA also estimated economic impacts associated with unlimited exports in cases in which even the High, Rapid limits were binding. In these cases, both LNG exports and prices were determined by global supply and demand. Even in these cases, U.S. natural gas prices did not rise to oil parity or to levels observed in consuming regions, and net economic benefits to the U.S. increased over the corresponding cases with limited exports.

To examine U.S. economic impacts under cases with even higher natural gas prices and levels of exports than in the unlimited export cases, NERA also estimated economic impacts associated with the highest levels of exports and U.S. natural gas prices in the EIA analysis, regardless of whether or not those quantities could actually be sold at the assumed netback prices. The price received for exports in these cases was calculated in the same way as in the cases based on NERA's GNGM, by adding the tolling fee plus a 15% markup over Henry Hub to the Henry Hub price. Even with the highest prices estimated by EIA for these hypothetical cases, NERA found that there would be net economic benefits to the U.S., and the benefits became larger, the higher the level of exports. This is because the export revenues from sales to other countries at those high prices more than offset the costs of freeing that gas up for export.

II. INTRODUCTION

This section describes the issues that DOE/FE asked to be addressed in this study and then describes the scope of both the EIA Study and the NERA analysis that make up the two-part study commissioned by the DOE/FE.

A. Statement of the Problem

1. At What Price Can Various Quantities of LNG Exports be Sold?

An analysis of U.S. LNG export potential requires consideration of not only the impact of additional demand on U.S. production costs, but also consideration of the price levels that would make U.S. LNG economical in the world market. For the U.S. natural gas market, LNG exports would represent an additional component of natural gas demand that must be met from U.S. supplies. For the global market, U.S. LNG exports represent another component of supply that must compete with supply from other regions of the world. As the demand for U.S. natural gas increases, so will the cost of producing incremental volumes. But U.S. LNG exports will compete with LNG produced from other regions of the world. At some U.S. price level, it will become more economic for a region other than the U.S. to provide the next unit of natural gas to meet global demand. A worldwide natural gas supply and demand model assists in determining under what conditions and limits this pricing point is reached.

2. What are the Economic Impacts on the U.S. of LNG Exports?

U.S. LNG exports have positive impacts on some segments of the U.S. economy and negative impacts on others. On the positive side, U.S. LNG exports provide an opportunity for natural gas producers to realize additional profits by selling incremental volumes of natural gas. Exports of natural gas will improve the U.S. balance of trade and result in a wealth transfer into the U.S. Construction of the liquefaction facilities to produce LNG will require capital investment. If this capital originates from sources outside the U.S., it will represent another form of wealth transfer into the U.S. Households will benefit from the additional wealth transferred into the U.S. If they, or their pensions, hold stock in natural gas producers, they will benefit from the increase in the value of their investment.

On the negative side, producing incremental natural gas volumes will increase the marginal cost of supply and therefore raise domestic natural gas prices and increase the value of natural gas in general. Households will be negatively affected by having to pay higher prices for the natural gas they use for heating and cooking. Domestic industries for which natural gas is a significant component of their cost structure will experience increases in their cost of production, which will adversely impact their competitive position in a global market and harm U.S. consumers who purchase their goods.

Natural gas is also an important fuel for electricity generation, providing about 20% of the fuel inputs to electricity generation. Moreover, in many regions and times of the year natural gas-fired generation sets the price of electricity so that increases in natural gas prices can impact electricity prices. These price increases will also propagate through the economy and affect both household energy bills and costs for businesses.

B. Scope of NERA and EIA Study

NERA Economic Consulting was asked by the U.S. DOE/FE to evaluate the macroeconomic impact of LNG exports using a general equilibrium model of the U.S. economy with an emphasis on the energy sector and natural gas in particular. NERA incorporated the U.S. EIA's case study output from the National Energy Modeling System ("NEMS") into the natural gas production module in its N_{ew}ERA model by calibrating natural gas supply and cost curves in the N_{ew}ERA macroeconomic model. NERA's task was to use this model to evaluate the impact that LNG exports could have on multiple economic factors, primarily U.S. gross domestic product ("GDP"), employment, and real income. The complete statement of work is attached as Appendix F.

1. EIA Study

The DOE/FE requested that the U.S. EIA perform an analysis of "the impact of increased domestic natural gas demand, as exports."[9] Specifically, DOE/FE asked the EIA to assess how specified scenarios of increased natural gas exports could affect domestic energy markets, focusing on consumption, production, and prices.

DOE/FE requested that EIA analyze four scenarios of LNG export-related increases in natural gas demand:

1. 6 billion cubic feet per day (Bcf/d), phased in at a rate of 1 Bcf/d per year (Low/Slow scenario);
2. 6 Bcf/d phased in at a rate of 3 Bcf/d per year (Low/Rapid scenario);
3. 12 Bcf/d phased in at a rate of 1 Bcf/d per year (High/Slow scenario); and
4. 12 Bcf/d phased in at a rate of 3 Bcf/d per year (High/Rapid scenario).

Total U.S. marketed natural gas production in 2011 was about 66 Bcf/d. Additional LNG exports at 6 Bcf/d represents roughly 9 percent of current production and 12 Bcf/d represents roughly18 percent of current production.

DOE/FE requested that EIA analyze for each of the four LNG export scenarios four cases from the EIA AEO 2011. These scenarios reflect different perspectives on the domestic natural gas supply situation and the growth rate of the U.S. economy. These are:

1. The AEO 2011 Reference case;

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[9] U.S. EIA, "Effects of Increased Natural Gas Exports on Domestic Energy Markets," p. 20.

2. The High Shale EUR case (reflecting more optimistic assumptions about domestic natural gas supply prospects, with the EUR per shale gas well for new, undrilled wells assumed to be 50 percent higher than in the Reference case);
3. The Low Shale EUR case (reflecting less optimistic assumptions about domestic natural gas supply prospects, with the EUR per shale gas well for new, undrilled wells assumed to be 50 percent lower than in the Reference case); and
4. The High Economic Growth case (assuming the U.S. gross domestic product will grow at an average annual rate of 3.2 percent from 2009 to 2035, compared to 2.7 percent in the Reference case, which increases domestic energy demand).

In January 2012, EIA released the results of its analysis in a report entitled "Effect of Increased Natural Gas Exports on Domestic Energy Markets," hereafter referred to as the "EIA Study".

2. NERA Study

NERA relied on the EIA Study to characterize how U.S. natural gas supply, demand, and prices would respond if the specified levels of LNG exports were achieved. However, the EIA study was not intended to address the question of how large the demand for U.S. LNG exports would be under different wellhead prices in the United States. That became the first question that NERA had to answer: at what price could U.S. LNG exports be sold in the world market, and how much would this price change as the amount of exports offered into the world market increased?

NERA's analysis of global LNG markets leads to the conclusion that in many cases the world market would not accept the full amount assumed in the EIA scenarios at prices high enough to cover the U.S. wellhead price projected by EIA. In these cases, NERA replaced the export levels and price impacts found in the EIA scenarios with lower levels of exports (and *a fortiori* prices) estimated by the GNGM. These lower export levels were applied to the N_{ew}ERA model to generate macroeconomic impacts. In order to remain tied to the EIA analysis, the N_{ew}ERA model was calibrated to give the same natural gas price responses as EIA for the same assumptions about the level of LNG exports. This was done by incorporating in N_{ew}ERA the same assumptions about how U.S. natural gas supply and demand would be affected by changes in the U.S. natural gas wellhead price as implied by the NEMS model used in the EIA study.

C. Organization of the Report

This report begins by discussing what NERA was asked to do and the methodology followed by NERA. This discussion of methodology includes the key assumptions made by NERA in its analysis and a description of the models utilized. Then construction of scenarios for U.S. LNG exports is described, followed by presentation of the results and a discussion of their economic implications.

III. DESCRIPTION OF WORLDWIDE NATURAL GAS MARKETS AND NERA'S ANALYTICAL MODELS

A. Natural Gas Market Description

1. Worldwide

The global natural gas market consists of a collection of distinctive regional markets. Each regional market is characterized by its location, availability of indigenous resource, pipeline infrastructure, accessibility to natural gas from other regions of the world, and its rate of growth in natural gas demand. Some regions are connected to other regions by pipelines, others by LNG facilities, and some operate relatively autonomously.

In general, a region will meet its natural gas demand first with indigenous production, second with gas deliveries by pipelines connected to other regions, and third with LNG shipments. In 2010, natural gas consumption worldwide reached 113 Tcf. As shown in Figure 8, most natural gas demand in a region is met by natural gas production in the same region. In 2010, approximately 9.7 Tcf or almost 9% of demand was met by LNG.

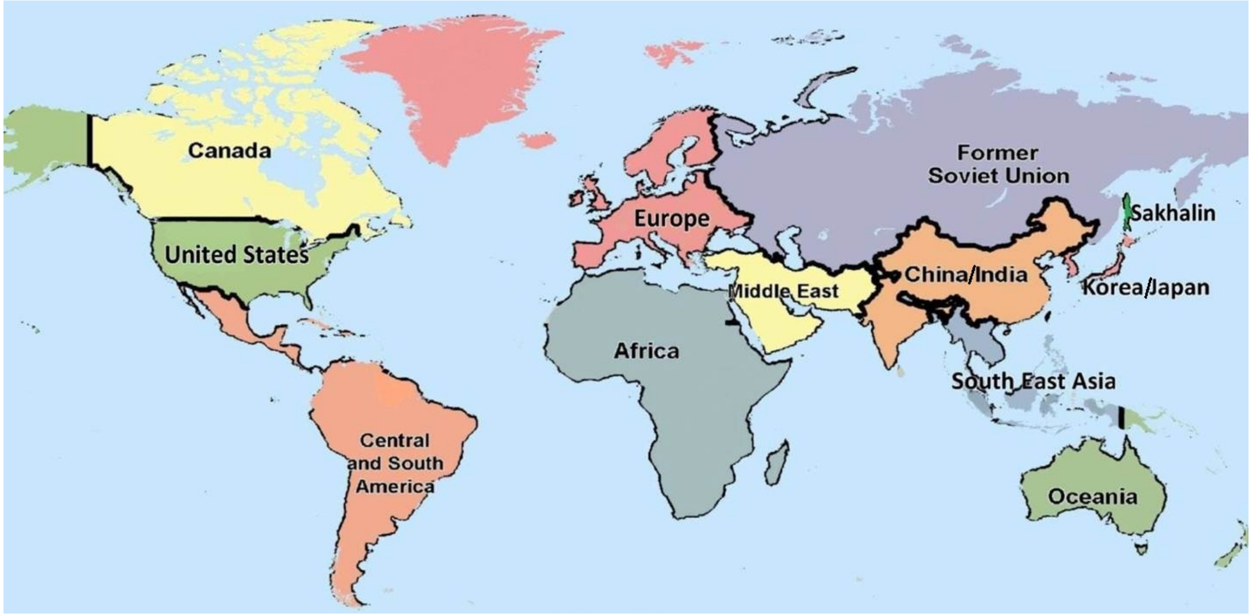
Figure 8: Global Natural Gas Demand and Production (Tcf)

	Production	Consumption
Africa	7.80	3.90
Canada	6.10	3.30
China/India	4.60	5.70
C&S America	6.80	6.60
Europe	9.50	19.20
FSU	28.87	24.30
Korea/Japan	0.20	5.00
Middle East	16.30	12.50
Oceania	2.10	1.20
Sakhalin	0.43	0.00
Southeast Asia	9.30	7.40
U.S.	21.10	23.80
Total World	113.10	112.90

Some regions are rich in natural gas resources and others are experiencing rapid growth in demand. The combination of these two characteristics determines whether the region operates as a net importer or exporter of natural gas. The characteristics of a regional market also have an impact on natural gas pricing mechanisms. The following describes the characteristics of the regional natural gas markets considered in this report.

We present our discussion in terms of regions because we have grouped countries into major exporting, importing, and demand regions for our modeling purposes. For our analysis, we grouped the world into 12 regions: U.S., Canada, Korea/Japan, China/India, Europe, Oceania, Southeast Asia, Africa, Central and South America, former Soviet Union, Middle East and Sakhalin. These regions are shown in Figure 9.

Figure 9: Regional Groupings for the Global Natural Gas Model



Japan and Korea are countries that have little indigenous natural gas resource and no prospects for gas pipelines connecting to other regions. Both countries depend almost entirely upon LNG imports to meet their natural gas demand. As a result, both countries are very dependent upon reliable sources of LNG. This is reflective in their contracting practices and willingness to have LNG prices tied to petroleum prices (petroleum is a potential substitute for natural gas). This dependence would become even more acute if Japan were to implement a policy to move away from nuclear power generation and toward greater reliance on natural gas-fired generation.

In contrast, China and India are countries that do have some indigenous natural gas resources, but these resources alone are insufficient to meet their natural gas demand. Both countries are situated such that additional natural gas pipelines from other regions of the world could possibly be built to meet a part of their natural gas needs, but such projects face geopolitical challenges. Natural gas demand in these countries is growing rapidly as a result of expanding economies, improving wealth and a desire to use cleaner burning fuels. LNG will be an important component of their natural gas supply portfolio. These countries demand more than they can produce and the pricing mechanism for their LNG purchases reflects this.

Europe also has insufficient indigenous natural gas production to meet its natural gas demand. It does, however, have extensive pipeline connections to both Africa and the Former Soviet Union ("FSU"). Despite having a gap between production and consumption, Europe's growth in natural gas demand is modest. As a result, LNG is one of several options for meeting natural gas demand. The competition among indigenous natural gas supplies, pipeline imports, and LNG imports has resulted in a market in which there is growing pressure to move away from petroleum index pricing toward natural gas index pricing.

FSU is one of the world's leading natural gas producers. It can easily accommodate its own internal natural gas demand in part because of its slow demand growth. It has ample natural gas supplies that it exports by pipeline (in most instances pipelines, if practical, are a more economical method to transport natural gas than LNG) to Europe and could potentially export by pipeline to China. FSU has subsidized pricing within its own region but has used its market power to insist upon petroleum index pricing for its exports.

The Middle East (primarily Qatar and Iran) has access to vast natural gas resources, which are inexpensive to produce. These resources are more than ample to supply a relatively small but growing demand for natural gas in the Middle East. Since the Middle East is located relatively far from other major natural gas demand regions (Asia and Europe), gas pipeline projects have not materialized, although they have been discussed. LNG represents one attractive means for Qatar to monetize its natural gas resource, and it has become the world's largest LNG producer. However, Qatar has decided to restrain its sales of LNG.

Southeast Asia and Australia are also regions with abundant low cost natural gas resources. They can in the near term (Southeast Asia with its rapid economic growth will require increasing natural gas volumes in the future) accommodate their domestic demand with additional volumes to export. Given the vast distances and the isolation by water, pipeline projects that move natural gas to primary Asian markets are not practical. As a result, LNG is a very attractive mean to monetize their resource.

The combined market of Central and South America is relatively small for natural gas. The region has managed to meet its demand with its own indigenous supplies. It has exported some LNG to European markets. Central and South America has untapped natural gas resources that could result in growing LNG exports.

The North American region has a large natural gas demand but has historically been able to satisfy its demand with indigenous resources. It has a small LNG import/export industry driven by specific niche markets. Thus, it has mostly functioned as a semi-autonomous market, separate from the rest of the world.

2. LNG Trade Patterns

LNG Trading patterns are determined by a number of criteria: short-term demand, availability of supplies, and proximity of supply projects to markets. A significant portion of LNG is traded on a long-term basis using dedicated supplies, transported with dedicated vessels to identified markets. Other LNG cargoes are traded on an open market moving to the highest valued customer. Southeast Asian and Australian suppliers often supply Asian markets, whereas African suppliers most often serve Europe. Because of their relative location, Middle East suppliers can and do ship to both Europe and Asia. Figure 10 lists 2010 LNG shipping totals with the leftmost column representing the exporters and the top row representing the importing regions.

Figure 10: 2010 LNG Trade (Tcf)

From\To	Africa	Canada	China/ India	C&S America	Europe	FSU	Korea/ Japan	Middle East	Oceania	Sakhalin	Southeast Asia	U.S.	**Total Exports**
Africa		0.03	0.05	0.31	1.33		0.24	0.21			0.07	0.31	**2.54**
Canada													**0.00**
China/India													**0.00**
C&S America		0.00		0.01	0.02		0.00					0.01	**0.05**
Europe				0.01	0.11		0.05	0.01			0.00		**0.18**
FSU													**0.00**
Korea/Japan													**0.00**
Middle East		0.01	0.44	0.08	1.15		1.28	0.10			0.15	0.08	**3.29**
Oceania			0.17				0.62				0.04		**0.83**
Sakhalin			0.02				0.39	0.00			0.02		**0.43**
Southeast Asia			0.14	0.06			1.92	0.01			0.21		**2.34**
U.S.							0.03						**0.03**
Total Imports	**0.00**	**0.04**	**0.81**	**0.47**	**2.61**	**0.00**	**4.53**	**0.34**	**0.00**	**0.00**	**0.49**	**0.40**	**9.70**

Source: "The LNG Industry 2010," GIIGNL.

3. Basis Differentials

The basis[10] between two different regional gas market hubs reflects the difference in the pricing mechanism for each regional market. If pricing for both market hubs were set by the same mechanism and there were no constraints in the transportation system, the basis would simply be the cost of transportation between the two market hubs. Different pricing mechanisms, however, set the price in each regional market, so the basis is often not set by transportation differences alone. For example, the basis between natural gas prices in Japan and Europe's natural gas prices reflects the differences in natural gas supply sources for both markets. Japan depends completely upon LNG as it source for natural gas and indexes the LNG price to crude. For Europe, LNG is only one of several potential sources of supply for natural gas, others being interregional pipelines and indigenous natural gas production. The pricing at the National Balancing Point ("NBP") reflects the competition for market share between these three sources. Because of its limited LNG terminals for export or import, North America pricing at Henry Hub has been for the most part set by competition between different North American supply sources of natural gas and has been independent of pricing in Japan and Europe. If the marginal supply source for natural gas in Europe and North America were to become LNG, then the pricing in the two regions would be set by LNG transportation differences.

B. NERA's Global Natural Gas Model

The GNGM is a partial-equilibrium model designed to estimate the amount of natural gas production, consumption, and trade by major world natural gas consuming and/or producing regions. The model maximizes the sum of consumers' and producers' surplus less transportation costs, subject to mass balancing constraints and regasification, liquefaction, and pipeline capacity constraints.

The model divides the world into the 12 regions described above. These regions are largely adapted from the EIA IEO regional definitions, with some modifications to address the LNG-intensive regions. The model's international natural gas consumption and production projections for these regions are based upon the EIA's AEO and IEO 2011 Reference cases.

The supply of natural gas in each region is represented by a constant elasticity of substitution ("CES") supply curve. The demand curve for natural gas has a similar functional form as the supply curve. As with the supply curves, the demand curve in each region is represented by a CES function (Appendix A).

C. N_{ew}ERA Macroeconomic Model

NERA developed the N_{ew}ERA model to forecast the impact of policy, regulatory, and economic factors on the energy sectors and the economy. When evaluating policies that have significant

10 The basis is the difference in price between two different natural gas market hubs.

impacts on the entire economy, one needs to use a model that captures the effects as they ripple through all sectors of the economy and the associated feedback effects. The version of the N$_{ew}$ERA model used for this analysis includes a macroeconomic model with all sectors of the economy.

The macroeconomic model incorporates all production sectors, including liquefaction plants for LNG exports, and final demand of the economy. The consequences are transmitted throughout the economy as sectors respond until the economy reaches equilibrium. The production and consumption functions employed in the model enable gradual substitution of inputs in response to relative price changes, thus avoiding all-or-nothing solutions.

There are great uncertainties about how the U.S. natural gas market will evolve, and the N$_{ew}$ERA model is designed explicitly to address the key factors affecting future natural gas demand, supply, and prices. One of the major uncertainties is the availability of shale gas in the United States. To account for this uncertainty and the subsequent effect it could have on the domestic markets, the N$_{ew}$ERA model includes resource supply curves for U.S. natural gas. The model also accounts for foreign imports, in particular pipeline imports from Canada, and the potential build-up of liquefaction plants for LNG exports. N$_{ew}$ERA also has a supply (demand) curve for U.S. imports (exports) that represents how the global LNG market price would react to changes in U.S. imports or exports. On a practical level, there are also other important uncertainties about the ownership of LNG plants and how the LNG contracts will be formulated. These have important consequences on how much revenue can be earned by the U.S. and hence overall macroeconomic impacts. In the N$_{ew}$ERA model it is possible to represent these variations in domestic versus foreign ownership of assets and capture of export revenues to better understand the issues.

U.S. wellhead natural gas prices are not precisely the same in the GNGM and the U.S. N$_{ew}$ERA model. Supply curves in both models were calibrated to the EIA implicit supply curves, but the GNGM has a more simplified representation of U.S. natural gas supply and demand than the more detailed N$_{ew}$ERA model so that the two models solve for slightly different prices with the same levels of LNG exports. The differences are not material to any of the results in the study.

The N$_{ew}$ERA model includes other energy markets. In particular, it represents the domestic and international crude oil and refined petroleum markets.

We balance the international trade account in the N$_{ew}$ERA model by constraining changes in the current account deficit over the model horizon. The condition is that the net present value of the foreign indebtedness over the model horizon remains at the benchmark year level. This prevents distortions in economic effects that would result from perpetual increase in borrowing, but does not overly constrain the model by requiring current account balance in each year.

This treatment of the current account deficit does not mean that there cannot be trade benefits from LNG exports. Although trade will be in balance over time, the terms of trade shift in favor of the U.S. because of LNG exports. That is, by exporting goods of greater value to overseas customers, the U.S. is able to import larger quantities of goods than it would able to if the same domestic resources were devoted to producing exports of lesser value. Allowing high value exports to proceed has a similar effect on terms of trade as would an increase in the world price of existing exports or an increase in productivity in export industries. In all these cases, the U.S. gains more imported goods in exchange for the same amount of effort being devoted to production of goods for export. The opposite is also possible, in that a drop in the world price of U.S. exports or a subsidy that promoted exports of lesser value would move terms of trade against the U.S., in that with the same effort put into producing exports the U.S. would receive less imports in exchange and terms of trade would move against the U.S. The fact that LNG will be exported only if there is sufficient market demand ensures that terms of trade will improve if LNG exports take place.

The N_{ew}ERA model outputs include demand and supply of all goods and services, prices of all commodities, and terms of trade effects (including changes in imports and exports). The model outputs also include gross regional product, consumption, investment, disposable income and changes in income from labor, capital, and resources.

IV. DESCRIPTION OF SCENARIOS

EIA's analysis combined assumptions about levels of natural gas exports with assumptions about uncertain factors that will drive U.S. natural gas supply and demand to create 16 scenarios. EIA's analysis did not and was not intended to address the question of whether these quantities could be sold into world markets under the conditions assumed in each scenario. Since global demand for LNG exports from the United States also depends on a number of uncertain factors, NERA designed scenarios for global supply and demand to capture those uncertainties. The global scenarios were based on different sets of assumptions about natural gas supply and demand outside the United States. The combination of assumptions about maximum permitted levels of exports, U.S. supply and demand conditions, and global supply and demand conditions yielded 63 distinct scenarios to be considered.

The full range of scenarios that we considered included the different combinations of international supply and demand, availability of domestic natural gas, and LNG export capabilities. The remainder of this section discusses this range of scenarios.

A. How Worldwide Scenarios and U.S. Scenarios Were Designed

1. World Outlooks

The International scenarios were designed to examine the role of U.S. LNG in the world market (Figure 11). Before determining the macroeconomic impacts in the U.S., one must know the circumstances under which U.S. LNG would be absorbed into the world market, the level of exports that would be economic on the world market and the value (netback) of exported LNG in the U.S. In order to accomplish this, several International scenarios were developed that allowed for growing worldwide demand for natural gas and an increasing market for LNG. These were of more interest to this study because the alternative of lower worldwide demand would mean little or no U.S. LNG exports, which would have little or no impact on the U.S. economy.

Figure 11: International Scenarios

Case Name	Japan Nuclear Plants Retired	Korean Nuclear Plants Retired	Planned Liquefaction Capacity in Other Regions Is Built
International Reference	No	No	Yes
Demand Shock	Yes	No	Yes
Supply/Demand Shock	Yes	Yes	No

a. International Reference Case: A Plausible Baseline Forecast of Future Global Demand and Supply

The International Reference case is intended to provide a plausible baseline forecast for global natural gas demand, supply, and prices from today through the year 2035. The supply and demand volumes are based upon EIA IEO 2011 with countries aggregated to the regions in the NERA Global Natural Gas Model. The regional natural gas pricing is intended to model the pricing mechanisms in force in the regions today and their expected evolution in the future. Data to develop these pricing forecasts were derived from both the EIA and the International Energy Agency's World Energy Outlook 2011 ("IEA WEO").

Our specific assumptions for the global cases are described in Appendix A.

b. Uncertainties about Global Natural Gas Demand and Supply

To reflect some of the uncertainty in demand for U.S. LNG exports, we analyzed additional scenarios that potentially increased U.S. LNG exports. Increasing rather than decreasing exports is of more interest in this study because it is the greater level of LNG exports that would result in larger impact on the U.S. economy. The two additional International scenarios increase either world demand alone or increase world demand while simultaneously constraining the development of some new LNG supply sources outside the U.S. Both scenarios would result in a greater opportunity for U.S. LNG to be sold in the world market.

- The first additional scenario ("Demand Shock") creates an example of increased demand by assuming that Japan converts all its nuclear power generation to natural gas-fired generation. This scenario creates additional demand for LNG in the already tight Asian market. Because Japan lacks domestic natural gas resources, the incremental demand could only be served by additional LNG volumes.

- The second scenario ("Supply/Demand Shock") is intended to test a boundary limit on the international market for U.S. LNG exports. This scenario assumes that both Japan and Korea convert their nuclear demand to natural gas and on the supply side it is assumed that no new liquefaction projects that are currently in the planning stages will be built in Oceania, Southeast Asia, or Africa. The precise quantitative shifts assumed in world supply and demand are described in Appendix A.

Neither of these scenarios is intended to be a prediction of the future. Their apparent precision (Asian market) is only there because differential transportation costs make it necessary to be specific about where non-U.S. demand and supply are located in order to assess the potential demand for U.S. natural gas. Many other, and possibly more likely, scenarios could be constructed, and some would lead to higher and others to lower exports. The scenarios that we modeled are intended as only one possible illustration of conditions that could create higher demand for U.S. LNG exports.

2. U.S. Scenarios Address Three Factors

a. Decisions about the Upper Limit on Exports

One of the primary purposes of this study is to evaluate the impacts of different levels of natural gas exports. The levels of exports that are used in constructing the U.S. scenarios are the four levels specified by the DOE/FE as part of EIA's Study. In addition, the DOE requested that we add one additional level of exports, "Slowest," to address additional uncertainties about how rapidly liquefaction capacity could be built that were not captured by the EIA analysis. Lastly, we evaluated a No-Export constraint scenario, whereby we could determine the maximum quantity of exports that would be demanded based purely on the economics of the natural gas market and a No-Export capacity scenario to provide a point of comparison for impacts of LNG exports.

b. Uncertainties about U.S. Natural Gas Demand and Supply

The advances in drilling technology that created the current shale gas boom are still sufficiently recent that there remains significant uncertainty as to the long-term natural gas supply outlook for the U.S. In addition to the uncertain geological resource, there are also other uncertainties such as how much it will cost to extract the natural gas, and many regulatory uncertainties including concerns about seismic activity, and impacts on water supplies that may lead to limits on shale gas development.

On the demand side there has been a considerable shift to natural gas in the electric sector in recent years as a result of the low natural gas prices. Looking into the future, there are expected to be many retirements of existing coal-fired generators as a result of the low natural gas prices and new EPA regulations encouraging natural gas use. As a result, most new baseload capacity being added today is fueled with natural gas. Industrial demand for natural gas is also tied to price levels. The current low prices have increased projected outputs from some natural gas-intensive industries like chemicals manufacturing. The shift toward natural gas could be accelerated by pending and possible future air, water, and waste regulations and climate change policies. Thus, the potential exists for significant increases in natural gas demand across the U.S. economy.

Combining uncertainties about the U.S. outlooks for natural gas supply and demand results in a wide range of projections for the prices, at which natural gas may be available for export.

To reflect this uncertainty, the EIA, in its AEO 2011, included several sensitivity cases in addition to its Reference Case. For natural gas supply, the two most significant are the Low Shale EUR and High Shale EUR sensitivity cases. We also adopt these cases, in addition to the Reference Case supply conditions, in evaluating the potential for exports of natural gas.

B. Matrix of U.S. Scenarios

The full range of potential U.S. scenarios was constructed based on two factors: 1) U.S. supply and 2) LNG export quotas. There are three different U.S. supply outlooks:[11]

1. Reference ("USREF"): the AEO 2011 Reference case;

2. High Shale Estimated Ultimate Recovery ("HEUR") case: reflecting more optimistic assumptions about domestic natural gas supply prospects, with the EUR per shale gas well for new, undrilled wells assumed to be 50 percent higher than in the Reference case; and

3. Low Shale EUR case ("LEUR"): reflecting less optimistic assumptions about domestic natural gas supply prospects, with the EUR per shale gas well for new, undrilled wells assumed to be 50 percent lower than in the Reference case.[12]

As for the LNG export quotas, we considered six different LNG export quota trajectories, all starting in 2015:

1. Low/Slow ("LS"): 6 Bcf/d, phased in at a rate of 1 Bcf/d per year;

2. Low/Rapid ("LR"): 6 Bcf/d phased in at a rate of 3 Bcf/d per year;

3. High/Slow ("HS"): 12 Bcf/d phased in at a rate of 1 Bcf/d per year;

4. High/Rapid ("HR"): 12 Bcf/d phased in at a rate of 3 Bcf/d per year;

5. Low/Slowest ("LSS"): 6 Bcf/d phased in at a rate of 0.5 Bcf/d per year; and

6. No-Export Constraint: No limits on U.S. LNG export capacity were set and therefore our Global Natural Gas Model determined exports entirely based on the relative economics.

The combination of these two factors results in the matrix of 18 (3 supply forecasts for each of 6 export quota trajectories) potential U.S. scenarios in Figure 12.

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[11] We eliminate a fourth case, High Demand, run by EIA because the range of demand uncertainty is expected to be within the range spanned by the three cases.

[12] While the statement of work also described a supply outlook using EIA's High Economic Growth case, we found that the results would have been identical to those in the Reference case, and thus, we did not separately analyze that case.

Figure 12: Matrix of U.S. Scenarios

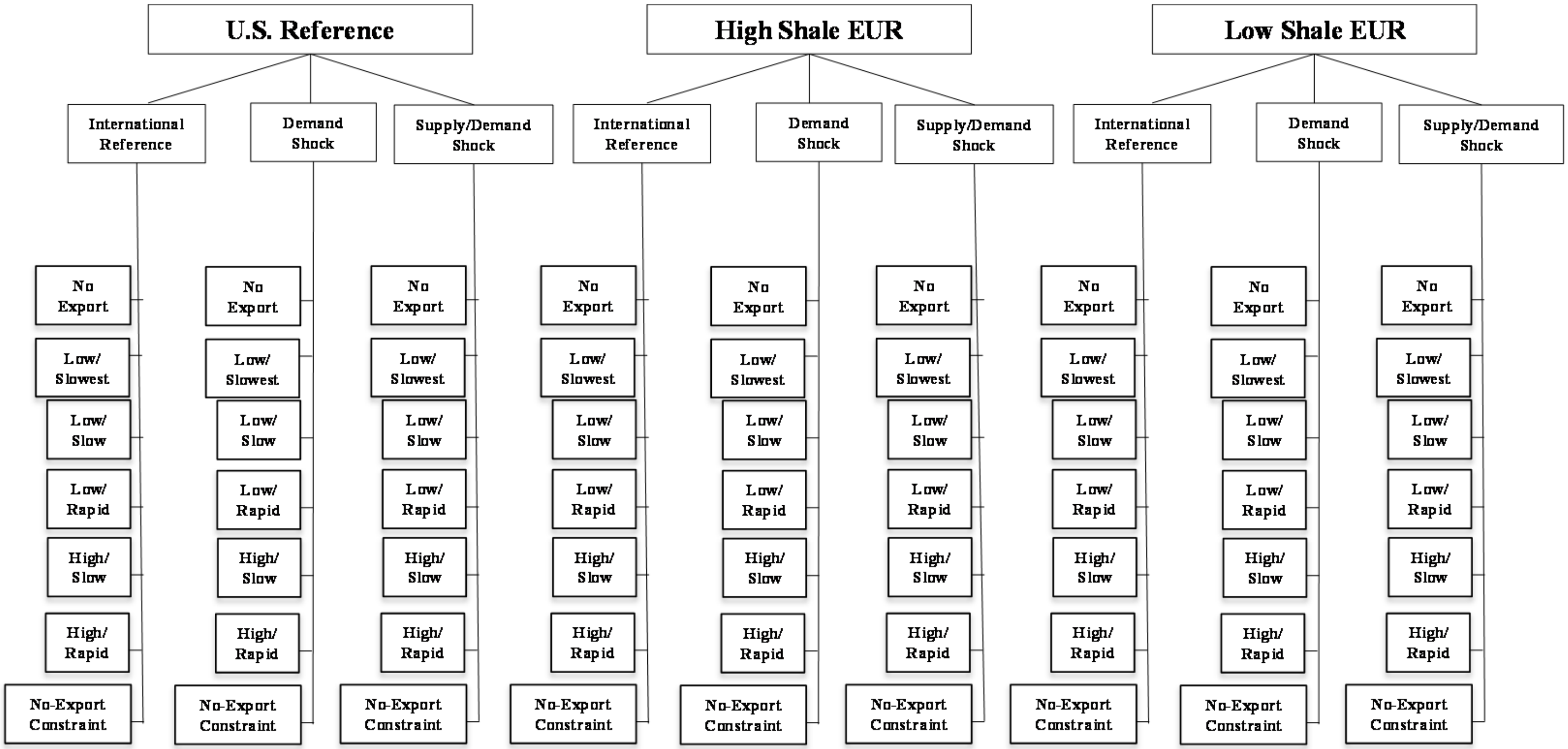
U.S. Supply	LNG Export Capacity	U.S. Supply	LNG Export Capacity	U.S. Supply	LNG Export Capacity
Reference	Low/Slow	High EUR	Low/Slow	Low EUR	Low/Slow
Reference	Low/Rapid	High EUR	Low/Rapid	Low EUR	Low/Rapid
Reference	High/Slow	High EUR	High/Slow	Low EUR	High/Slow
Reference	High/Rapid	High EUR	High/Rapid	Low EUR	High/Rapid
Reference	Low/Slowest	High EUR	Low/Slowest	Low EUR	Low/Slowest
Reference	Unlimited	High EUR	Unlimited	Low EUR	Unlimited

In addition, we created a "No-Export Capacity" scenario for each of the three U.S. supply cases.

C. Matrix of Worldwide Natural Gas Scenarios

NERA used its Global Natural Gas Model to analyze international impacts resulting from potential U.S. LNG exports. As shown in Figure 13, a matrix of scenarios combining the three worldwide scenarios with three U.S. supply scenarios and the seven rates of U.S. LNG capacity expansion resulted in a total of 63 different scenarios that were analyzed.

Figure 13: Tree of All 63 Scenarios



V. GLOBAL NATURAL GAS MODEL RESULTS

A. NERA Worldwide Supply and Demand Baseline

NERA's Baseline is based upon EIA's projected production and demand volumes from its 2011 IEO and AEO Reference cases with some modifications.

To develop a worldwide supply and consumption baseline, we first adjusted the IEO's estimates for production and consumption in the ten non-North American regions. Then we adjusted the IEO projections for two North American regions. For the ten non-North American regions, we computed the average of the IEO's estimate for worldwide production and demand excluding North American production, consumption and LNG imports. Then, we scaled the production in each of these ten regions individually by the ratio of this average and the original production in these ten regions. We used a similar methodology for determining demand in these ten regions.

Next, we calibrated both the U.S. imports from Canada and U.S. LNG imports. U.S. pipeline imports from Canada varied for each of the three U.S. supply cases: AEO reference, High Shale EUR, and Low Shale EUR. U.S. LNG imports were next calculated as the difference between total U.S. imports less pipeline imports. This calculation was repeated for each U.S. supply case. The calculated LNG imports are consistent with the official AEO numbers.

For LNG exporting regions, we checked that they had sufficient liquefaction capacity so that their calibrated production was less than or equal to their demand plus their liquefaction and inter-regional pipeline capacity. If not, we adjusted the region's liquefaction capacity so that this condition held with equality. For the Middle East, we imposed a limit on the level of 4.64 Tcf on its LNG exports. Since its liquefaction capacity exceeds its export limit, the Middle East supply must be less than or equal to its demand plus its LNG export limit. If this condition failed to hold, we adjusted Middle East supply until Middle East supply equaled its demand plus its LNG export limit.

In calibrating the FSU, NERA assumes that the recalibrated (as per the above adjustment made to the IEO data) production is correct and any oversupply created by the calibration of supply and demand is exported by pipeline.

For LNG importing regions, we checked to determine if, after performing the recalibration described above, the demand in each importing region was less than the sum of their domestic natural gas production, regasification capacity, and inter-regional pipeline capacity. In each region where this condition failed, we expanded its regasification capacity until this condition held with equality. Figure 14 reports the resulting natural gas productions to which we calibrated each region in our GNGM. Figure 15 reports the resulting natural gas demand to which we calibrated each region in our GNGM.

Figure 14: Baseline Natural Gas Production (Tcf)

	2010	2015	2020	2025	2030	2035
Africa	7.80	9.70	11.10	12.20	13.30	14.10
Canada	6.10	7.00	7.70	8.30	8.70	9.00
China/India	4.60	5.60	6.70	8.00	9.60	9.70
C&S America	6.80	7.90	8.30	9.20	10.50	11.70
Europe	9.50	8.10	7.40	7.50	7.90	8.30
FSU	28.87	30.05	32.12	34.89	37.77	39.94
Korea/Japan	0.20	0.20	0.20	0.20	0.20	0.20
Middle East	16.30	19.70	22.40	24.60	26.70	28.80
Oceania	2.10	2.60	3.10	3.80	4.80	5.70
Sakhalin	0.43	0.45	0.48	0.51	0.53	0.56
Southeast Asia	9.30	10.00	10.70	11.60	12.60	13.40
U.S.	21.10	22.40	23.40	24.00	25.10	26.40
World	113.10	123.70	133.60	144.80	157.70	167.80

Figure 15: Baseline Natural Gas Demand (Tcf)

	2010	2015	2020	2025	2030	2035
Africa	3.90	4.70	5.90	7.10	8.30	9.10
Canada	3.30	3.50	3.70	4.20	4.60	5.00
China/India	5.70	8.60	10.70	13.10	15.10	16.60
C&S America	6.60	7.40	8.90	10.50	12.20	14.40
Europe	19.20	19.80	20.40	20.90	22.00	23.20
FSU	24.30	24.30	24.50	24.90	25.80	26.50
Korea/Japan	5.00	5.20	5.30	5.70	5.90	5.90
Middle East	12.50	14.70	17.00	19.10	21.30	24.00
Oceania	1.20	1.30	1.50	1.80	2.00	2.20
Sakhalin	0.00	0.00	0.00	0.00	0.00	0.00
Southeast Asia	7.40	8.50	10.00	12.00	13.90	15.30
U.S.	23.80	25.10	25.30	25.10	25.90	26.50
World	112.90	123.10	133.20	144.40	157.00	168.70

NERA developed a set of world natural gas price projections based upon a number of data sources. The approach focuses on the wellhead price forecasts for net export regions and city gate price forecasts for net import regions.

U.S. wellhead natural gas prices are not precisely the same in the global natural gas model and the U.S. N_{ew}ERA model. Supply curves in both models were calibrated to the EIA implicit supply curves, but the GNGM has a more simplified representation of U.S. natural gas supply and demand than the more detailed N_{ew}ERA model so that the two models solve for slightly different prices with the same levels of LNG exports. The differences are not material to any of the results in the study.

In natural gas-abundant regions like the Middle East and Africa, the wellhead price is assumed to equal the natural gas development and lifting cost. City gate prices are estimated by adding a transportation cost to the wellhead prices. In the major Asian demand markets, natural gas prices are determined on a near oil-parity basis using crude oil price forecasts from IEA's WEO 2011. The resultant prices are highly consistent with the relevant historical pipeline import prices13 and LNG spot market prices as well as various oil and natural gas indices (*i.e.*, JCC, WTI, Henry Hub, AECO Hub indices, and UK National Balancing Point). U.S. wellhead and average city gate prices are adopted from AEO 2012 Early Release. Canadian wellhead prices are projected to initially be $0.35 less than the U.S. prices in the Reference case. The resulting city gate and wellhead prices are presented in Figure 16 and Figure 17.

[13] German BAFA natural gas import border price, Belgium Zeebrugge spot prices, TTF Natural Gas Futures contracts, *etc*.

Figure 16: Projected Wellhead Prices (2010$/MMBtu)

	2010	2015	2020	2025	2030	2035
Africa	$1.75	$1.89	$2.09	$2.31	$2.55	$2.81
Canada	$3.39	$3.72	$4.25	$5.20	$5.64	$6.68
China/India	$12.29	$12.86	$13.00	$13.25	$13.57	$13.51
C&S America	$2.00	$2.16	$2.39	$2.64	$2.91	$3.22
Europe	$9.04	$9.97	$10.80	$11.95	$12.39	$13.23
FSU	$4.25	$4.60	$5.08	$5.61	$6.19	$6.84
Korea/Japan	$14.59	$15.30	$15.47	$15.79	$16.19	$16.11
Middle East	$1.25	$1.35	$1.49	$1.65	$1.82	$2.01
Oceania	$1.75	$1.89	$2.09	$2.31	$2.55	$2.81
Sakhalin	$1.25	$1.35	$1.49	$1.65	$1.82	$2.01
Southeast Asia	$2.00	$2.16	$2.39	$2.64	$2.91	$3.22
U.S.	$3.72	$3.83	$4.28	$5.10	$5.48	$6.36

Figure 17: Projected City Gate Prices (2010$/MMBtu)

	2010	2015	2020	2025	2030	2035
Africa	$2.75	$2.89	$3.09	$3.31	$3.55	$3.81
Canada	$4.79	$5.12	$5.65	$6.60	$7.04	$8.08
China/India	$13.79	$14.36	$14.50	$14.75	$15.07	$15.01
C&S America	$4.50	$4.66	$4.89	$5.14	$5.41	$5.72
Europe	$10.04	$10.97	$11.80	$12.95	$13.39	$14.23
FSU	$5.25	$5.60	$6.08	$6.61	$7.19	$7.84
Korea/Japan	$15.09	$15.80	$15.97	$16.29	$16.69	$16.61
Middle East	$4.08	$4.18	$4.32	$4.48	$4.65	$4.84
Oceania	$3.25	$3.39	$3.59	$3.81	$4.05	$4.31
Sakhalin	$3.75	$3.85	$3.99	$4.15	$4.32	$4.51
Southeast Asia	$3.00	$3.16	$3.39	$3.64	$3.91	$4.22
U.S.	$4.72	$4.83	$5.28	$6.10	$6.48	$7.36

After calibrating the GNGM to the above prices and quantities, we allowed the model to solve for the least-cost method of transporting gas so that supplies and demands are met. Figure 18,

Figure 19, and Figure 20 display the pipeline flows between model regions, LNG exports, and LNG imports for all model years in the baseline.

Figure 18: Baseline Inter-Region Pipeline Flows (Tcf)

Origin	Destination	2010	2015	2020	2025	2030	2035
Africa	Europe	1.53	1.68	1.41	0.94	0.88	0.87
Canada	U.S.	2.33	2.33	1.40	0.74	0.64	0.04
FSU	China/India	0.07	0.34	1.18	1.55	1.59	1.83
FSU	Europe	4.55	5.88	7.21	9.22	10.38	10.84

Figure 19: Baseline LNG Exports (Tcf)

Exporter	2010	2015	2020	2025	2030	2035
Africa	2.38	3.46	4.02	4.45	4.12	3.77
C&S America	0.37	0.66	0.50	0.19	0.16	0.06
Sakhalin	0.44	0.48	0.49	0.52	0.55	0.59
Middle East	4.10	4.64	4.64	4.64	4.64	4.64
Oceania	0.74	1.28	1.63	2.02	2.60	3.04
Southeast Asia	1.64	1.42	0.85	-	-	-

Figure 20: Baseline LNG Imports (Tcf)

Importer	2010	2015	2020	2025	2030	2035
China/India	1.02	2.58	2.52	3.21	3.69	3.48
Europe	3.58	3.99	4.02	2.82	2.57	2.98
Korea/Japan	4.80	5.00	5.05	5.21	5.43	5.48
U.S.	0.37	0.37	0.50	0.36	0.16	0.06

B. Behavior of Market Participants

In a market in which existing suppliers are collecting profits, the potential entry of a new supplier creates an issue concerning how the existing suppliers should respond. Existing suppliers have three general strategy options:

1. Existing suppliers can voluntarily reduce their own production, conceding market share to the new entrant in order to maintain market prices.

2. Existing suppliers can act as price takers, adjusting their volume of sales until prices reach a new, lower equilibrium.

3. Existing suppliers can choose to produce at previously planned levels with the hope of discouraging the new potential supplier from entering the market by driving prices below levels acceptable to the new entrant.

How much the U.S. will be able to export, and at what price, depends critically on how other LNG producers like Qatar that are low cost producers but currently limiting exports would react to the appearance of a new competitor in the market. Our model of the world gas market is one of a single dominant supplier, which has the largest shares of LNG exports and is thought to be limiting output, and a competitive fringe whose production adjusts to market prices.[14] Our calculation of U.S. benefits from trade assumes that the dominant supplier would not change its plans for expanding production to counter U.S. entry into the market (strategy 3). Their continued production would leave no room for U.S. exports until prices were driven down far enough to stimulate sufficient additional demand to absorb economic exports from the U.S. Since the competitive fringe does reduce output (strategy 2) as prices fall due to U.S. LNG exports, there is an opportunity for the U.S. to enter the market but only by driving delivered LNG prices in key markets below what they are today. Should these countries respond instead by cutting production below planned levels to maintain prices, the U.S. could gain greater benefits and a larger market share. If the dominant supplier chooses to cut prices, then exporting LNG from the U.S. would become less attractive to investors.

Another consideration is the behavior of LNG consumers. At this point in time, countries like Japan and Korea appear to be paying a substantial premium over the price required to obtain supplies from regions that have not imposed limits on planned export capacity. At the same time, those countries are clearly looking into arrangements in the United States that would provide natural gas at a delivered cost substantially below prices they currently pay for LNG deliveries. This could be because they view the U.S. as a uniquely secure source of supply, or it could be that current high prices reported for imports into Japan and Korea are for contracts that will expire and be replaced by more competitively priced supplies. If countries like Japan and Korea became convinced that they could obtain secure supplies without long-term oil-based pricing contracts, and ceased paying a premium over marginal cost, the entire price structure could shift downward. Since the U.S. does not appear to be the world's lowest cost supplier, this could have serious consequences for the profitability of U.S. exports.

In this study, we address issues of exporter responses by assuming that there is a competitive market with exogenously determined export limits chosen by each exporting region and determined by their liquefaction capacity. This assumption allows us to explore different scenarios for supply from the rest of the world when the U.S. begins to export. This is a middle

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[14] We consider the dominant supplier to be Qatar, with a 31% share of the market in 2011, while also exercising some production restraint.

ground between assuming that the dominant producer will limit exports sufficiently to maintain the current premium apparent in the prices paid in regions like Japan and Korea, or that dominant exporters will remove production constraints because with U.S. entry their market shares fall to levels that do not justify propping up prices for the entire market.

It is outside the scope of this study to analyze alternative responses by other LNG suppliers in order to determine what would be in their best economic interest or how they might behave strategically to maximize their gains. This would require a different kind of model that addresses imperfect competition in global LNG markets and could explain the apparent ability of some large exporters to set prices for some importing countries at prices higher than the cost of production plus transportation.

C. Available LNG Liquefaction and Shipping Capacity

This analysis did not investigate the technical feasibility of building new liquefaction capacity in a timely fashion to support the level of exports the model found optimal. In all cases, the GNGM assumed no limits on either LNG liquefaction capacity additions outside the U.S. or world LNG shipping capacity. The only LNG export capacity limits were placed on the U.S. and the Middle East.

D. The Effects of U.S. LNG Exports on Regional Natural Gas Markets

When the U.S. exports LNG, the worldwide and domestic natural gas markets are affected in the following ways:

- The additional supplies from U.S. LNG exports cause a drop in city gate prices in the importing regions;
- The lower prices lead to increased natural gas consumption in the importing regions;
- Relative to the baseline forecast, U.S. LNG exports displace some LNG exports from other regions, which leads to lower production levels in many of the other exporting regions;
- U.S. LNG exports displace FSU pipeline exports to Europe and China, which leads to lower FSU production;
- Exporting regions with lower LNG or pipeline exports and hence lower production levels experience a drop in wellhead and city gate prices because of the lower demand for their gas;
- Natural gas production rises in the U.S. because there is additional demand for its gas;

- Wellhead natural gas prices rise in the U.S. because of the increased demand, which leads to higher city gate prices; and
- Higher U.S. prices cause a reduction in U.S. natural gas consumption.

Whether or not a region's exports would be displaced by U.S. LNG exports depend on several factors:

- The difference in delivered costs between an exporting region and the U.S.;
- The magnitude of the demand shock or increased demand; and
- The magnitude of the supply shock or reduction in world supply.

Because Africa and the Middle East are the lowest cost producers, U.S. LNG exports have the smallest effect on their exports. Also, the Middle East's exports are limited by our assumption that Qatar continues to limit its exports of natural gas at its announced levels. Thus, there are pent-up LNG exports, which mean that the Middle East can still export its same level of LNG even with a decline in international gas prices.

Since the cost of exports is higher in some other regions, they are more vulnerable to having their exports displaced by U.S. LNG exports. In the International Reference case, U.S. LNG exports displace LNG exports from all regions to some extent in many of the years. U.S. exports also cause reductions in inter-regional pipeline exports: FSU to Europe and China, as well as Africa to Europe.

In comparing the International Reference case to the Demand Shock and Supply/Demand Shock cases, we find that global LNG exports increase because the world demand for natural gas is greater. Like other regions, U.S. LNG exports increase, which means that they displace a greater number of exports. However, those regions that have some of their exports displaced still export more natural gas under the Demand Shock and Supply/Demand Shock scenarios than under the equivalent International Reference scenarios.

In the Supply/Demand Shock scenarios, Oceania, Southeast Asia, and Africa have their LNG exports restricted. This restriction leads to these regions receiving a netback price in excess of their wellhead prices. Thus, these regions have a margin that buffers them when the U.S. LNG exports try to enter the market. These regions can lower their export price for LNG some while still ensuring their netback price is greater than or equal to their wellhead price and maintain their level of LNG exports at the level that existed before the U.S. entered the market. However, Southeast Asia has a much smaller buffer than Oceania and Africa so when the U.S. enters the market it effectively displaces much of Southeast Asia's supply.

By 2030, demand for LNG becomes greater so low-cost producing regions such as Sakhalin and the Middle East experience no decline in LNG exports when the U.S. LNG exports enter the market.

When the U.S. enters the global LNG market, each region's supply, demand, wellhead price, and city gate price for natural gas respond as expected. More precisely, importing regions increase their demand for natural gas, and exporting regions either reduce or maintain their supply of natural gas. The wellhead and city gate prices for natural gas decline in all importing regions and remain the same in exporting regions except for in the U.S. and Canada, which are now able to export LNG.

E. Under What Conditions Would the U.S. Export LNG?

In order to understand the economic impacts on the U.S. resulting from LNG exports, it is necessary to understand the circumstances under which U.S. natural gas producers will find it profitable to export LNG. To accomplish this, we used GNGM to run a series of scenarios for all combinations of the three U.S. scenarios (Reference, High Shale EUR, and Low Shale EUR) and three international scenarios (International Reference, Demand Shock, and Supply/Demand Shock). In these runs, we varied the constraints on LNG export levels across seven settings (No-Exports, Low/Slowest, Low/Slow, Low/Rapid, High/Slow, High/Rapid, and Unconstrained). Based upon these 63 runs, we found the following:

- For the scenarios which combined the International Reference and U.S. Reference cases, there were no U.S. LNG exports. In part, this is due to the fact that the EIA scenarios upon which they are based assume that global natural gas demand is met by global supplies without U.S. LNG exports. This outcome also implies that U.S. LNG exports under a U.S. Reference scenario would not be lower cost than existing or planned sources of LNG in other regions of the world and thus do not displace them.
- When there is additional growth in global natural gas demand beyond that of the International Reference scenario, then the U.S. exports LNG to help meet this incremental demand. The degree to which the U.S. exports LNG depends upon the abundance and quality of the U.S. resource base.
- When the U.S. gas supplies are more abundant and lower cost than in the U.S. Reference case, the U.S. can competitively export LNG either to meet incremental global demand or to displace planned LNG supplies in other regions.
- Should the U.S. shale gas resource prove less abundant or cost effective, then U.S. LNG exports will be minimal under the most optimistic global scenario (Supply/Demand Shock).

In the next sections, we present the modeling results for each of the three U.S. cases that served as the basis for arriving at these conclusions.

1. Findings for the U.S. Reference Scenario

This section reports the level of U.S. LNG exports under the 21 scenarios (includes no LNG export scenario) that assume the U.S. Reference scenario. These scenarios consider different international assumptions about international demand and supply of natural gas as well as different assumptions about the U.S.'s ability to export LNG. Figure 21 reports the U.S.'s maximum export capacity for each LNG export capacity scenario.

Figure 21: U.S. LNG Export Capacity Limits (Tcf)

LNG Export Capacity Scenarios	2015	2020	2025	2030	2035
Low/Slowest	0.18	1.10	2.01	2.19	2.19
Low/Slow	0.37	2.19	2.19	2.19	2.19
Low/Rapid	1.10	2.19	2.19	2.19	2.19
High/Slow	0.37	2.19	4.02	4.38	4.38
High/Rapid	1.10	4.38	4.38	4.38	4.38
No Constraint	N/A	N/A	N/A	N/A	N/A

Figure 22 reports the level of U.S. LNG exports. Viewing Figure 21and Figure 22, one can see the effect of the LNG export capacity limits on restraining U.S. exports and the effect of these limits under different assumptions about the International scenarios.

Figure 22: U.S. LNG Exports –U.S. Reference (Tcf)

Bold numbers indicate that the U.S. LNG export limit is binding

<table>
<tr><th>U.S. Scenario</th><th>International Scenario</th><th>LNG Export Capacity Scenarios</th><th>2015</th><th>2020</th><th>2025</th><th>2030</th><th>2035</th></tr>
<tr><td rowspan="12">U.S. Reference</td><td rowspan="6">Demand Shock</td><td>Low/Slowest</td><td>0.18</td><td>0.98</td><td>1.43</td><td>1.19</td><td>1.37</td></tr>
<tr><td>Low/Slow</td><td>0.37</td><td>0.98</td><td>1.43</td><td>1.19</td><td>1.37</td></tr>
<tr><td>Low/Rapid</td><td>1.02</td><td>0.98</td><td>1.43</td><td>1.19</td><td>1.37</td></tr>
<tr><td>High/Slow</td><td>0.37</td><td>0.98</td><td>1.43</td><td>1.19</td><td>1.37</td></tr>
<tr><td>High/Rapid</td><td>1.02</td><td>0.98</td><td>1.43</td><td>1.19</td><td>1.37</td></tr>
<tr><td>No Constraint</td><td>1.02</td><td>0.98</td><td>1.43</td><td>1.19</td><td>1.37</td></tr>
<tr><td rowspan="6">Supply/ Demand Shock</td><td>Low/Slowest</td><td>0.18</td><td>1.10</td><td>2.01</td><td>2.19</td><td>2.19</td></tr>
<tr><td>Low/Slow</td><td>0.37</td><td>2.19</td><td>2.19</td><td>2.19</td><td>2.19</td></tr>
<tr><td>Low/Rapid</td><td>1.10</td><td>2.19</td><td>2.19</td><td>2.19</td><td>2.19</td></tr>
<tr><td>High/Slow</td><td>0.37</td><td>2.19</td><td>3.93</td><td>4.38</td><td>4.38</td></tr>
<tr><td>High/Rapid</td><td>1.10</td><td>2.92</td><td>3.93</td><td>4.38</td><td>4.38</td></tr>
<tr><td>No Constraint</td><td>2.17</td><td>2.92</td><td>3.93</td><td>4.54</td><td>5.75</td></tr>
</table>

Figure 22 omits the International Reference Scenario because when there are no international shocks that either raise world demand or lower world supply from baseline levels, then the U.S. does not export LNG. However, the U.S. does export LNG when higher levels of world demand are assumed and exports even greater amounts of LNG when both world demand increases and non-U.S. supply planned expansions are not built (units denoted as "under construction" are still assumed to be built).

Under the Demand Shock scenario from 2020 onward, the economic level of U.S. LNG exports do not reach export capacity limits. Therefore, the level of exports in the years 2020 through 2035 is the same for all LNG export capacity levels. Under Supply/Demand Shock scenario, however, the LNG export capacity limits are often binding.[15] The low U.S. LNG capacity export limits are binding for all rates of expansion (Low/Slowest, Low/slow, and Low/Rapid) for all years. For the high LNG export levels, some years are binding and some are not. Under the Supply/Demand Shock scenarios, LNG exports are always greater than or equal to LNG exports in the Demand Shock cases.

The U.S. LNG export capacity binds when the optimal level of exports as determined by the model (see the rows denoted "No Constraint") exceeds the LNG export capacity level. The difference between the value of LNG exports in the "No Constraint" row and a particular case with a LNG export capacity defines the quantity of exports that LNG export capacity prohibits from coming onto the world market. The greater this number, the more binding the LNG export capacity and the more valuable an LNG terminal would be. In 2025 for example, the U.S. would choose to export almost 4 Tcf of LNG, but if its export capacity limit followed one of the low level cases (Low/Slowest, Low/Slow, or Low/Rapid), there would be a shortfall of almost 2 Tcf of export capacity. On the other hand, if the export capacity followed one of the high level cases (High/Slow or High/Rapid), the U.S. would have about 0.4 Tcf of spare capacity.

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15 The U.S. LNG export capacity binds when the market equilibrium level of exports as determined by the model exceeds the maximum LNG export capacity assumed in that scenario.

2. Findings for the U.S. High Shale EUR Scenario

Figure 23: U.S. LNG Export – High Shale EUR (Tcf)

Bold numbers indicate that the U.S. LNG export limit is binding

U.S. Scenario	International Scenario	LNG Export Capacity Scenarios	2015	2020	2025	2030	2035
High Shale EUR	International Reference	Low/Slowest	**0.18**	**1.10**	**2.01**	**2.19**	**2.19**
		Low/Slow	**0.37**	**2.19**	**2.19**	**2.19**	**2.19**
		Low/Rapid	**1.10**	**2.19**	**2.19**	**2.19**	**2.19**
		High/Slow	**0.37**	**2.19**	3.77	2.78	3.38
		High/Rapid	**1.10**	2.97	3.77	2.78	3.38
		No Constraint	2.23	2.97	3.77	2.78	3.38
	Demand Shock	Low/Slowest	**0.18**	**1.10**	**2.01**	**2.19**	**2.19**
		Low/Slow	**0.37**	**2.19**	**2.19**	**2.19**	**2.19**
		Low/Rapid	**1.10**	**2.19**	**2.19**	**2.19**	**2.19**
		High/Slow	**0.37**	**2.19**	**4.02**	**4.38**	**4.38**
		High/Rapid	**1.10**	3.94	**4.38**	**4.38**	**4.38**
		No Constraint	3.30	3.94	4.87	4.59	5.61
	Supply/ Demand Shock	Low/Slowest	**0.18**	**1.10**	**2.01**	**2.19**	**2.19**
		Low/Slow	**0.37**	**2.19**	**2.19**	**2.19**	**2.19**
		Low/Rapid	**1.10**	**2.19**	**2.19**	**2.19**	**2.19**
		High/Slow	**0.37**	**2.19**	**4.02**	**4.38**	**4.38**
		High/Rapid	**1.10**	**4.38**	**4.38**	**4.38**	**4.38**
		No Constraint	4.23	5.44	6.72	6.89	8.39

Analogous to Figure 22, Figure 23 shows LNG export levels for the U.S. High Shale EUR scenario and a combination of international and LNG export capacity scenarios. Under this highest level of U.S. natural gas supplies, it is cost-effective to export U.S. LNG with or without any international supply or demand shocks. In 2025, the LNG export capacity is binding in all but two cases: no international shock with either High/Slow or High/Rapid LNG export capacity limits. For all other scenarios, the export levels reflect the different U.S. LNG export capacity levels. The only exception is in the year 2020 for the High/Rapid scenario. Exports are even greater for the unconstrained cases with Demand Shocks and Supply/Demand Shocks.

The U.S. LNG export capacity limits become increasingly more binding as the international shocks lead to greater demand for U.S. LNG exports. Under the Supply/Demand shocks, the U.S. LNG export capacity limits bind in all years for the High Shale EUR case. By 2025, the capacity limits restrict between 2.3 and 4.5 Tcf of U.S. exports. Even with only a Demand shock, the U.S. LNG export capacity limits bind in all years for all limits except the High/Rapid case in 2020 in which U.S. LNG exports are only 0.4 Tcf below the U.S. LNG export capacity limit (Figure 21 and Figure 23) when the export capacity limit is 4.38 Tcf. Without any international shocks, the U.S. LNG export capacity limits bind in all years for the Low/Slowest, Low/Slow and Low/Rapid cases, and the U.S. LNG export capacity limits are non-binding for the High/Slow and High/Rapid cases after 2025.

3. Findings for the U.S. Low Shale EUR Scenario

Figure 24 shows all combinations of International scenarios and LNG export capacity scenarios in which the U.S. exports LNG for the U.S. Low Shale EUR scenario. With Low Shale EUR, U.S. supplies are more costly, and as a result, there are no U.S. LNG exports in either the International Reference or Demand Shock scenarios. For the Supply/Demand shock scenarios, U.S. LNG export capacity is binding only in some years in some cases.

Figure 24: U.S. LNG Export – Low Shale EUR (Tcf)

Bold numbers indicate that the U.S. LNG export limit is binding

U.S. Scenario	International Scenario	LNG Export Capacity Scenarios	2015	2020	2025	2030	2035
Low Shale EUR	Supply/ Demand Shock	Low/Slowest	0	0.78	0.90	0.27	0.52
		Low/Slow	0	0.78	0.90	0.27	0.52
		Low/Rapid	0	0.78	0.90	0.27	0.52
		High/Slow	0	0.78	0.90	0.27	0.52
		High/Rapid	0	0.78	0.90	0.27	0.52
		No Constraint	0	0.78	0.90	0.27	0.52

4. Netback Pricing and the Conditions for "Rents" or "Profits"

When LNG export capacity constrains exports, rents or profits are generated. These rents or profits are the difference in value between the netback and wellhead price. The netback price is the value of the LNG exports in the consuming market, less the costs incurred with transporting the natural gas from the wellhead to the consuming market. In the case of LNG, these costs consist of: pipeline transportation from the wellhead to the liquefaction plant, liquefaction costs, transportation costs by ship from the liquefaction plant to the regasification plant, regasification costs, and pipeline transportation from the regasification facility to the city gate.

The netback price can be either greater than or equal to the average wellhead price. It cannot be lower otherwise there would be no economic incentive to produce the natural gas. In cases where the U.S. LNG exports are below the LNG export capacity, the netback prices the U.S. receives for its exports equal the U.S. wellhead price. However, when the LNG export capacity binds so that LNG exports equal the LNG export capacity level, the U.S. market becomes disconnected from the world market, and the netback prices that the U.S. receives exceed its wellhead prices. In this event, the difference between the netback price and the wellhead price leads to a positive profit or rent.

5. LNG Exports: Relationship between Price and Volume

Figure 25 indicates the range of LNG exports and U.S. natural gas prices that were estimated across all 63 global scenarios, many of which had zero exports and therefore no price impacts.[16] Based on Figure 25, NERA selected 13 scenarios for detailed U.S. economic analysis. These 13 scenarios spanned the full range of potential impacts and provided discrete points within that range for discussion. In this section, we describe the analysis performed to select the 13 scenarios.

Because each of the 63 scenarios was characterized by both a U.S. and international dimension (as well as different U.S. LNG export capacity), shapes and colors were used to denote the different combinations:

- Shapes are used to differentiate among the different U.S. scenarios: U.S. Reference (diamond), High Shale EUR (triangle), and Low Shale EUR (square); and
- Colors are used to differentiate among the International cases: International Reference (red), Demand Shock (blue), and Supply/Demand Shock (yellow). In some instances, the same level of U.S. LNG exports and wellhead prices existed for multiple International cases. In these instances, the naturally combined color of the multiple cases is used (*e.g.*, a green symbol (combination of blue and yellow) if the Demand Shock and Supply/Demand Shock scenarios yield the same results.

Therefore, each point on Figure 25 conveys the U.S. and International scenarios, which may correspond to multiple LNG export capacity scenarios. For example, the northwest yellow square (0.9 Tcf of exports) corresponds to the High/Slow and High/Rapid LNG export capacity scenarios. In our detailed U.S. analysis, we only need to consider one of the multiple scenarios. Thus, we can greatly reduce the number of scenarios because Figure 25 suggests there are far fewer than 63 unique LNG export levels.

The yellow markers (scenarios that include the International Supply/Demand shock) yield the highest levels of LNG exports and U.S. natural gas prices and form the upper right hand boundary of impacts. The most northeast red, blue, and yellow markers for each shape represent the cases where LNG exports are unconstrained. For the scenarios where the LNG exports are below the export capacity limits, the marker represents multiple scenarios.

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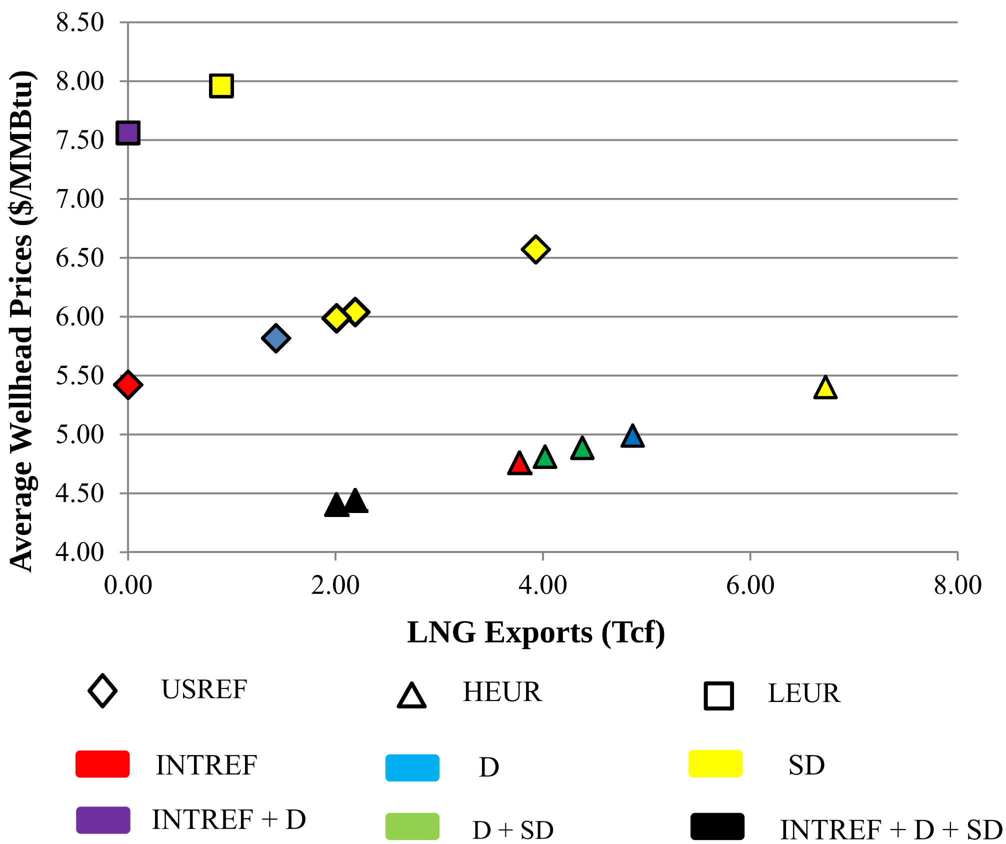
[16] In order to keep the discussion of macroeconomic impacts as concise as possible, this report does not discuss in detail all the scenarios that were run.

Figure 25: U.S. LNG Exports in 2025 Under Different Assumptions
(Note each point can correspond to multiple LNG export capacity scenarios.)



BCF/day = 2.74 * Tcf/Year

The triangles (scenarios that include the High EUR) form a line moving up and to the right, which essentially traces out the U.S. supply curve for LNG under the High EUR scenario. These scenarios combine the lowest U.S. natural gas prices with the highest levels of exports, as would be expected. With High EUR assumptions, U.S. natural gas supply can be increased at relatively low cost enabling larger levels of exports to be economic. For the detailed U.S. economic analysis, we used the High EUR cases to provide the high end of the range for U.S. LNG exports. Since the results are nearly identical between the Demand Shock and Supply and Demand Shock scenarios, we included the five export capacity scenarios under the Supply and Demand Shock because they yielded slightly higher exports.

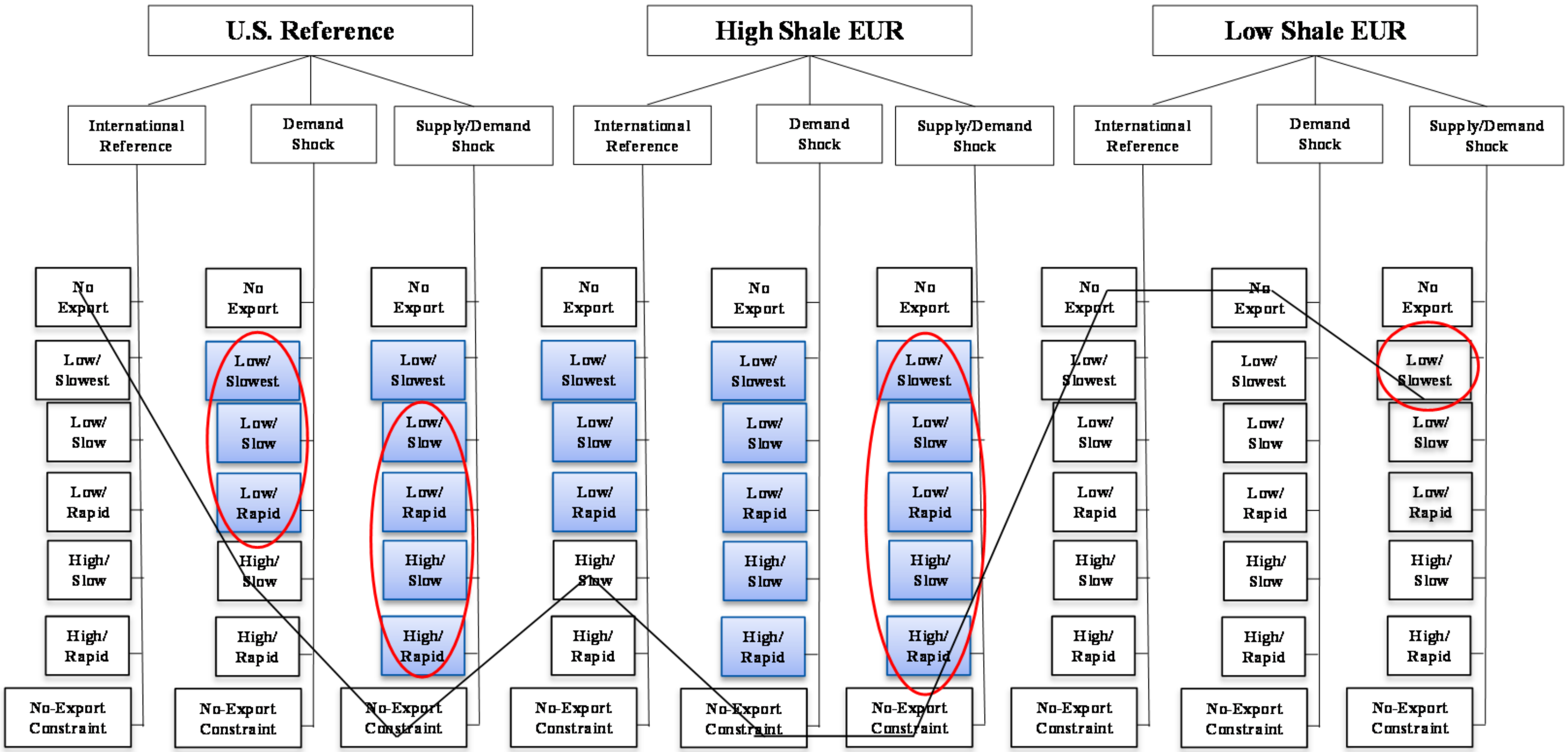
The supply curve traced out by the scenarios that include U.S. Reference case (represented by diamonds) are higher than in the High EUR cases because domestic gas is less plentiful. When only a Demand shock exists, the LNG export capacity limits are non-binding so the level of exports (the lone blue diamond) is the same for all six LNG export capacity scenarios under the U.S. Reference case. Raising the limits on LNG exports in the presence of the International

Demand Shock and Supply/Demand Shock, however, causes actual exports to increase and satisfy more of the higher world demand as exhibited by the series of yellow diamonds that move along a northeast line. In the U.S. Reference case, there are zero exports under International Reference assumptions as represented by the red diamond.

A line joining the squares in Figure 25 traces out the 2025 supply curve for the Low EUR case. The trajectory of the wellhead prices is the highest compared to other cases because of the high underlying baseline wellhead prices. Under the Low EUR baseline, the U.S. wellhead price is $7.56/Mcf in 2025, so that only with International Supply and Demand shocks is there sufficient global demand to bring about positive LNG exports at a price at least as high as the LEUR baseline. The combination of Low EUR and an international supply and demand shock leads to a combination of higher U.S. natural gas prices and lower exports than in the corresponding High EUR or U.S. Reference scenarios. Since exports are similar in the LEUR scenarios in which they exist, we only considered the most binding case (Low EUR with Supply/Demand Shock under the Low/Slowest LNG export capacity), in the detailed U.S. economic analysis. This scenario provides the low end of the export range.

F. Findings and Scenarios Chosen for N_{ew}ERA Model

Figure 26: Scenario Tree with Maximum Feasible Export Levels Highlighted in Blue and N_{ew}Era Scenarios Circled



The first use we made of the GNGM was to determine the level of exports in each of these scenarios that would be accepted by the world market at a price high enough to buy gas at the prevailing wellhead price in the United States, transport it to a liquefaction facility, and liquefy and load it onto a tanker. In some of the above cases, we found that there were no LNG exports because LNG exports would not be profitable. In many cases, we found that the amount of LNG exports that met this profitability test was below the LNG export capacity level assumed in that case. In others, we found that the assumed limit on exports would be binding. In a few cases, we found that the market if allowed would accept more than any of the export limits.

In Figure 26 under the U.S. Reference assumptions as well as in the International Reference case, we found that there would be no export volumes that could be sold profitably into the world market. In the case that combined High Shale EUR and International Reference, it was possible to achieve the Low/Rapid level of exports. After 2010, the exports approach the level of the High/Rapid constraint but never exceed it.

The line in Figure 26 designates the cases in which we observed the maximum level of exports for that combination of U.S. and International assumptions. Export levels and U.S. prices in any case falling below the line were identical to the case identified by the line. Thus, looking down the column for U.S. High EUR supply conditions combined with International Supply/Demand, we found that LNG exports and U.S. wellhead prices were the same with the High/Rapid export limits as with the more constraining High/Slow limits. We therefore did not analyze further any scenarios that fell below the line in Figure 26 and used the No-Export capacity cases to provide a benchmark to which the impacts of increased levels of exports could be compared.

Based on the results of these scenarios, we pared down the scenarios to analyze in the N_{ew}ERA macroeconomic model. Taking into account the possible world natural gas market dynamics, the GNGM model results suggest 21 scenarios in which there were some levels of LNG exports from the U.S. These scenarios were further reduced to 13 scenarios by taking the minimum level of exports across international outlooks. This was done because N_{ew}ERA model does not differentiate various international outlooks. For N_{ew}ERA, the critical issue is the level of U.S. LNG exports and U.S. natural gas production. Of the 13 N_{ew}ERA scenarios (circled in Figure 26), 7 scenarios reflected the U.S. Reference case, 5 reflected the High Shale EUR case with full U.S. LNG export capacity utilization and 1 from the Low EUR case with the lowest export expansion.

VI. U.S. ECONOMIC IMPACTS FROM N$_{EW}$ERA

A. Organization of the Findings

There are many factors that influence the amount of LNG exports from the U.S. into the world markets. These factors include supply and demand conditions in the world markets and the availability of shale gas in the U.S. The GNGM analysis, discussed in the previous section, found 13 export volume cases under different world gas market dynamics and U.S. natural gas resource outlooks. These cases are implemented as 13 N$_{ew}$Era scenarios[17] and are grouped as:

- Low/Slow and Low/Rapid DOE/FE export expansion volumes for the Reference natural gas resource outlook referred to as USREF_SD_LS and USREF_SD_LR;

- Low/Slow, Low/Rapid, High/Slow, High/Rapid and Low/Slowest GNGM export expansion volumes for the Reference natural gas resource outlook referred to as USREF_D_LS, USREF_D_LR, USREF_SD_HS, USREF_SD_HR and USREF_D_LSS;

- Low/Slow, Low/Rapid, High/Slow, High/Rapid and Low/Slowest DOE/FE export expansion volumes for the High Shale EUR natural gas resource outlook referred to as HEUR_SD_LS, HEUR_SD_LR, HEUR_SD_HS, HEUR_SD_HR and HEUR_SD_LSS; and

- Low/Slowest GNGM export expansion volumes for the Low Shale EUR natural gas resource outlook referred to as LEUR_SD_LSS

The Reference natural gas outlook scenarios were run against its No-Export volume baseline consistent with AEO 2011 Reference case (Bau_REF). Similarly, the High Shale EUR and Low Shale EUR scenarios were run against its No-Export volume baseline consistent with AEO 2011 High Shale EUR (Bau_HEUR) and AEO 2011 Low Shale EUR (Bau_LEUR) respectively.

This section discusses the impacts on the U.S. natural gas markets and the overall macroeconomic impacts for these 13 scenarios. The impacts are a result of implementing the export expansion scenarios against a baseline without any LNG exports. The economic benefits of the scenarios, as measured by different economic measures, are cross compared. We used economic measures such as welfare, aggregate consumption, disposable income, GDP, and loss of wage income to estimate the impact of the scenarios. The scenario results provide a range of outcomes that capture key sources of uncertainties in the international and the U.S. natural gas markets.

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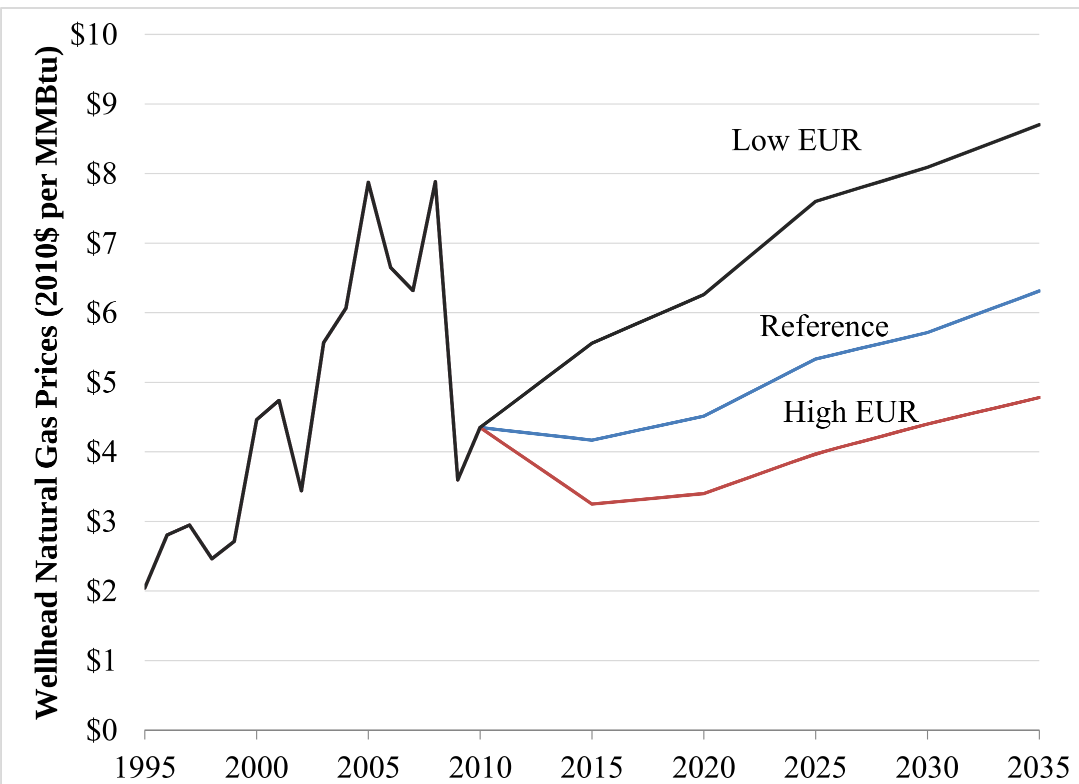
[17] NERA also ran 3 cases in which the LNG export capacity was assumed to be unlimited.

B. Natural Gas Market Impacts

1. Price, Production, and Demand

The wellhead natural gas price increases steadily in all three of the baseline cases (REF, High EUR and Low EUR). Under the REF case the wellhead price increases from $4.40/MMBtu in 2010 to $6.30/MMBtu while under the High EUR and the Low EUR cases the price increases to about $4.80/MMBtu (a 10% increase from the 2010 price) and $8.70/MMBtu (a 100% increase from 2010), respectively. Comparing the projected natural gas price under the three baseline cases with historical natural gas prices, we see that the prices exceed recent historical highs only under the Low EUR case beyond 2030 (see Figure 27). The natural gas price path and its response in the scenarios with LNG exports will depend on the availability and accessibility of natural gas resources. Additionally, the price changes will be influenced by the expansion rate of LNG exports. The lower level of supply under the Low EUR case results in a higher projected natural gas price while the High EUR case, with abundant shale gas, results in a lower projected natural gas price path.

Figure 27: Historical and Projected Wellhead Natural Gas Price Paths



Source: Energy Information Agency (EIA)

The extent of the natural gas price response to an expansion of LNG exports depends upon the supply and demand conditions and the corresponding baseline price. For a given baseline, the higher the level of LNG exports the greater the change in natural gas price. Similarly, the natural gas price rises much faster under a scenario that has a quicker rate of expansion of LNG exports.

From Figure 28 we can see that under the Low/Rapid expansion scenario, USREF_SD_LR, the price rises by 7.7% in 2015 while under the Low/Slow expansion scenario, USREF_SD_LS, the price rises by only 2.4% in 2015. The demand for LNG exports in the Low/Rapid scenario (1.1 Tcf) is much greater than in the Low/Slow scenarios (0.37 Tcf); hence, the pressure on the natural gas price in the Low/Rapid scenario is higher. However, post-2015 LNG export volumes are the same in both scenarios, thus leading to the same level of increase in the wellhead price. The wellhead price rises 14% by 2020 relative to the baseline and then tapers off to a 6.4% increase by 2035 under both scenarios.

For the same Reference case baseline, Bau_Ref, the wellhead natural gas price varies by export level scenarios. The NERA High/Rapid export scenario (USREF_SD_HR) leads to the largest price increases of about 20% in 2020 ($0.90/Mcf) and 14% in 2035 ($0.90/Mcf) relative to the Reference baseline. The increase in the wellhead price is the smallest for the NERA low export scenarios (USREF_D_LS, USREF_D_LR and USREF_D_LSS). The Low/Slowest export scenario, USREF_D_LSS, has a 2015 increase of about 1% ($0.05/Mcf) and a 2035 price increase of about 4% ($0.25/Mcf).

The price increase for the High EUR scenarios is similar to the increases in the EIA Study since the export volumes are the same.[18] The largest increase in price takes place under the High/Rapid scenario in 2020 (32% relative to the High EUR baseline). However, as quickly as the price rises in 2020 it only increases by 21% in 2025 and 13% in 2025 relative to the High EUR baseline.[19] To put the percentage change in context, Figure 29 shows the level value changes relative to the corresponding baseline. Given the lower baseline price under the High EUR case, the absolute increase in the natural gas prices is smaller under the High EUR scenarios than the Reference case scenarios. The price increase under the Low EUR scenario with the slowest export volume is only a 6% increase in price relative to the baseline, or about $0.40/Mcf.

A higher natural gas price in the scenarios has three primary impacts on the overall economy. First, it tends to increase the cost of producing goods and services that are dependent on natural gas, which leads to decreasing economic output. Second, the higher price of natural gas leads to an increase in export revenues, which improves the balance of payment position. Third, it provides wealth transfer in the form of take-or-pay tolling charges that support the income of the consumers. The overall macroeconomic impacts depend on the magnitudes of these three effects as discussed in the next section.

[18] See Appendix D for comparison of natural gas prices.

[19] Since the results are shown for three baselines with three different prices, comparing percentage changes across these baseline cases can be misleading since they do not correspond to the same level value changes. In general, when comparing scenarios between Reference and High EUR cases, the level change would be smaller under the High EUR case for the same percentage increase in price.

Figure 28: Wellhead Natural Gas Price and Percentage Change for NERA Core Scenarios

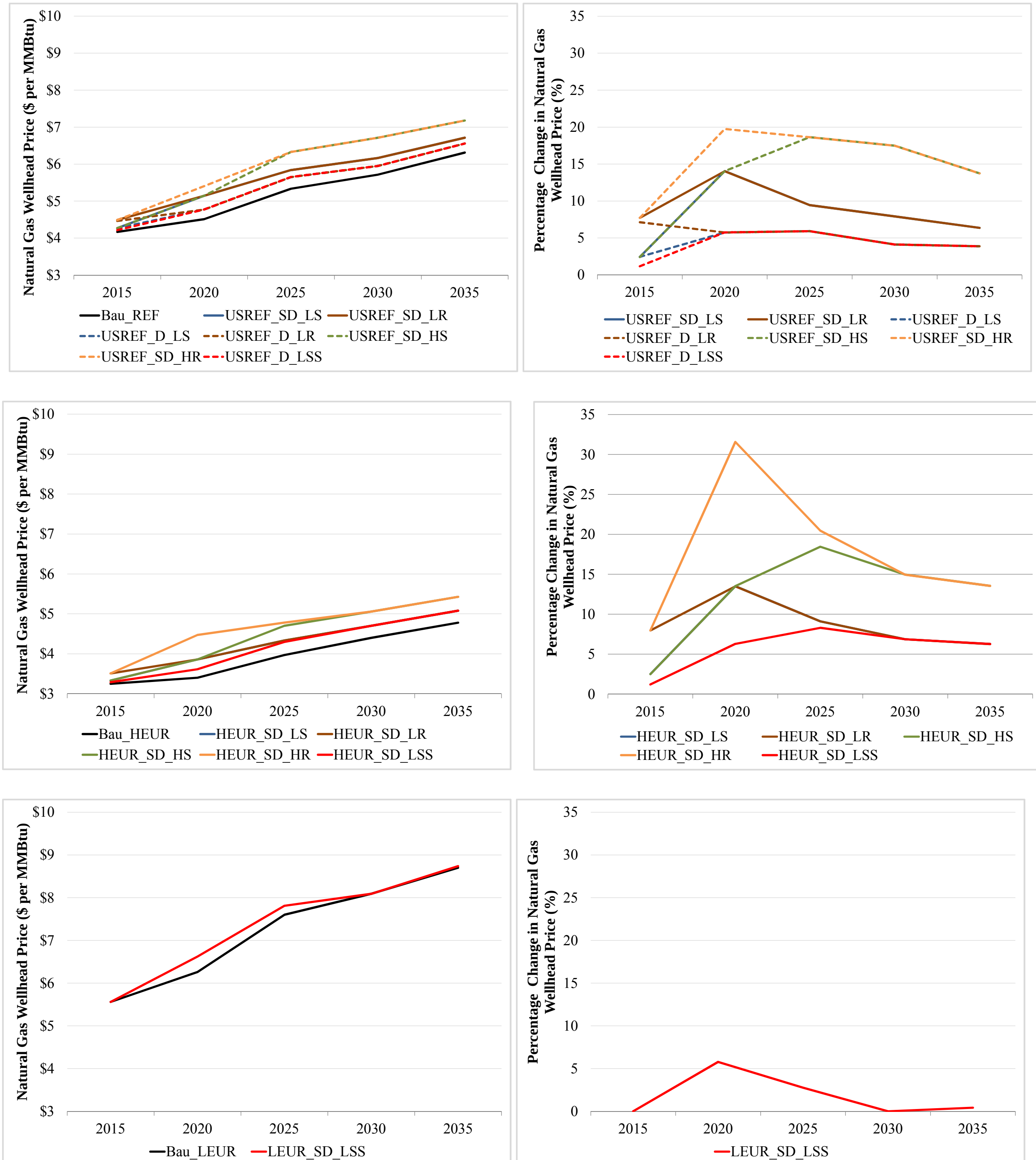


Figure 29: Change in Natural Gas Price Relative to the Corresponding Baseline of Zero LNG Exports (2010$/Mcf)

	2015	2020	2025	2030	2035
USREF_SD_LR	$0.33	$0.65	$0.52	$0.47	$0.41
USREF_SD_LS	$0.10	$0.65	$0.52	$0.47	$0.41
USREF_SD_HR	$0.33	$0.92	$1.02	$1.03	$0.89
USREF_SD_HS	$0.10	$0.65	$1.02	$1.03	$0.89
USREF_D_LR	$0.31	$0.27	$0.33	$0.24	$0.25
USREF_D_LS	$0.10	$0.27	$0.33	$0.24	$0.25
USREF_D_LSS	$0.05	$0.27	$0.33	$0.24	$0.25
HEUR_SD_HR	$0.27	$1.11	$0.84	$0.68	$0.67
HEUR_SD_HS	$0.08	$0.47	$0.75	$0.68	$0.67
HEUR_SD_LR	$0.27	$0.47	$0.37	$0.31	$0.31
HEUR_SD_LS	$0.08	$0.47	$0.37	$0.31	$0.31
HEUR_SD_LSS	$0.04	$0.22	$0.34	$0.31	$0.31
LEUR_SD_LSS	$0.00	$0.37	$0.22	$0.00	$0.04

Natural gas production increases under all three baseline cases to partially support the rise in export volumes in all of the scenarios. In the Reference case, the high scenarios (USREF_SD_HS and USREF_SD_HR) have production steadily increasing by about 10% in 2035 with production in the High/Slow scenario rising at a slower pace than in the High/Rapid scenario. In the low scenarios (USREF_SD_LS and USREF_SD_LR) and the slowest scenario (USREF_D_LSS), the production increases by about 5% and 3% in 2035, respectively (see the first two panels in Figure 30). The rise in production under the High EUR case scenarios is smaller than the corresponding Reference case scenarios.

The response in natural gas production depends upon the nature of the supply curve. Production is much more constrained in the short run as a result of drilling needs and other limitations. In the long run, gas producers are able to overcome these constraints. Hence there is more production response in the long run than in the short run.[20] Figure 30 shows that in 2015 the increase in production accounts for about 30% to 40% of the export volume, while in 2035 due to gas producers overcoming production constraints, the share of the increase in production in export volumes increases to about 60%.

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[20] In the short run, the natural gas supply curve is much more inelastic than in the long run.

Figure 30: Natural Gas Production and Percentage Change for NERA Core Scenarios

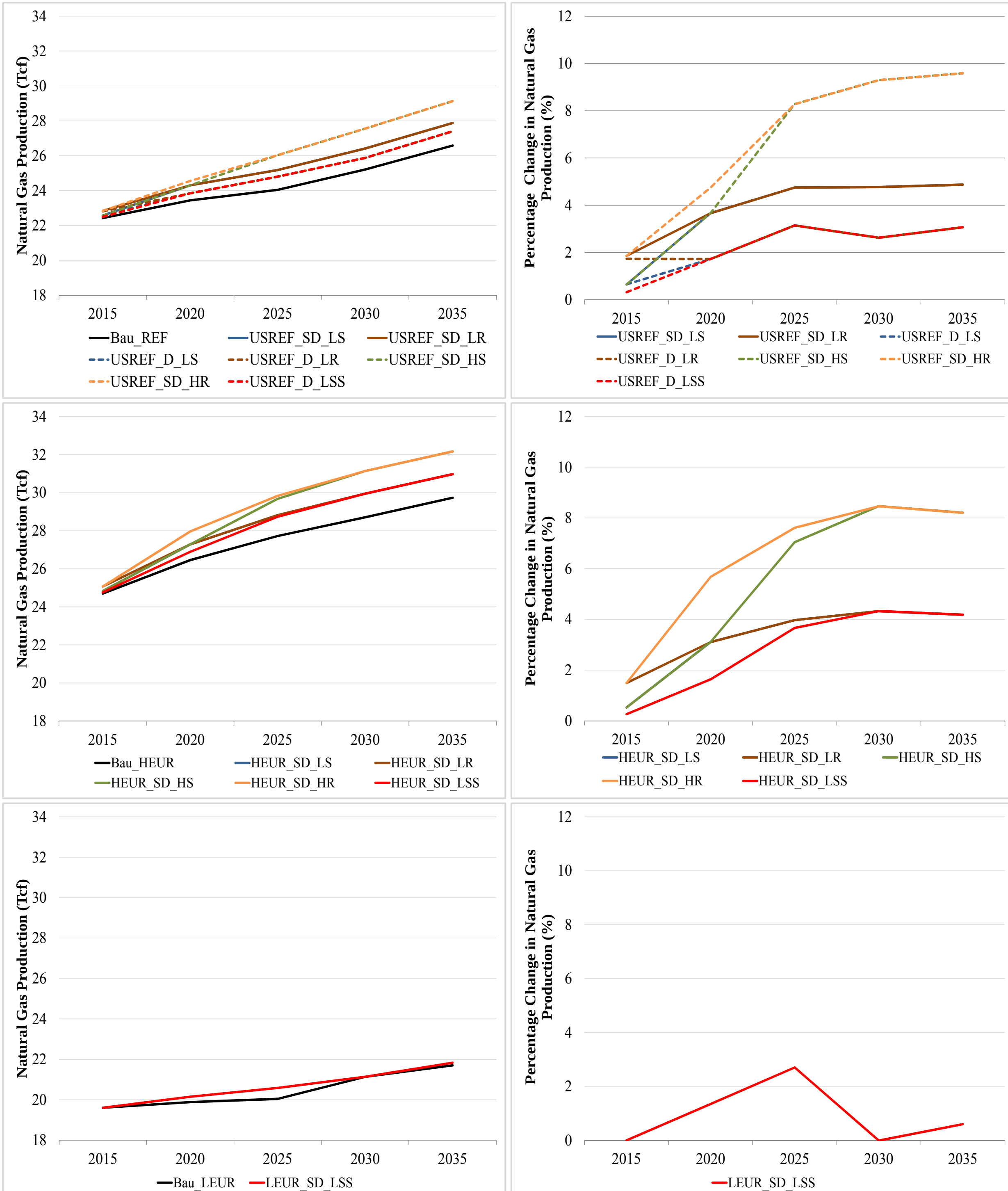


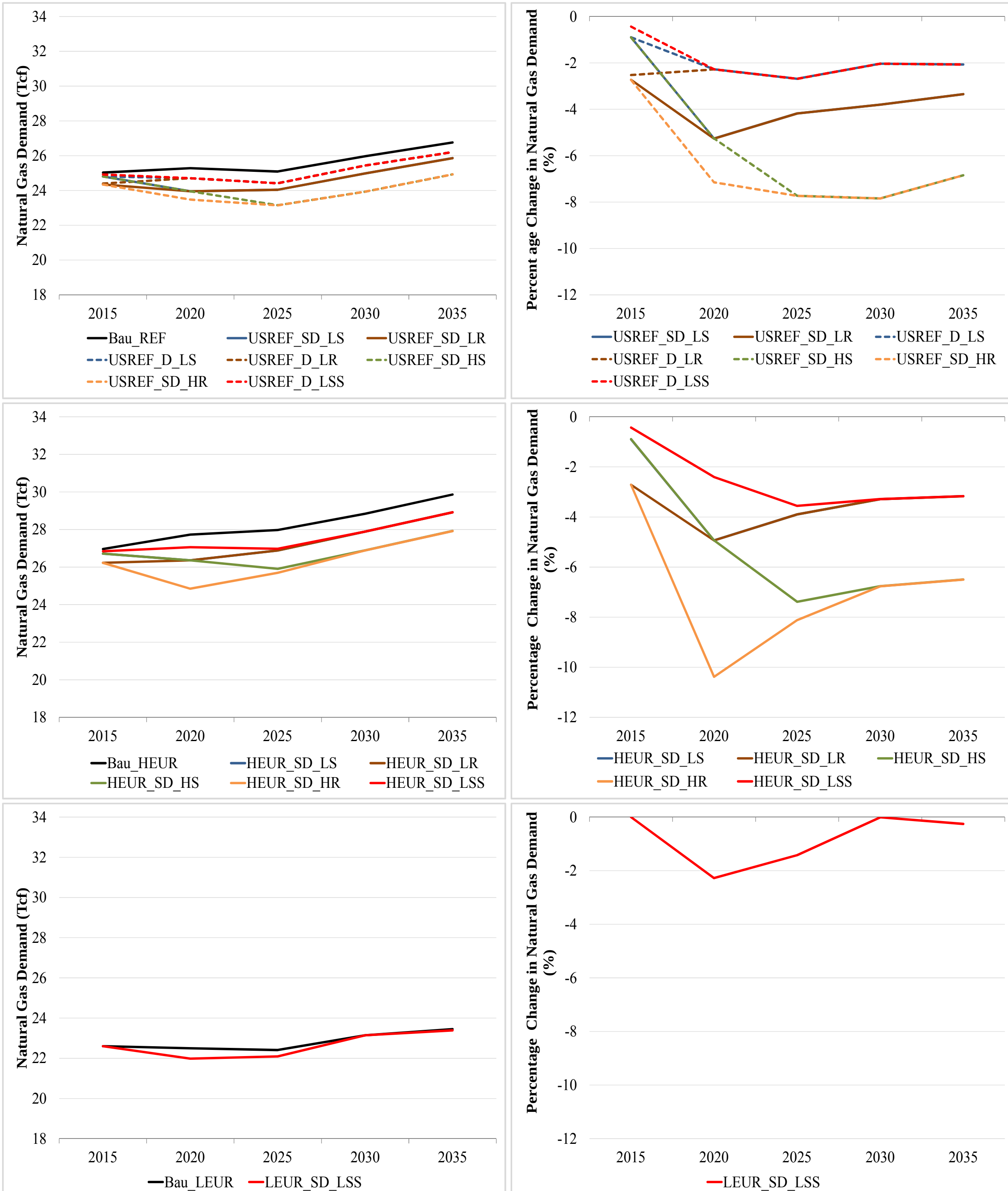
Figure 31: Change in Natural Gas Production Relative to the Corresponding Baseline (Tcf)

Scenario	Increase in Production (Tcf)					Ratio of Increase in Production to Export Volumes				
	2015	2020	2025	2030	2035	2015	2020	2025	2030	2035
USREF_SD_LR	0.42	0.86	1.14	1.20	1.29	38%	39%	52%	55%	59%
USREF_SD_LS	0.15	0.86	1.14	1.20	1.29	39%	39%	52%	55%	59%
USREF_SD_HR	0.42	1.11	1.99	2.34	2.55	38%	38%	51%	53%	58%
USREF_SD_HS	0.14	0.86	1.99	2.34	2.55	39%	39%	51%	54%	58%
USREF_D_LR	0.39	0.40	0.76	0.66	0.82	35%	41%	53%	56%	60%
USREF_D_LS	0.15	0.40	0.76	0.66	0.82	39%	41%	53%	56%	37%
USREF_D_LSS	0.07	0.40	0.76	0.66	0.82	40%	41%	53%	56%	60%
HEUR_SD_HR	0.37	1.50	2.11	2.43	2.44	34%	34%	48%	55%	56%
HEUR_SD_HS	0.13	0.82	1.95	2.43	2.44	35%	38%	49%	55%	56%
HEUR_SD_LR	0.37	0.82	1.10	1.24	1.24	34%	37%	50%	57%	57%
HEUR_SD_LS	0.13	0.82	1.10	1.24	1.24	35%	38%	50%	57%	57%
HEUR_SD_LSS	0.06	0.43	1.02	1.24	1.24	35%	39%	51%	57%	57%
LEUR_SD_LSS	0.00	0.27	0.54	0.00	0.13	0%	34%	63%	0%	69%

The increase in natural gas price has three main impacts on the production of goods and services that primarily depend upon natural gas as a fuel. First, the production processes would switch to fuels that are relatively cheaper. Second, the increase in fuel costs would result in a reduction in overall output. Lastly, the price increase would induce new technology that could more efficiently use natural gas. All of these impacts would reduce the demand for natural gas. The extent of this demand response depends on the ease of substituting away from natural gas in the production of goods and services. Pipeline imports into the U.S. are assumed to remain unchanged between scenarios within a given baseline case. Pipeline imports for the Reference, High EUR, and Low EUR cases are calibrated to the EIA's AEO 2011 projections. Figure 32 shows the natural gas demand changes for all cases and scenarios. The largest drop in natural gas demand occurs in 2020 when the natural gas price increases the most.

In the Reference and High EUR cases, the high scenarios are projected to have the largest demand response because overall prices are the highest. The largest drop in natural gas demand in 2020 for the Reference, High EUR, and Low EUR is about 8%, 10%, and 2%, respectively. In the long run (2035), natural gas demand drops by about 5% for the Reference and the High EUR cases while there is no response in demand under the Low EUR case. In general, the largest drop in natural gas demand corresponds to the year and scenario in which the price increase is the largest. For the High/Rapid scenario under the High EUR case, the largest drop occurs in 2020. Given that the implied price elasticity of demand is similar across all cases, the long-run demand impacts across cases tend to converge for the corresponding scenarios. Figure 32 shows the demand for all scenarios.

Figure 32: Natural Gas Demand and Percent Change for NERA Core Scenarios



C. Macroeconomic Impacts

1. Welfare

Expansion of natural gas exports changes the price of goods and services purchased by U.S. consumers. In addition, it also alters the income level of the consumers through increased wealth transfers in the form of tolling charges on LNG exports. These economic effects change the well-being of consumers as measured by equivalent variation in income. The equivalent variation measures the monetary impact that is equivalent to the change in consumers' utility from the price changes and provides an accurate measure of the impacts of a policy on consumers.[21]

We report the change in welfare relative to the baseline in Figure 33 for all the scenarios. A positive change in welfare means that the policy improves welfare from the perspective of the consumer. All export scenarios are welfare-improving for U.S. consumers. The welfare improvement is the largest under the high export scenarios even though the price impacts are also the largest. Under these export scenarios, the U.S. consumers[22] receive additional income from two sources. First, the LNG exports provide additional export revenues, and second, consumers who are owners of the liquefaction plants, receive take-or-pay tolling charges for the amount of LNG exports. These additional sources of income for U.S. consumers outweigh the loss associated with higher energy prices. Consequently, consumers, in aggregate, are better off as a result of opening up LNG exports.

Comparing welfare results across the scenarios, the change in welfare of the low export volume scenarios for the High EUR case is about half that of the corresponding scenarios for the Reference case (see Figure 33). The welfare impacts under the Reference case scenarios are higher than for corresponding High EUR case scenarios. Under the High EUR case, the wellhead price is much lower than the Reference case and therefore results in lower welfare impacts. Similarly in both the Reference and High EUR cases, the high export volume scenarios have much larger welfare impacts than the lower export volume scenarios. Again, the amount of wealth transfer under high export volume scenarios drives the higher welfare impacts. In fact, the U.S. consumers are better off in all of the export volume scenarios that were analyzed.

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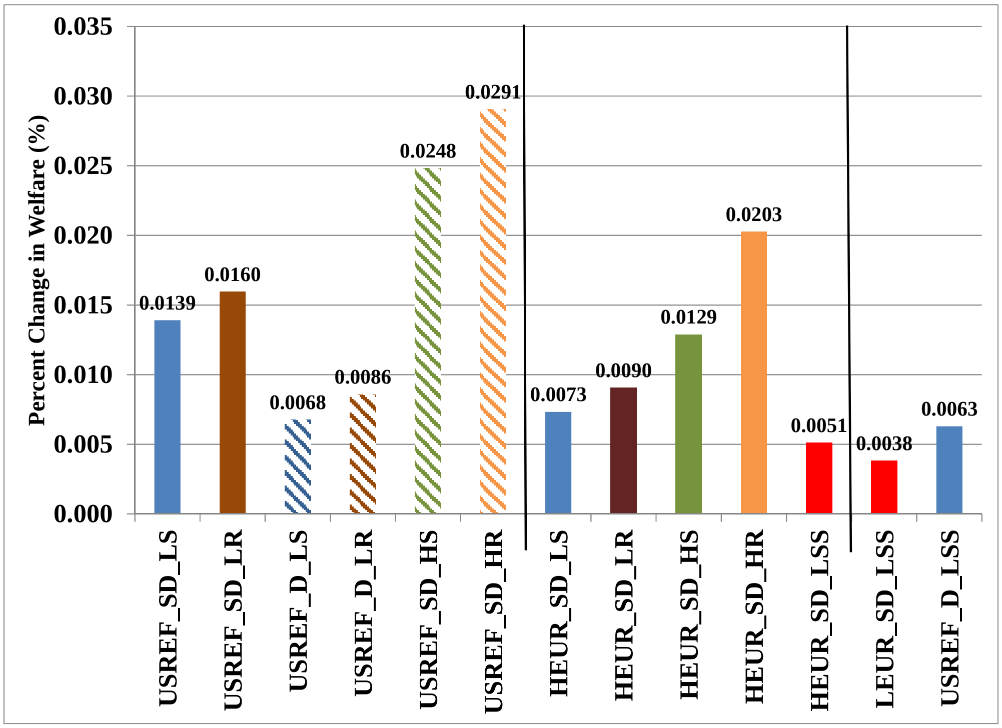
[21] *Intermediate Microeconomics: A Modern Approach*, Hal Varian, 7th Edition (December 2005), W.W. Norton & Company, pp. 255-256. "Another way to measure the impact of a price change in monetary terms is to ask how much money would have to be taken away from the consumer *before* the price change to leave him as well off as he would be *after* the price change. This is called the **equivalent variation** in income since it is the income change that is equivalent to the price change in terms of the change in utility." (emphasis in original).

[22] Consumers own all production processes and industries by virtue of owning stock in them.

Figure 33: Percentage Change in Welfare for NERA Core Scenarios[23]



2. GDP

GDP is another economic metric that is often used to evaluate the effectiveness of a policy by measuring the level of total economic activity in the economy. In the short run, the GDP impacts are positive as the economy benefits from investment in the liquefaction process, export revenues, resource income, and additional wealth transfer in the form of tolling charges. In the long run, GDP impacts are smaller but remain positive because of higher resource income.

A higher natural gas price does lead to higher energy costs and impacts industries that use natural gas extensively. However, the effects of higher price do not offset the positive impacts from wealth transfers and result in higher GDP over the model horizon in all scenarios. In the high scenarios and especially in periods with high natural gas prices, the export revenue stream increases while increasing the natural gas resource income as well. These effects combined with wealth transfer lead to the largest positive impacts on the GDP. In all scenarios, the impact on GDP is the largest in 2020 then drops as the export volumes stabilize. In a subsequent section, we discuss changes in different sources of household income.

Under the Reference case, the change in GDP in 2015 is between 0.01% for the Low/Slowest scenario to 0.05% in the High/Rapid scenario. The increase in GDP in the High EUR case is as large as 0.26% because resource income and LNG exports are the greatest. Overall, GDP

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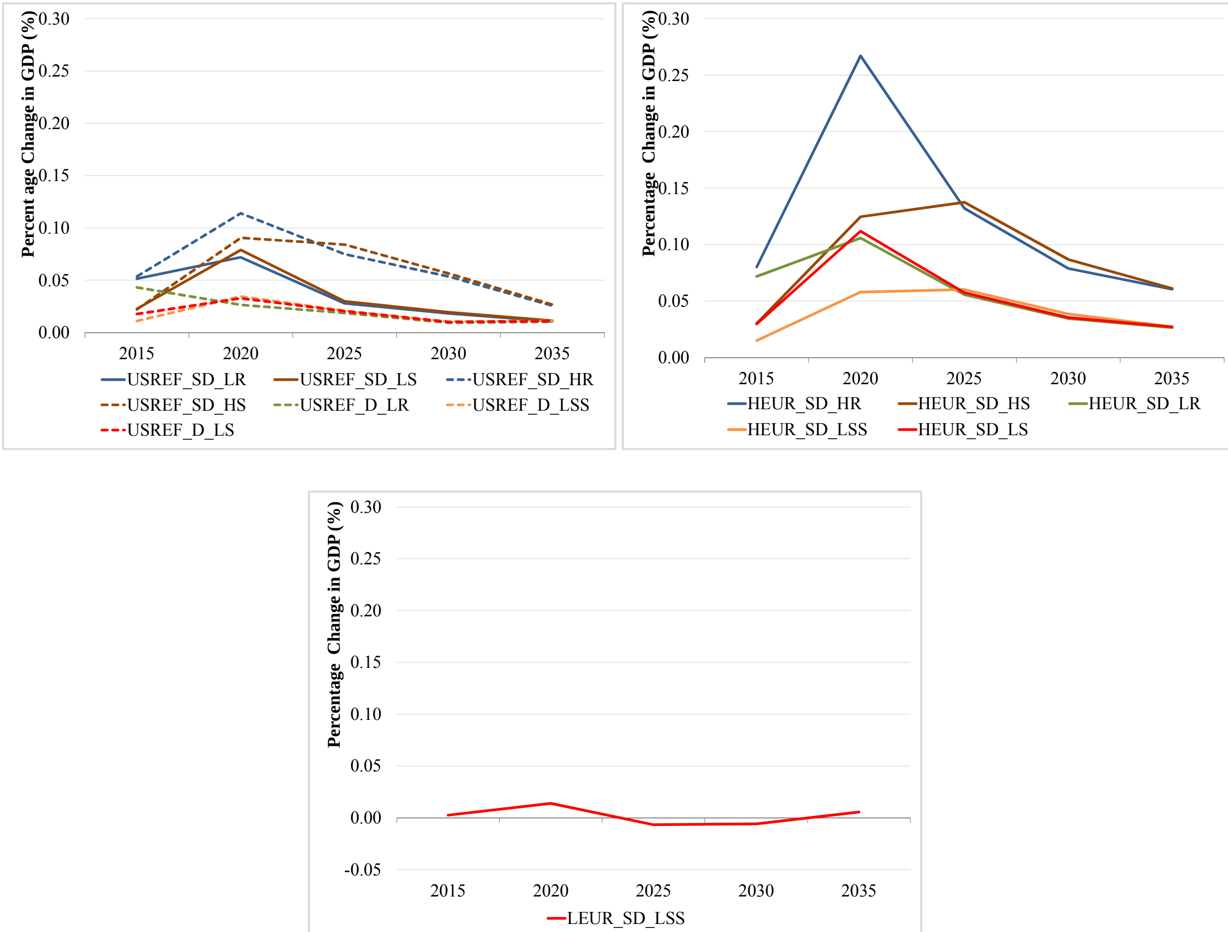
23 Welfare is calculated as a single number that represents in present value terms the amount that households are made better (worse) off over the entire time horizon from 2015 to 2035.

impacts are positive for all scenarios with higher impact in the short run and minimum impact in the long run.

Figure 34: Percentage Change in GDP for NERA Core Scenarios

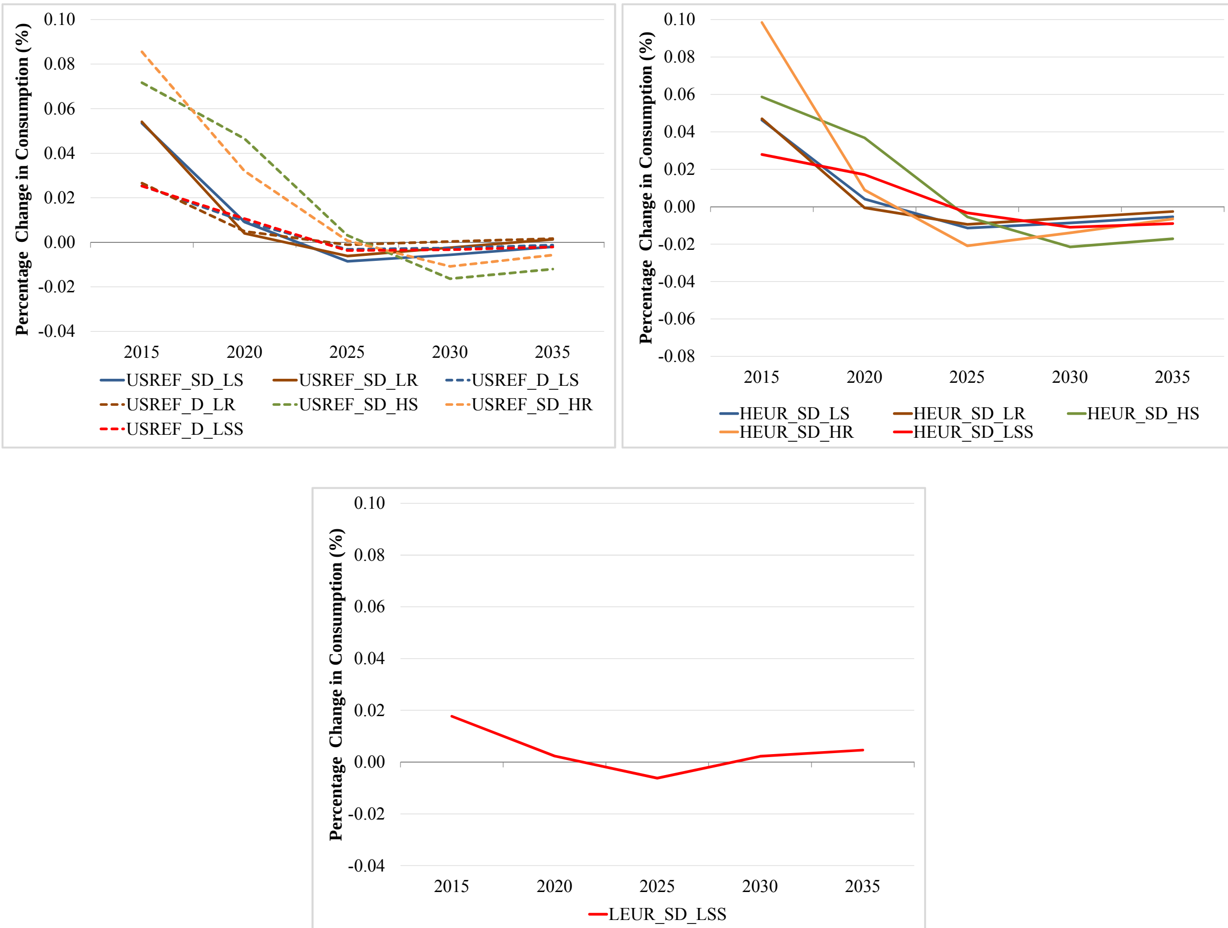


3. Aggregate Consumption

Aggregate consumption measures the total spending on goods and services in the economy. In 2015, consumption increases from the No-Export case between 0.02% for the low scenarios to 0.8% for the high scenarios. Consumption impacts for the High EUR scenarios also show similar impacts (Figure 35). Under the High/Rapid scenarios, the increase in consumption in 2015 is much greater (0.10%) because higher export volumes result in leading to much larger export revenue impacts. By 2035, consumption decreases by less than 0.02%.

Higher aggregate spending or consumption resulting from a policy suggests higher economic activity and more purchasing power for the consumers. The scenario results of the Reference case, seen in Figure 35, show that the consumption increases or remains unchanged until 2025 for almost all of the scenarios. These results suggest that the wealth transfer from exports of LNG provides net positive income for the consumers to spend after taking into account potential decreases in capital and wage income from reduced output.

Figure 35: Percentage Change in Consumption for NERA Core Scenarios



4. Aggregate Investment

Investment in the economy occurs to replace old capital and augment new capital formation. In this study, additional investment also takes place to convert current regasification plants to liquefaction plants and/or build new green-field liquefaction plants. The investment that is necessary to support the expansion of LNG exports is largest in 2015.[24] The investment outlay under each of the LNG export expansion scenarios is discussed in Appendix C. In 2015 and 2020, investment increases to support higher consumption (and production) of goods and services and investment in the liquefaction plants. As seen in Figure 36, investment increases for all scenarios, except for the Low/Rapid scenarios. Investment in 2015 could increase by as much as 0.10%. As the price of natural gas increases, the economy demands or produces fewer goods and services. This results in lower wages and capital income for consumers. Hence, under such economic conditions, consumers save less of their income for investment. The investment drop is the largest under the High EUR case for the High/Rapid scenario (-0.2%) where industrial

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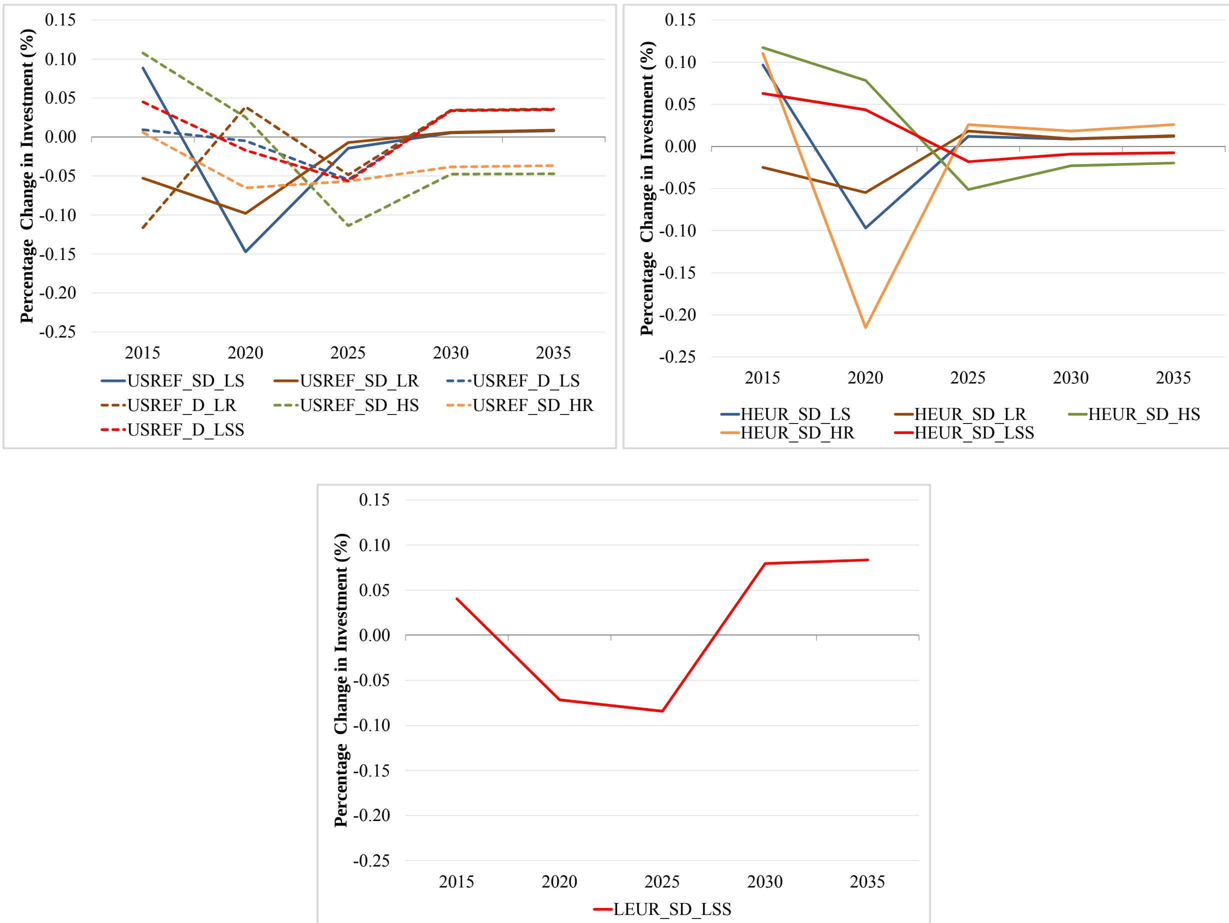
[24] Each model year represents a span of five years, thus the investment in 2015 represents an average annual investment between 2015 and 2019.

decline is the largest because of the increases in energy prices in general and the natural gas price in particular. As with consumption, the results for the low scenarios under the Reference and High EUR cases (with the same level of LNG exports) show similar investment changes. The range of change in investment over the long run (2030 through 2035) for all scenarios is between -0.05% and 0.08%.

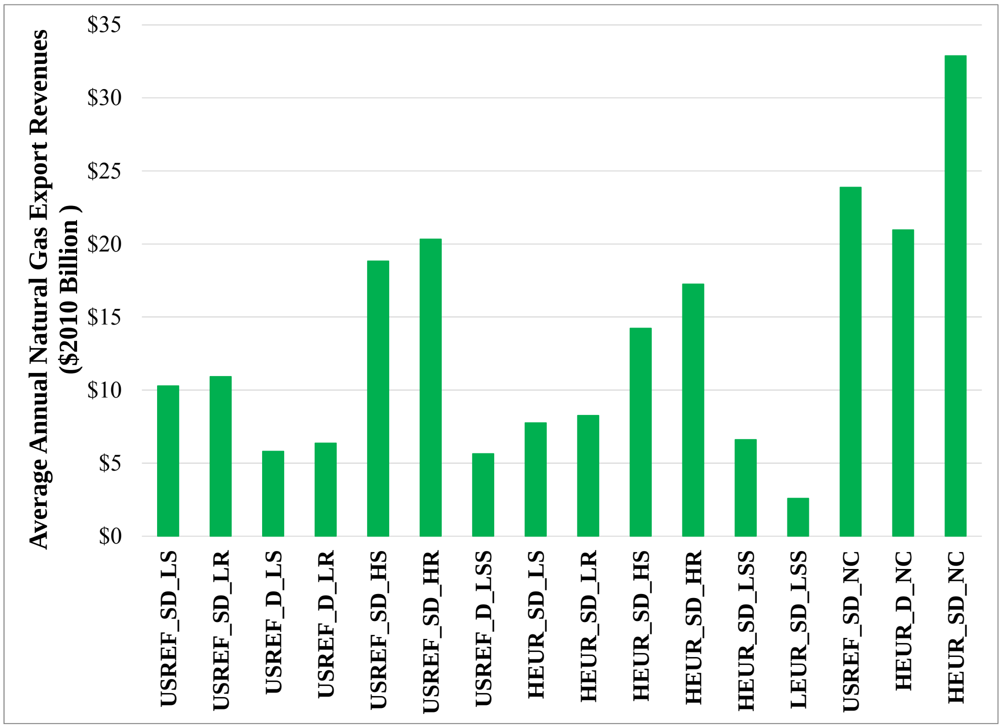
Figure 36: Percentage Change in Investment for NERA Core Scenarios



5. Natural Gas Export Revenues

As a result of higher levels of natural gas exports and increased natural gas prices, LNG export revenues offer an additional source of income. Depending on the baseline case and scenario used, the average annual increase in revenues from LNG exports ranges from about $2.6 billion (2010$) to almost $32.9 billion (2010$) as seen in Figure 37. Unsurprisingly, the high end of this range is from the unconstrained scenario, while the low end is the Low/Slowest scenario. The average revenue increase in all of the high scenarios for each baseline is roughly double the increase in the low scenarios. The difference in revenue increases between comparable rapid and slow scenarios is about 6% to 20%, with the low scenarios showing a smaller difference between their rapid and slow counterparts than the high scenarios.

Figure 37: Average Annual Increase in Natural Gas Export Revenues

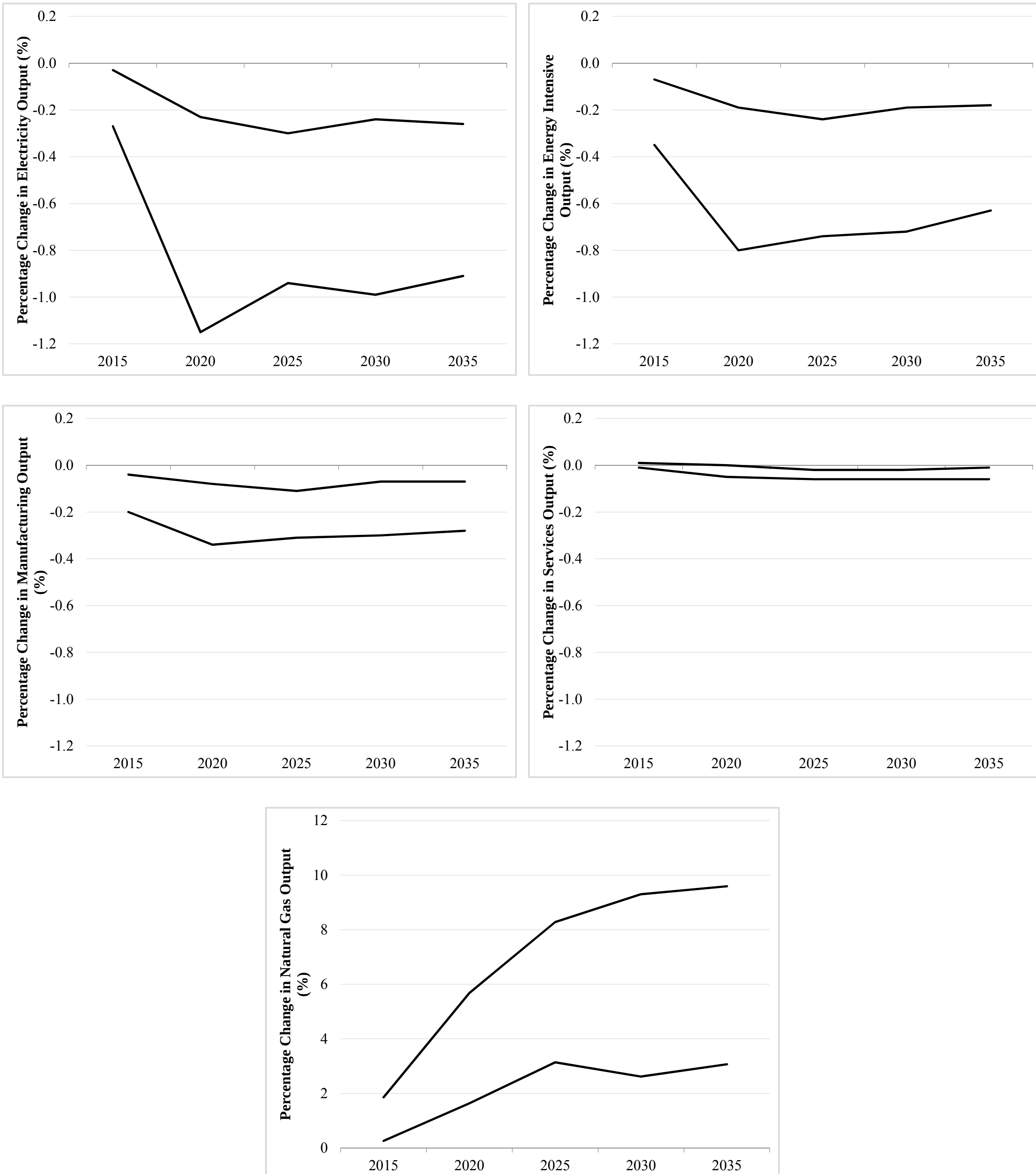


6. Range of Sectoral Output Changes for Some Key Economic Sectors

Changes in natural gas prices have real effects throughout the economy. Economic sectors such as the electricity sector, energy-intensive sectors ("EIS"), the manufacturing sector, and the services sector are dependent on natural gas as a fuel and are therefore vulnerable to natural gas price increases. These particular sectors will be disproportionately impacted leading to lower output. In contrast, natural gas producers and sellers will benefit from higher natural gas prices and output. These varying impacts will shift income patterns between economic sectors. The overall effect on the economy depends on the degree to which the economy adjusts by fuel switching, introducing new technologies, or mitigating costs by compensating parties that are disproportionately impacted.

Figure 38 illustrates the minimum and maximum range of changes in some economic sectors. The range of impacts on sectoral output varies considerably by sector. The electricity and EIS sectoral output changes are the largest across all scenarios. Maximum losses in electricity sector output could be between 0.2% and 1%, when compared across all scenarios while the decline in output of EIS could be between 0.2% and 0.8%. The manufacturing sector, being a modest consumer of natural gas, sees a fairly narrow range of plus or minus 0.5% loss in output around 0.2%. Since the services sector is not natural gas intensive (one-third of the natural gas is consumed by the commercial sector), the impact this sector's output is minimal.

Figure 38: Minimum and Maximum Output Changes for Some Key Economic Sectors

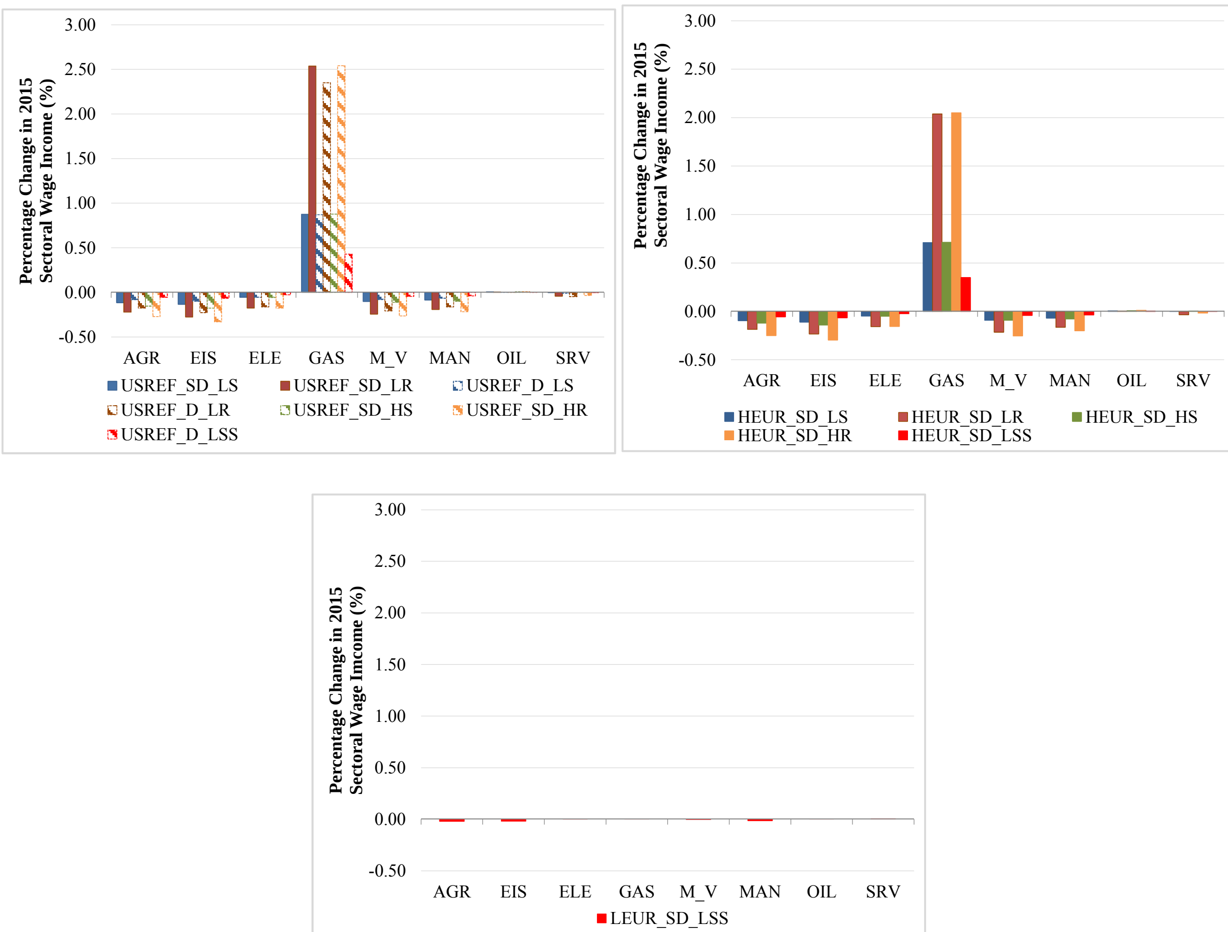


7. Wage Income and Other Components of Household Income

Sectoral output, discussed in the previous section, translates directly into changes in input levels for a given sector. In general, if the output of a sector increases so do the inputs associated with the production of this sector's goods and services. An increase in natural gas output leads to more wage income in the natural gas sector as domestic production increases. In the short run, industries are able to adjust to changes in demand for output by increasing employment if the sector expands or by reducing employment if the sector contracts.

Figure 39 shows the change in total wage income in 2015 for all scenarios. Wage income decreases in all industrial sectors except for the natural gas sector. Services and manufacturing sectors see the largest change in wage income in 2015 as these are sectors that are highly labor intensive.

Figure 39: Percentage Change in 2015 Sectoral Wage Income



As seen from the discussion above, the overall macroeconomic impacts are driven by the changes in the sources of household income. Households derive income from capital, labor, and resources. These value-added incomes also form a large share of GDP and aggregate consumption. Hence, to tie all the above impacts together, we illustrate the magnitude of each of the income subcomponents and how they relate to the overall macroeconomic impacts in Figure 40.

Figure 40: Changes in Subcomponents of GDP in 2020 and 2035

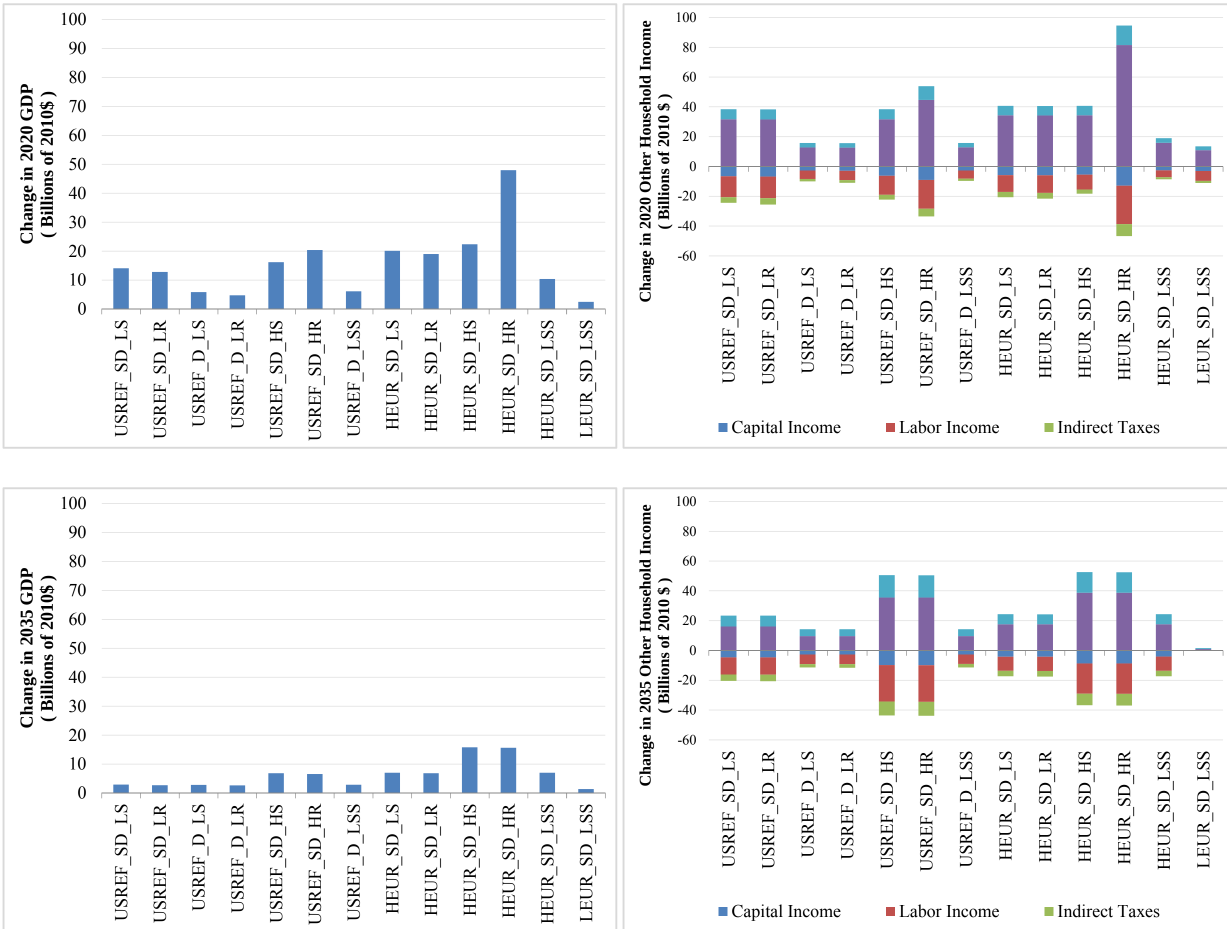


Figure 40 shows a snapshot of changes in GDP and household income components in 2020 and 2035. GDP impacts in 2020 provide the largest increase, while 2035 impacts provide a picture of the long run changes. Capital income, wage income, and indirect tax revenues drop in all scenarios, while resource income and net transfers associated with LNG export revenues increase in all scenarios. As previously discussed, capital and wage income declines are caused by high fuel prices leading to reductions in output and hence lower demand for input factors of production. However, there is positive income from higher resource value and net wealth transfer. This additional source of income is unique to the export expansion policy. This leads to the total increase in household income exceeding the total decrease. The net positive effect in real income translates into higher GDP and consumption.[25]

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[25] The net transfer income increases even more in the case where the U.S. captures quota rents leading to a net benefit to the U.S. economy.

D. Impacts on Energy-Intensive Sectors

1. Output and Wage Income

The EIS sector includes the following 5 energy using subsectors identified in the IMPLAN[26] database:

1) Paper and pulp manufacturing (NAICS 322);

2) Chemical manufacturing (NAICS 326);

3) Glass manufacturing (NAICS 3272);

4) Cement manufacturing (NAICS 3273); and

5) Primary metal manufacturing (NAICS 331) that includes iron, steel and aluminum.[27]

As the name of this sector indicates, these industries are very energy intensive and are dependent on natural gas as a key input.[28]

The model results for EIS industrial output are shown in Figure 41 for all scenarios. Because of the heavy reliance on natural gas as input, the impact on the sector is driven by natural gas prices. Under the Reference case for the high scenarios, output declines by about 0.7% while under the High EUR case output declines by about 0.8% in 2020 and then settles at around 0.6%. The reduction in EIS output for the low scenarios is less than 0.4%. Under the Low EUR case and Low/Slowest export volume scenario EIS, output changes minimally. Overall, EIS reduction is less that 1.0%.

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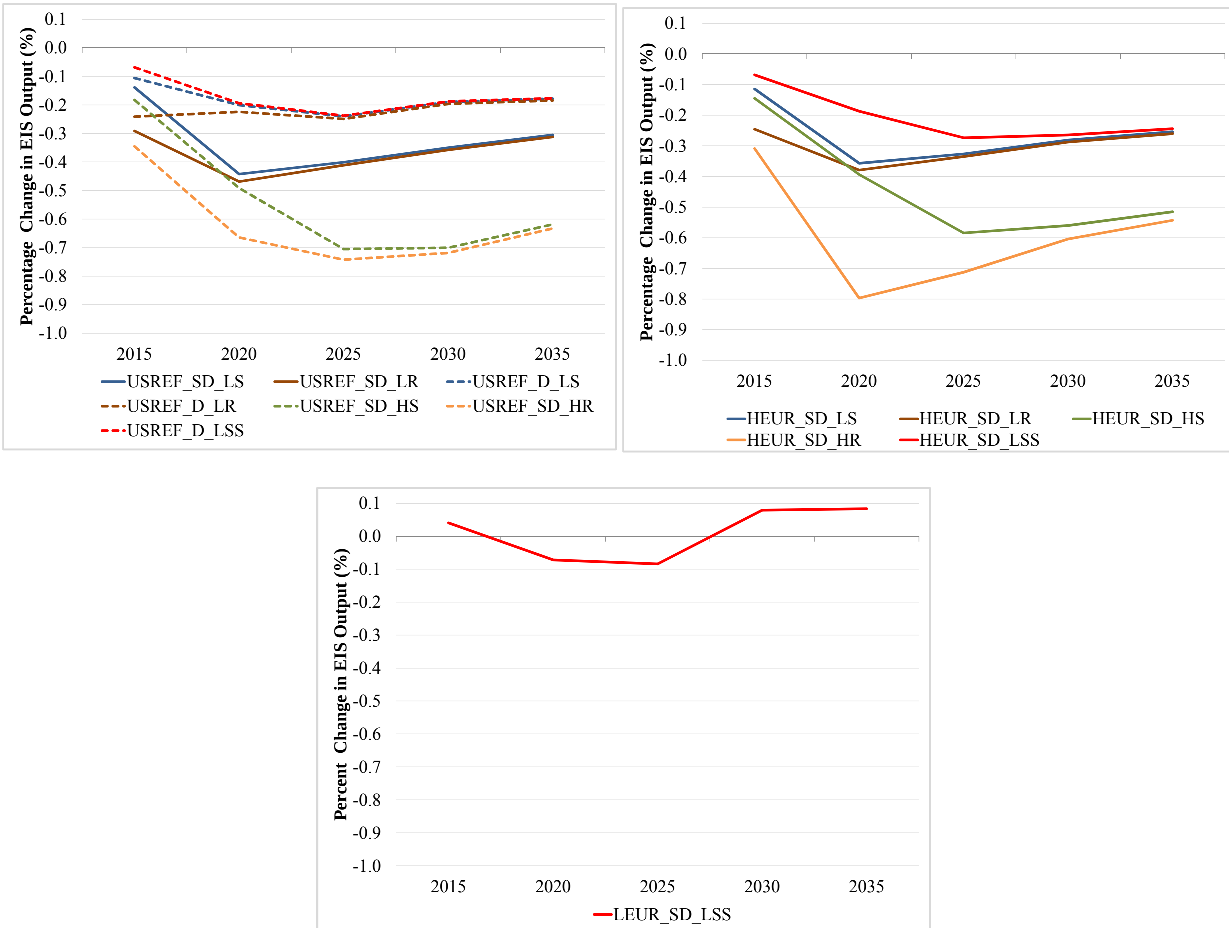
26 IMPLAN dataset provides inter-industry production and financial transactions for all states of the U.S. (www.implan.com).

27 The North American Industry Classification System ("NAICS") is the standard used to classify business establishments.

28 For this study, we have represented the EIS sector based on a 3-digit classification that aggregates upstream and downstream industries within each class. Thus, in aggregating at this level the final energy intensity would be less than one would expect if only we were to aggregate only the downstream industries or at higher NAICS-digit levels.

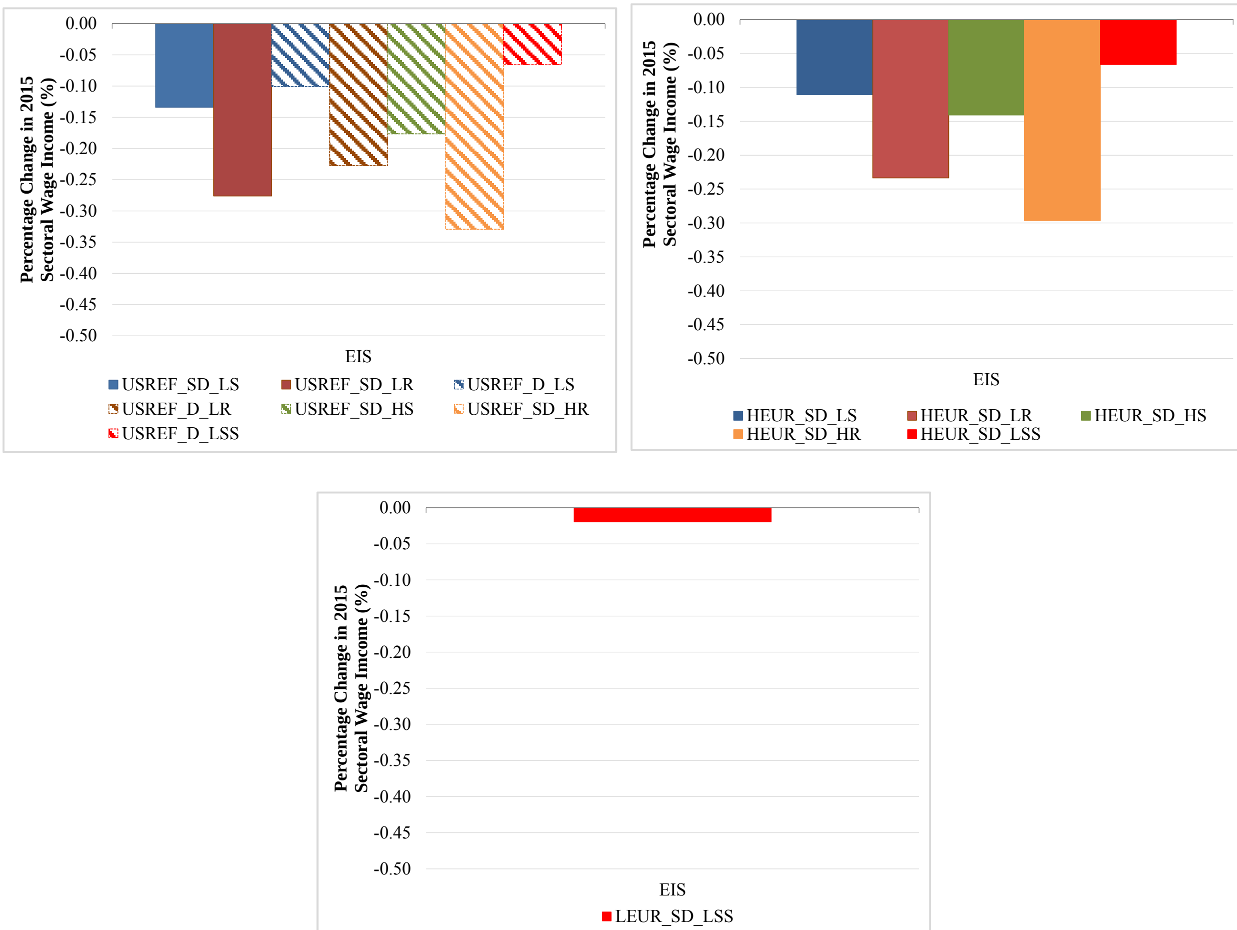
Figure 41: Percentage Change in EIS Output for NERA Core Scenarios



As mentioned in the previous sections, a reduction in sectoral output means intermediate input demand also is reduced. The EIS sector declines result in lower demand for labor, capital, energy, and other intermediate goods and services.

Figure 42 shows the changes in wage income in 2015. Under the Reference outlook, wage income would be about 0.10% to about 0.40% below baseline levels, which still represents real wage growth over time. The largest slowdown in the growth of wage income occurs in periods where reductions in EIS industrial output relative to baseline are the largest. Since the increase in natural gas prices is highest under the high/Rapid scenarios with the HEUR Shale gas outlook, the largest total labor compensation decrease in EIS occurs in that scenario, a decrease of about 0.70% in 2020 relative to baseline. Wage income never falls short of baseline levels by more than 1% in any year or any industry in any scenario.

Figure 42: Percentage Change in 2015 Energy Intensive Sector Wage Income for NERA Core Scenarios



2. Rate of Change

Even if this entire change in wage income in EIA represented a shift of jobs out of the sector, the change in EIS employment would be relatively small compared to normal turnover in the industries concerned and, under normal economic conditions, would not necessarily result in any change in aggregate employment other than a temporary increase in the number of workers between jobs. This can be seen by comparing the average annual change in employment to annual turnover rates by industry. The annual Job Openings and Labor Turnover (JOLTS) survey done by the Bureau of Labor Statistics[29] shows that the lowest annual quits rate observed, representing voluntary termination of employment in the worst year of the recession, was 6.9% for durable goods manufacturing. The largest change in wage income in the peak year of a scenario, with the largest increases in natural gas prices, is a reduction of about 5% in a 5-year period, or less than 1% per year. This is less than 15% of the normal turnover rate in that industry.

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[29] "Job Openings and Labor Turnover," Bureau of Labor Statistics, January 2012, Table 16.

3. Harm is Likely to be Confined to Very Narrow Segments of Industry

To identify where higher natural gas prices might cause severe impacts such as plant closings (due to an inability to compete with overseas suppliers not experiencing similar natural gas price increases), it is necessary to look at much smaller slices of U.S. manufacturing. Fortunately, this was done in a study by an Interagency Task Force in 2007 that analyzed the impacts of proposed climate legislation, the Waxman-Markey bill (H.R.2454), on energy-intensive, trade-exposed industries ("EITE") using data from the 2007 Economic Census.[30] The cap-and-trade program in the Waxman-Markey bill would have caused increases in energy costs and impacts on EITE even broader than would the allowing of LNG exports because the Waxman-Markey bill applied to all fuels and increased the costs of fuels used for about 70% of electricity generation. Thus, the Task Force's data and conclusions are directly relevant.

The Interagency Report defined an industry's energy intensity as "its energy expenditures as a share of the value of its domestic production."[31] The measure of energy intensity used in the Interagency Report included all sources of energy, including electricity, coal, fuel oil, and natural gas. Thus, natural gas intensity will be even less than energy intensity.

The Interagency Report further defined an energy-intensive, trade-exposed industry (those that were "presumptively eligible" for emission allowance allocations under the Waxman-Markey bill) as ones where the industry's "energy intensity or its greenhouse gas intensity is at least 5 percent, and its trade intensity is at least 15 percent."[32]

The Interagency Report found:

> *According to the preliminary assessment of the nearly 500 six-digit manufacturing industries, 44 would be deemed "presumptively eligible" for allowance rebates under H.R. 2454 ["presumptive eligibility" screened out industries that did not have a significant exposure to foreign competition]. Of these, 12 are in the chemicals sector, 4 are in the paper sector, 13 are in the nonmetallic minerals sector (e.g., cement and glass manufacturers), and 8 are in the primary metals sector (e.g., aluminum and steel manufacturers). Many of these sectors are at or near the beginning of the value chain, and provide the basic materials needed for manufacturing advanced technologies. In addition to these 44 industries, the processing subsectors of a few mineral industries are also likely to be deemed "presumptively eligible." In total, in 2007, the "presumptively eligible" industries accounted for 12 percent of total manufacturing output and*

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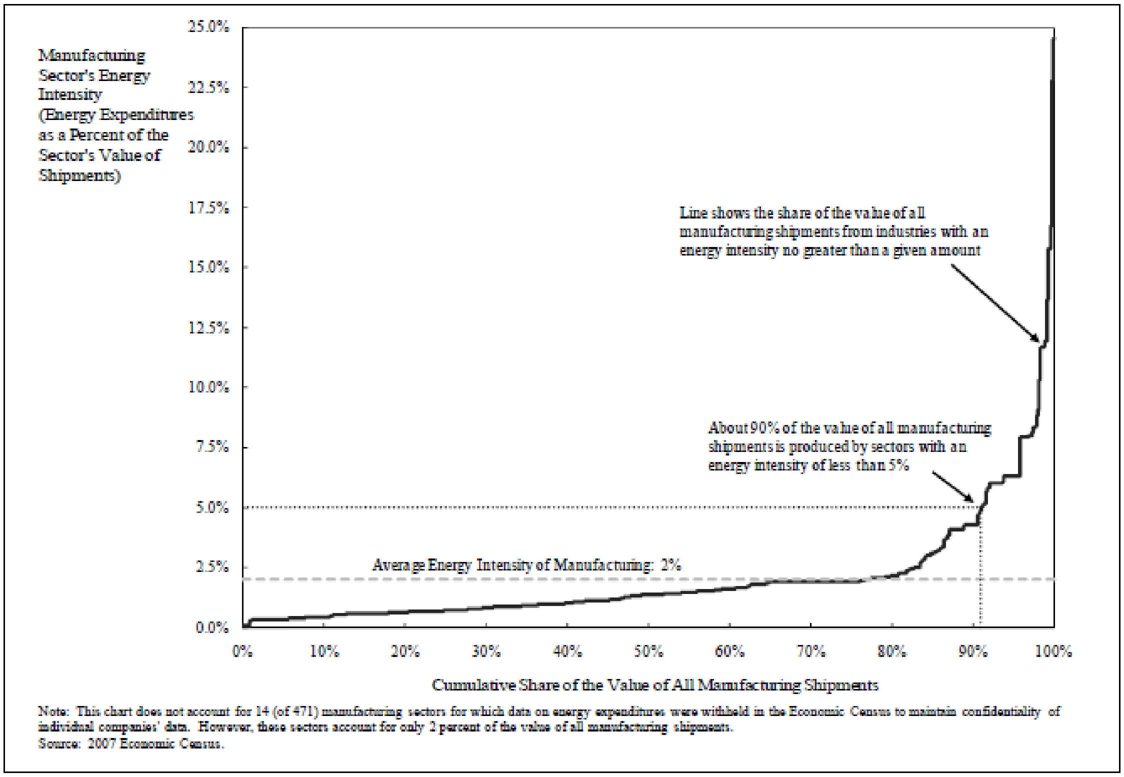
30 "The Effects of H.R.2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries," An Interagency Report Responding to a Request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown December 2, 2009.

31 "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries," p. 8.

32 "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries," p. 8.

employed about 780,000 workers, or about 6 percent of manufacturing employment and half a percent of total U.S. non-farm employment. [Figure 1 shows that] most industrial sectors have energy intensities of less than 5 percent, and will therefore have minimal direct exposure to a climate policy's economic impacts.[33]

Figure 43: Interagency Report (Figure 1)



Source: "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries," p. 7.

If we were to use the same criterion for EITE for natural gas, it would imply that an energy-intensive industry was one that would have expenditures on natural gas at the projected industrial price for natural gas greater than 5% of its value of output.

4. Vulnerable Industries are not High Value-Added Industries

A high value-added industry is one in which wage income and profits are a large share of revenues, implying that purchases of other material inputs and energy are a relatively small share. This implies that in a high value-added industry, increases in natural gas prices would have a relatively small impact on overall costs of production. Exactly that pattern is seen in Figure 44, which shows that the industries with the highest energy intensity are low margin

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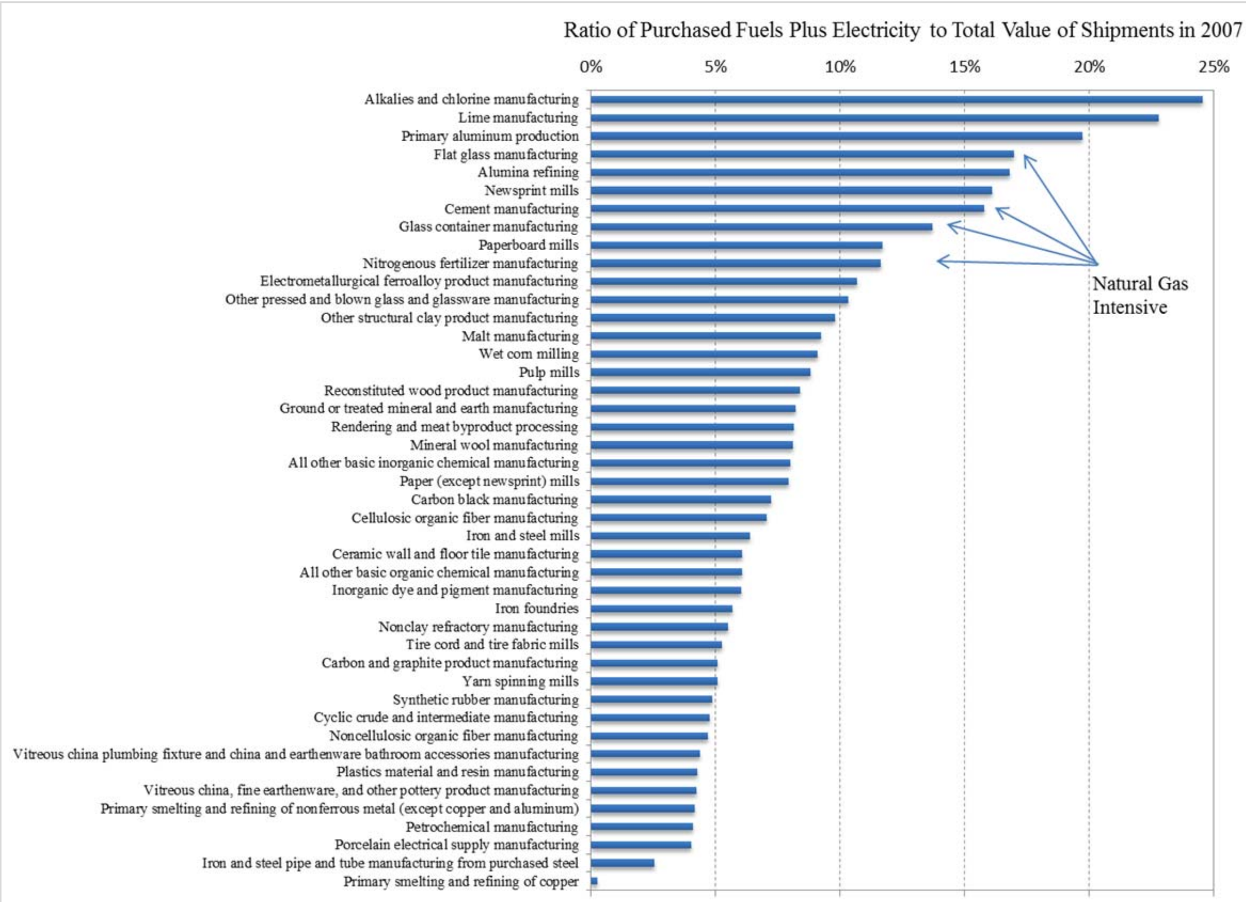
[33] "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries," p. 9.

industries that use high heats for refining, smelting, or beneficiation processes, or else they are bulk chemical processes with low value-to-weight ratios and large amounts of natural gas used as a feedstock.

Figure 44: Energy Intensity of Industries "Presumptively Eligible" for Assistance under Waxman-Markey



Source: Based on information from Census.gov. Energy intensity is measured as the value of purchased fuels plus electricity divided by the total value of shipments.

For manufacturing as a whole in 2007,[34] the ratio of value added to the total value of shipments was 78%. In the nitrogenous fertilizer industry, as an example of a natural gas-intensive, trade-exposed industry, the ratio of value added to value of shipments was only 44%. It is also a small industry with a total of 3,920 employees nationwide in 2007.[35] The ratio of value added to value of shipments for the industries that would be classified as EITE under the Waxman-Markey criteria was approximately 41%.[36] Thus there is little evidence that trade-exposed industries that

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[34] The date of the most recent Economic Census that provides these detailed data is the year 2007.

[35] http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

[36] Excludes two six-digit NAICS codes for which data was withheld to protect confidentiality, 331411 and 331419. Source: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk.

would experience the largest cost increases due to higher natural gas prices are high value-added industries.

The Interagency Study similarly observed:

> *On the whole, energy expenditures equal only 2 percent of the value of U.S. manufacturing's output (see Figure 1) and three-quarters of all manufacturing output is from industries with energy expenditures below 2 percent of the value of their output. Thus, the vast majority of U.S. industry will be relatively unaffected by a greenhouse gas cap-and-trade program.*[37]

The same conclusion should apply to the effects of price increases attributable to LNG exports.

5. Impacts on Energy-Intensive Industries at the Plant or 5- to 6-Digit NAICS Level

The issue of EITE industries was investigated exhaustively during Congressional deliberations on climate legislation in the last Congress. In particular, H.R.2454 (the Waxman-Markey bill) set out specific criteria for classification as EITE. A broad consensus developed among analysts that at the 2 to 4-digit level of NAICS classification there were no industries that fit those criteria for EITE, and that only at the 5- to 6-digit level would there be severe impacts on any specific industry.[38] The phrase "deep but narrow" was frequently used to characterize the nature of competitive impacts. Some examples of industries that did fit the criteria for EITE were 311251 (nitrogenous fertilizer) within the 31 (2-digit chemicals) industry and 331111 (iron and steel mills) within the 3311 (4-digit iron and steel) industry. Analysis in this report strongly suggests that competitive impacts of higher natural gas prices attributable to LNG exports will be very narrow, but it was not possible to model impacts on each of the potentially affected sectors.

E. Sensitivities

1. Lost Values from Quota Rents

When scarcity is created there is value associated with supplying an additional unit. In economic terms, a quantity restriction to create this scarcity is called a quota. By enacting a quota, one creates a price difference between the world supply price (netback price) and the domestic price. This generates economic rent referred to as the "quota rent." Mathematically, a quota rent is the quota amount times the difference between the world net back price and the domestic price. A quota rent provides an additional source of revenue to the seller.

The quota levels for the13 scenarios analyzed and discussed in this study correspond to the export volumes assumed in the EIA Study. We assume that the quota rents are held by foreign

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[37] "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries," p. 7.

[38] Richard Morgenstern, *et al.*, RFF Workshop Report.

parties. That is, the rents do not recycle back into the U.S. economy. In this section, we look at how the welfare results would change if the quota rents were recycled back to the U.S.

Figure 45 shows the quota price in 2010 dollars per Mcf for all 13 scenarios determined in the GNGM. The quota price is the marginal price of the quota, or the quota rents divided by the level of exports. The quota price is zero for scenarios that have a non-binding quota constraint. That is, export volumes are less than the quota levels. All of the scenarios under the High EUR and Low EUR cases have binding quota constraints leading to a positive quota price. The quota price is highest in the scenarios in which the domestic natural gas price is the lowest (*i.e.*, the low scenarios for the High EUR outlook). The largest quota price results in the High EUR case with the Low/Slowest export expansion scenario (HEUR_SD_LSS). For this scenario, the quota price is around $3/Mcf.

Figure 45: Quota Price (2010$/Mcf)

Scenario	Quota Price (2010$/Mcf)				
	2015	2020	2025	2030	2035
USREF_SD_LS	1.24	0.52	1.11	1.2	1.62
USREF_SD_LR	1.09	0.52	1.11	1.2	1.62
USREF_D_LS	-	-	-	-	-
USREF_D_LR	-	-	-	-	-
USREF_SD_HS	1.24	0.52	-	0.08	0.67
USREF_SD_HR	0.74	-	-	0.08	0.67
USREF_D_LSS	0.46	-	-	-	-
HEUR_SD_LS	2.23	1.88	2.71	2.69	3.28
HEUR_SD_LR	1.8	1.88	2.71	2.69	3.28
HEUR_SD_HS	2.23	1.88	1.73	1.73	2.47
HEUR_SD_HR	1.8	0.52	1.53	1.73	2.47
HEUR_SD_LSS	2.34	2.63	2.81	2.69	3.28
LEUR_SD_LSS	-	-	-	-	-

Figure 46: Quota Rents (Billions of 2010$)

Scenario	Quota Rents* (Billions of 2010$)				
	2015	2020	2025	2030	2035
USREF_SD_LS	0.41	1.02	2.19	2.37	3.19
USREF_SD_LR	1.08	1.02	2.19	2.37	3.19
USREF_D_LS	-	-	-	-	-
USREF_D_LR	-	-	-	-	-
USREF_SD_HS	0.41	1.02	-	0.32	2.64
USREF_SD_HR	0.73	-	-	0.32	2.64
USREF_D_LSS	0.07	-	-	-	-
HEUR_SD_LS	0.74	3.71	5.34	5.30	6.46
HEUR_SD_LR	1.78	3.71	5.34	5.30	6.46
HEUR_SD_HS	0.74	3.71	6.26	6.82	9.74
HEUR_SD_HR	1.78	2.05	6.03	6.82	9.74
HEUR_SD_LSS	0.38	2.60	5.08	5.30	6.46
LEUR_SD_LSS	-	-	-	-	-

** The quota rents are based on net export volumes.*

The quota rents on the other hand, depend on the price and quantity. Even though the price is the highest under the low export scenarios, as seen in Figure 45, quota rents are the largest for the high export expansion scenarios. Under the high quota rent scenario, HEUR_SD_HR, the average annual quota rents range from $1.8 billion to $9.7 billion. Over the model horizon, 2015 through 2035, maximum total quota rents amount to about $130 billion (Figure 47). This is an important source of additional income that would have potential benefits to the U.S. economy. However, in the event that U.S. companies are unable to capture these rents, this source of additional income would not accrue to the U.S. economy.

Figure 47: Total Lost Values

Scenario	Total Lost Value from 2015-2035 (Billions of 2010$)	Average Annual Lost Value (Billions of 2010$)
USREF_SD_LS	$45.92	$1.84
USREF_SD_LR	$49.25	$1.97
USREF_D_LS	$0.00	$0.00
USREF_D_LR	$0.00	$0.00
USREF_SD_HS	$21.97	$0.88
USREF_SD_HR	$18.45	$0.74
USREF_D_LSS	$0.37	$0.01
HEUR_SD_LS	$107.78	$4.31
HEUR_SD_LR	$112.98	$4.52
HEUR_SD_HS	$136.32	$5.45
HEUR_SD_HR	$132.10	$5.28
HEUR_SD_LSS	$99.16	$3.97
LEUR_SD_LSS	$0.00	$0.00

2. A Larger Share of Quota Rents Increases U.S. Net Benefits

To understand how the macroeconomic impacts (or U.S. net benefits) would change if the quota rents were retained by U.S. companies, we performed sensitivities on two different scenarios – one with high quota price, HEUR_SD_LSS, and the other with high quota rents, HEUR_SD_HR. The sensitivities put an upper bound on the potential range of improvement in the net benefits to the U.S. consumers.

In the sensitivity runs, we assume that quota rents are returned to the U.S. consumers as a lump-sum wealth transfer from foreign entities.

Figure 48 shows the range of welfare changes for the sensitivities of the two scenarios. Under both scenarios, the welfare improves because the quota rents provide additional income to the household in the form of a wealth transfer. Consumers have more to spend on goods and services leading to higher welfare. The welfare in the Low/Slowest scenario improves by more than threefold, while under the High/Rapid scenario the improvement in welfare increases by twofold. The ability to extract quota rents unequivocally benefits U.S. consumers.

Figure 48: Change in Welfare with Different Quota Rents[39]

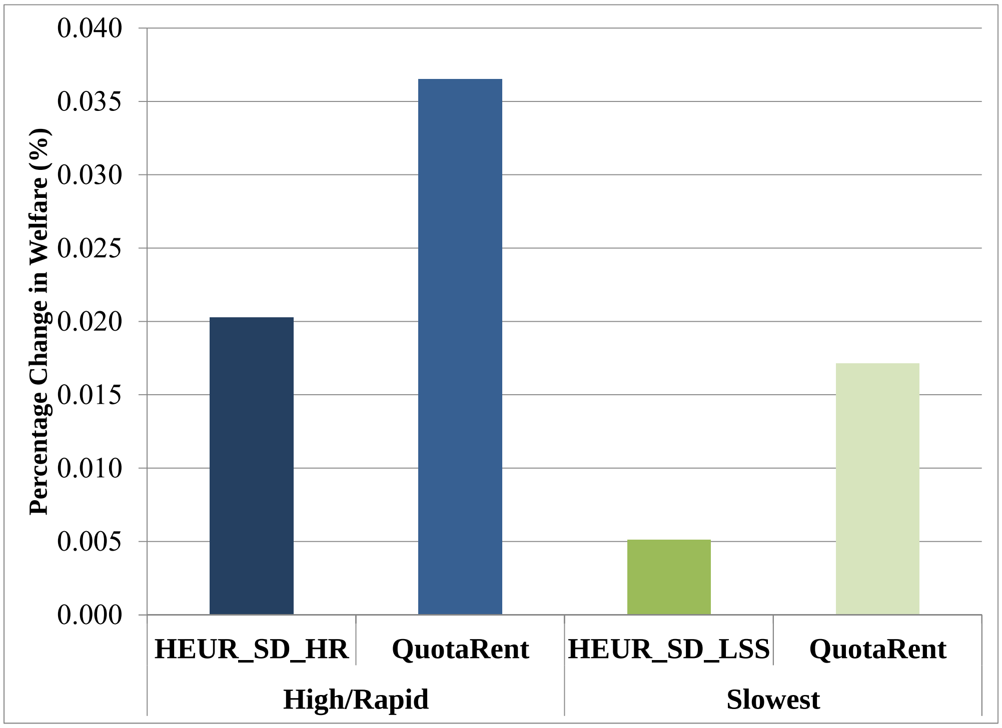

Figure 49 shows the change in impacts on aggregate consumption, GDP, and other household income for different quota rent sensitivities. The additional income from quota rents makes consumers wealthier, leading to increased expenditures on goods and services. This increase in economic activity leads to higher aggregate consumption and GDP. The impacts are highest when allowing for maximum quota rent transfer. The pattern of impacts is the same across the High/Rapid and Low/Slowest scenarios - the only difference is in the magnitude of the effect. The change under the Low/Slowest scenario is relatively smaller because of the smaller amount of transfers compared to the High/Rapid scenario. The consumption change under the maximum quota rent transfer scenario in 2015 is 50% higher than the scenario with no quota rent transfer. In this optimistic scenario, consumption changes are always positive throughout the model horizon for both scenarios. The charts below also highlight changes in other household incomes that add to GDP. While all other income source changes remain the same, only the net transfers change. As quota rents increase so does the change in net transfers leading to higher real income. As a result, higher quota rents lead to more imports, more consumption, higher GDP, and ultimately greater well-being of U.S. consumers.

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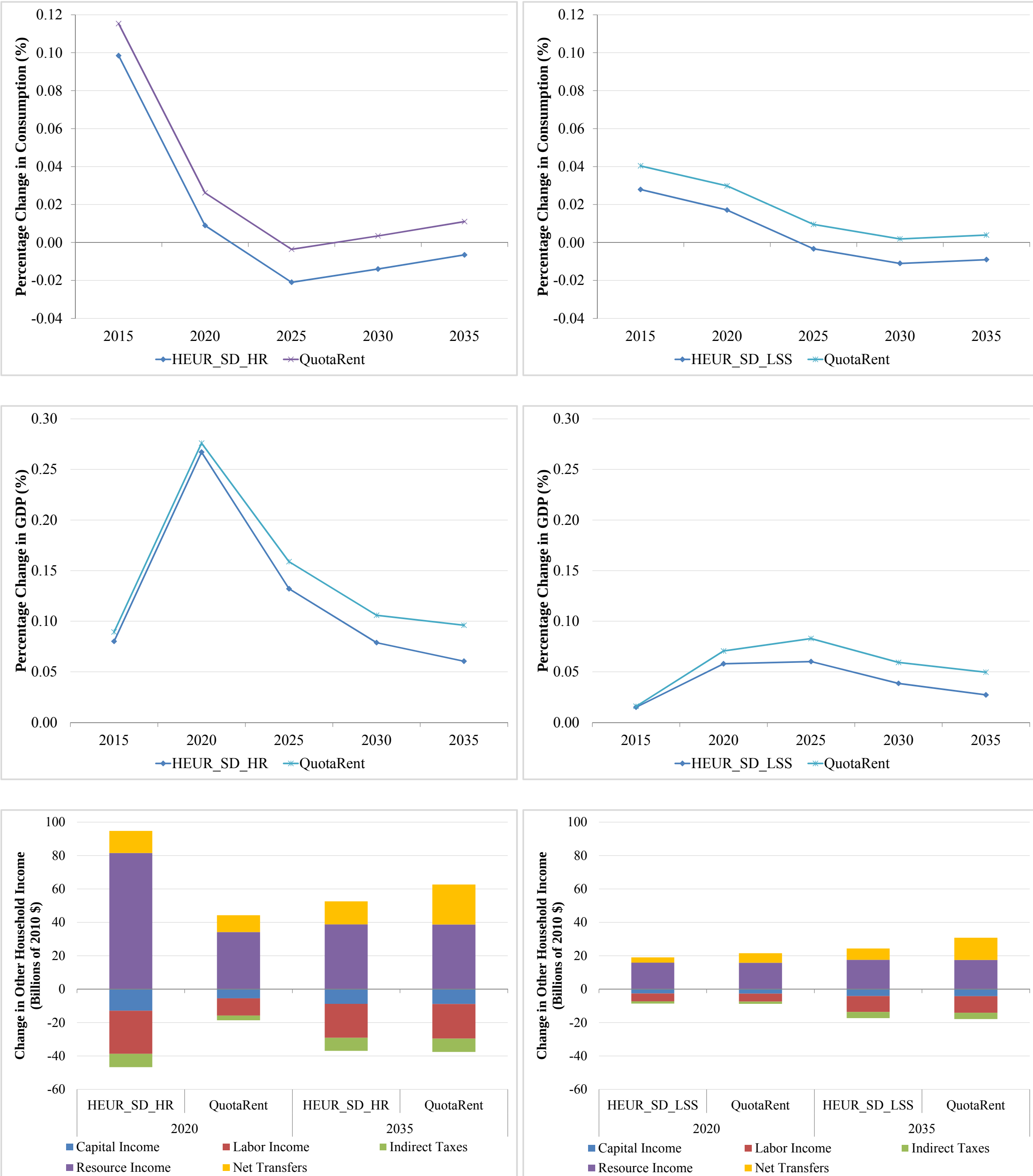
[39] Welfare is calculated as a single number that represents in present value terms the amount that households are made better (worse) off over the entire time horizon from 2015 to 2035.

Figure 49: Macroeconomic Impacts for the High EUR – High/Rapid and Low/Slowest Scenario Sensitivities



VII. CONCLUSIONS

NERA developed a Global Natural Gas Model ("GNGM") and a general equilibrium model of the U.S. economy ("N$_{ew}$ERA Model") to evaluate feasible levels of LNG exports and their impacts on the U.S. economy. These two models allowed us to determine feasible export levels, characterize the international gas market conditions, and evaluate overall macroeconomic effects. Given the wide range in export expansion outcomes, it is not surprising to find great variation in the macroeconomic impacts and natural gas market changes. Nevertheless, several observations may be distilled from the patterns that emerged.

A. LNG Exports Are Only Feasible under Scenarios with High International Demand and/or Low U.S. Costs of Production

Under status quo conditions in the world and the U.S. (U.S. Reference and International Reference cases) there is no feasible level of exports possible from the U.S. Under the low natural price case (High Shale EUR), LNG exports from the U.S. are feasible. However, under a low shale gas outlook (Low Shale EUR), international demand has to increase along with a tightening of international supply for the U.S. to be an LNG exporter.

B. U.S. Natural Gas Prices Do Not Rise to World Prices

LNG exports will not drive the price of domestic natural gas to levels observed in countries that are willing to pay oil parity-based prices for LNG imports. U.S. exports will drive prices down in regions where U.S. supplies are competitive so that even export prices will come down at the same time that U.S. prices will rise.

Moreover, basis differentials due to transportation costs from the U.S. to high-priced regions of the world will still exist, and U.S. prices will never get closer to those prices than the cost of liquefaction plus the cost of transportation to and regasification in the final destination. Thus even in the scenarios with no binding export levels, the wellhead price in the U.S. is below the import price in Japan, where the U.S. sends some of its exports.

The largest change in international natural gas prices in 2015 and 2025 is about $0.33/MMBtu and $1/MMBtu, respectively. These increases occur only in highly stressed conditions or when global markets are willing to take the full quantities of export volumes at prices above marginal production cost in the U.S. plus liquefaction, transportation, and regasification costs incurred to get the LNG to market.

C. Consumer Well-being Improves in All Scenarios

The macroeconomic analysis shows that there are consistent net economic benefits across all the scenarios examined and that the benefits generally become larger as the amount of exports increases. These benefits are measured most accurately in a comprehensive measure of economic welfare of U.S. households that takes into account changes in their income from all sources and the cost of goods and services they buy. This measure gives a single indicator of relative overall well-being of the U.S. population, and it consistently ranks all the scenarios with

LNG exports above the scenario with No-Exports. Welfare improvement is highest under the high export volume scenarios because U.S. consumers benefit from an increase in wealth transfer and export revenues.

D. There Are Net Benefits to the U.S.

A related measure that shows how economic impacts are distributed over time is GDP. Like welfare, GDP also increases as a result of LNG exports. The most dramatic changes are in the short term, when investment in liquefaction capacity adds to export revenues and tolling charges to grow GDP. Under the Reference case, GDP increases could range from $5 billion to $20 billion. Under the High Shale case, GDP in 2020 could increase by $10 billion to $47 billion. Under the Low Shale case, GDP in 2020 could increase by $4.4 billion. Every scenario shows improvement in GDP over the No-Exports cases although in the long run the impact on GDP is relatively smaller than in the short run.

Although the patterns are not perfectly consistent across all scenarios, the increase in investment for liquefaction facilities and increased natural gas drilling and production provides, in general, near-term stimulus to the economy. At the same time, higher energy costs do create a small drag on economic output in the U.S. so that total worker compensation declines.

E. There Is a Shift in Resource Income between Economic Sectors

The U.S. has experienced many changes in trade patterns as a result of changing patterns of comparative advantage in global trade. Each of these has had winners and losers. Grain exports raised the income of farmers and transferred income from U.S. consumers to farmers, steel imports lowered the income of U.S. steel companies and lowered costs of steel for U.S. manufacturing, etc.

The U.S. economy will experience some shifts in output by industrial sectors as a result of LNG exports. Compared to the No-Exports case, incomes of natural gas producers will be greater, labor compensation in the natural gas sector will increase while other industrial sector output and labor compensation decreases. The natural gas sector could experience an increase in production by 0.4 Tcf to 1.5 Tcf by 2020 and 0.3 Tcf to 2.6 Tcf by 2035 to support LNG exports. The LNG exports could lead to an average annual increase in natural export revenues of $10 billion to $30 billion. Impacts on sectoral output vary. Manufacturing sector output decreases by less than 0.4% while EIS and electric sector output impacts could be about 1% in 2020 when the natural gas price is the highest. Changes in industry output and labor compensation are very small. Even energy-intensive sectors experience changes of 1% or less in output and labor compensation during the period when U.S. natural gas prices are projected to rise more rapidly than in a No-Exports case.

Harm is likely to be confined to narrow segments of the industry, and vulnerable industries are not high value-added industries. The electricity sector, energy-intensive sector, and natural gas-dependent goods and services producers will all be impacted by price rises. Conversely, natural gas suppliers will benefit. Labor wages will likewise decrease or increase, respectively, depending on the sector of the economy. The overall impact on the economy depends on the tradeoff between these sectors.

In terms of natural gas-dependent production, producers switch to cheaper fuels or use natural gas more efficiently as natural gas prices rise and production overall is reduced. Reductions in tax revenues are directly related to changes in sectoral output. Industrial output declines the most in scenarios that have the highest increase in natural gas and fuel costs.

The costs and benefits of natural gas price increases are shifted in two ways. Costs and benefits experienced by industries do not remain with the companies paying the higher energy bills or receiving higher revenues. Part of the cost of higher energy bills will be shifted forward onto consumers, in the form of higher prices for goods being produced. The percentage of costs shifted forward depends on two main factors: first, how demand for those goods responds to increases in price, and second, whether there are competitors who experience smaller cost increases. The remainder of the cost of higher energy bills is shifted backwards onto suppliers of inputs to those industries, to their workers, and to owners of the companies. As each supplier in the chain experiences lower revenue, its losses are also shifted back onto workers and owners.

Gains from trade are shifted in the same way. Another part of the increased income of natural gas producers comes from foreign sources. This added revenue from overseas goes immediately to natural gas producers and exporters but does not come from U.S. consumers. Therefore, it is a net benefit to the U.S. economy and is also shifted back to the workers and owners of businesses involved directly and indirectly in natural gas production and exports.

In the end, all the costs and benefits of any change in trade patterns or prices are shifted back to labor and capital income and to the value of resources in the ground, including natural gas resources. One of the primary reasons for development of computable general equilibrium models like N_{ew}ERA is to allow analysts to estimate how impacts are shifted back to the different sources of income and their ultimate effects on the economy at large. In conclusion, the range of aggregate macroeconomic results from this study suggests that LNG export has net benefits to the U.S. economy.

APPENDIX A - TABLES OF ASSUMPTIONS AND NON-PROPRIETARY INPUT DATA FOR GLOBAL NATURAL GAS MODEL

A. Region Assignment

Figure 50: Global Natural Gas Model Region Assignments

Region	Countries
Africa	Algeria, Angola, Egypt, Equatorial Guinea, Ghana, Libya, Morocco, Mozambique, Nigeria, Tunisia
Canada	Canada
China/India	China, Hong Kong, India
Central and South America	Andes, Argentina, Bolivia, Brazil, Central America and Caribbean, Chile, Dominican Republic, Mexico, Peru, Southern Cone, Trinidad & Tobago, Uruguay, Venezuela
Europe	Albania, Austria, Belgium, Croatia, Denmark, Estonia, France, Germany, Greece, Ireland, Italy, Netherlands, North Sea, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, Ukraine, United Kingdom
Former Soviet Union	Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine, Uzbekistan
Korea/Japan	South Korea, Japan
Middle East	Abu Dhabi, Cyprus, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, Yemen
Oceania	Australia, New Zealand, Papua New Guinea
Sakhalin	Sakhalin Island
Southeast Asia	Brunei, Indonesia, Malaysia, Myanmar, Singapore, Taiwan, Thailand
U.S.	Puerto Rico, United States

B. EIA IEO 2011 Natural Gas Production and Consumption

Figure 51: EIA IEO 2011 Natural Gas Production (Tcf)

	2010	2015	2020	2025	2030	2035
Africa	7.80	9.70	11.10	12.20	13.30	14.10
Canada	6.10	7.00	7.70	8.30	8.70	9.00
China/India	4.60	5.60	6.70	8.00	9.60	9.70
C&S America	6.80	7.90	8.30	9.20	10.50	11.70
Europe	9.50	8.10	7.40	7.50	7.90	8.30
FSU	28.87	30.05	32.12	34.89	37.77	39.94
Korea/Japan	0.20	0.20	0.20	0.20	0.20	0.20
Middle East	16.30	19.70	22.40	24.60	26.70	28.80
Oceania	2.10	2.60	3.10	3.80	4.80	5.70
Sakhalin	0.43	0.45	0.48	0.51	0.53	0.56
Southeast Asia	9.30	10.00	10.70	11.60	12.60	13.40
U.S.	21.10	22.40	23.40	24.00	25.10	26.40
World	113.10	123.70	133.60	144.80	157.70	167.80

Figure 52: EIA IEO 2011 Natural Gas Consumption (Tcf)

	2010	2015	2020	2025	2030	2035
Africa	3.90	4.70	5.90	7.10	8.30	9.10
Canada	3.30	3.50	3.70	4.20	4.60	5.00
China/India	5.70	8.60	10.70	13.10	15.10	16.60
C&S America	6.60	7.40	8.90	10.50	12.20	14.40
Europe	19.20	19.80	20.40	20.90	22.00	23.20
FSU	24.30	24.30	24.50	24.90	25.80	26.50
Korea/Japan	5.00	5.20	5.30	5.70	5.90	5.90
Middle East	12.50	14.70	17.00	19.10	21.30	24.00
Oceania	1.20	1.30	1.50	1.80	2.00	2.20
Sakhalin	0.00	0.00	0.00	0.00	0.00	0.00
Southeast Asia	7.40	8.50	10.00	12.00	13.90	15.30
U.S.	23.80	25.10	25.30	25.10	25.90	26.50
Total World	112.90	123.10	133.20	144.40	157.00	168.70

C. Pricing Mechanisms in Each Region

1. Korea/Japan

Korea/Japan was assumed to continue to rely upon LNG to meet its natural gas demand. LNG was assumed to continue to be supplied under long-term contracts with index pricing tied to crude oil prices. It was assumed that with time, supplier competition would result in some softening in the LNG pricing relative to crude.[40] This Reference case assumes some growth in Korea/Japan demand but does not incorporate significant shifts away from nuclear energy to natural gas-fired generation.

2. China/India

LNG pricing for China/India is also assumed to be linked to crude oil prices but at a discount to Korea/Japan. The discount was intended to reflect that China/India, although short of natural gas supplies, have other sources of natural gas that LNG complements. As a result, we assumed that China/India would have some additional market leverage in negotiating contracting terms.

3. Europe

Europe receives natural gas from a variety of sources. The prices of some supplies are indexed to petroleum prices. Other sources are priced based upon regional gas-on-gas competition. In our analysis, we assumed that European natural gas prices would reflect a middle point with prices not tied directly either to petroleum or to local natural gas competition. We assumed that European prices would remain above the pricing levels forecast for North America but not as high as in Asia. Europe was also assumed to remain dependent upon imported supplies of natural gas to meet its moderately growing demand.

4. United States

The United States was assumed to follow the forecast for supply and demand and pricing as presented in the EIA's AEO 2011 Reference case.

5. Canada

The analysis assumed that Canada is part of an integrated North American natural gas market. As a consequence, Canadian pricing is linked to U.S. prices, and Canadian prices relate by a basis differential to U.S. prices. We assumed that Canadian production was sufficient to meet Canadian demand plus exports to the United States as forecast in the EIA AEO 2011. We did not allow for Canadian exports of LNG in the Reference case. Also, we held exports to the United States constant across different scenarios so as to be able to eliminate the secondary impacts of changing imports on the economic impacts of U.S. LNG on the U.S. economy.

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[40] This is consistent with the IEO WEO 2011, which forecasts the LNG to Crude index will decline from 82% to 63% between now and 2035.

6. Africa, Oceania, and Southeast Asia

These three regions were assumed to produce natural gas from remote locations. The analysis assumed that these natural gas supplies could be produced economically today at a price between $1 and $2/MMBtu. The EIA's IEO 2011 was used as the basis for forecasting production volumes.

7. Middle East

Qatar is assumed to be the low-cost producer of LNG in the world. It is assumed that although Qatar has vast natural gas resources, it decides to continue to limit its annual LNG exports to 4.6 Tcf during the forecast horizon.

8. Former Soviet Union

The FSU was assumed to grow its natural gas supply at rates that far exceed its domestic demand. The resulting excess supplies were assumed to be exported mostly to Europe and, to a lesser degree, to China/India.

9. Central and South America

Central and South America was assumed to produce sufficient natural gas to meet its growing demand in every year during the forecast horizon. The region also has the potential for LNG exports that the model considered in determining worldwide LNG flows.

Figure 53: Projected Wellhead Prices ($/MMBtu)

	2010	2015	2020	2025	2030	2035
Africa	$1.75	$1.89	$2.09	$2.31	$2.55	$2.81
Canada	$3.39	$3.72	$4.25	$5.20	$5.64	$6.68
China/India	$12.29	$12.86	$13.00	$13.25	$13.57	$13.51
C&S America	$2.00	$2.16	$2.39	$2.64	$2.91	$3.22
Europe	$9.04	$9.97	$10.80	$11.95	$12.39	$13.23
FSU	$4.25	$4.60	$5.08	$5.61	$6.19	$6.84
Korea/Japan	$14.59	$15.30	$15.47	$15.79	$16.19	$16.11
Middle East	$1.25	$1.35	$1.49	$1.65	$1.82	$2.01
Oceania	$1.75	$1.89	$2.09	$2.31	$2.55	$2.81
Sakhalin	$1.25	$1.35	$1.49	$1.65	$1.82	$2.01
Southeast Asia	$2.00	$2.16	$2.39	$2.64	$2.91	$3.22
U.S.	$3.72	$3.83	$4.28	$5.10	$5.48	$6.36

Source: U.S. wellhead prices are from EIA AEO 2012 Early Release.

Figure 54: Projected City Gate Prices ($/MMBtu)

	2010	2015	2020	2025	2030	2035
Africa	$2.75	$2.89	$3.09	$3.31	$3.55	$3.81
Canada	$4.79	$5.12	$5.65	$6.60	$7.04	$8.08
China/India	$13.79	$14.36	$14.50	$14.75	$15.07	$15.01
C&S America	$4.50	$4.66	$4.89	$5.14	$5.41	$5.72
Europe	$10.04	$10.97	$11.80	$12.95	$13.39	$14.23
FSU	$5.25	$5.60	$6.08	$6.61	$7.19	$7.84
Korea/Japan	$15.09	$15.80	$15.97	$16.29	$16.69	$16.61
Middle East	$4.08	$4.18	$4.32	$4.48	$4.65	$4.84
Oceania	$3.25	$3.39	$3.59	$3.81	$4.05	$4.31
Sakhalin	$3.75	$3.85	$3.99	$4.15	$4.32	$4.51
Southeast Asia	$3.00	$3.16	$3.39	$3.64	$3.91	$4.22
U.S.	$4.72	$4.83	$5.28	$6.10	$6.48	$7.36

D. Cost to Move Natural Gas via Pipelines

Figure 55: Cost to Move Natural Gas through Intra- or Inter-Regional Pipelines ($/MMBtu)

From	To	Cost
Africa	Africa	$1.00
Africa	Europe	$1.00
Canada	Canada	$1.20
Canada	U.S.	$1.20
China/India	China/India	$1.50
FSU	FSU	$1.00
FSU	Europe	$1.00
FSU	China-India	$1.00
U.S.	U.S.	$1.00
U.S.	Canada	$1.00
C&S America	C&S America	$2.50
Middle East	Middle East	$2.83
Oceania	Oceania	$1.50
Korea/Japan	Korea/Japan	$0.50
Europe	Europe	$1.00
Sakhalin	Sakhalin	$0.50
Southeast Asia	Southeast Asia	$1.00

E. LNG Infrastructures and Associated Costs

1. Liquefaction

The world liquefaction plants data is based upon the International Group of LNG Importers' ("GIIGNL") 2010 LNG Industry report. The dataset includes 48 existing liquefaction facilities worldwide, totaling 13.58 Tcf of export capacity. The future liquefaction facility dataset, based upon *LNG Journal* (October 2011),[41] includes 32 LNG export projects and totals 10.59 Tcf of planned export capacity. This dataset covers worldwide liquefaction projects from 2011 to 2017. Beyond 2017, each region's liquefaction capacity is assumed to grow at the average annual growth rate of its natural gas supply.[42]

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41 LNG Journal, Oct 2011. Available at: http://lngjournal.com/lng/.

42 Rates are adopted from IEO 2011.

The liquefaction cost per MMBtu can be broken down into three components:

1. An operation and maintenance cost of $0.16;
2. A capital cost that depends on the location of the facility; and
3. A fuel use cost that varies with natural gas prices over time.

To derive the capital cost per MMBtu, we obtained a set of investment costs per million metric tons per annum ("MMTPA") by region (Figure 56).[43] The U.S.'s investment cost per MMTPA is competitive because most domestic projects convert existing idle regasification facilities to liquefaction facilities. This implies a 30% to 40% cost savings relative to greenfield projects. Offshore LNG export projects are more costly, raising the investment costs per unit of capacity in Southeast Asia and Oceania.

Figure 56: Liquefaction Plants Investment Cost by Region ($millions/ MMTPA Capacity)

	$Millions/MMTPA	Capital Cost ($/MMBtu produced)
Africa	$1,031	$3.05
Canada	$1,145	$3.39
C&S America	$802	$2.37
Europe	$802	$2.37
FSU	$802	$2.37
Middle East	$859	$2.54
Oceania	$1,317	$3.90
Sakhalin	$802	$2.37
Southeast Asia	$1,145	$3.39
U.S.	$544	$1.61

The total investment cost is then annualized assuming an average plant life of 25 years and a discount rate of 10%. The capital cost per MMBtu of LNG produced is obtained after applying a 72% capacity utilization factor to the capital cost per MMBtu of LNG capacity. Figure 57 shows the liquefaction fixed cost component in $/MMBtu LNG produced.

$$\text{Equivalent Annual Cost} = \frac{\text{Asset Price} \times \text{Discount Rate}}{1-\left(1+\text{Discount Rate}\right)^{-\text{Number of Periods}}}$$

[43] From Paul Nicholson, a Marsh & McLennan company colleague (NERA is a subsidiary of Marsh & McClennan).

In the liquefaction process, 9% of the LNG is burned off. This fuel use cost is priced at the wellhead and included in the total liquefaction costs.

Figure 57: Liquefaction Costs per MMBtu by Region, 2010-2035

	2010	2015	2020	2025	2030	2035
Africa	$3.37	$3.38	$3.40	$3.42	$3.44	$3.46
Canada	$3.85	$3.88	$3.93	$4.02	$4.06	$4.15
C & S America	$2.71	$2.73	$2.75	$2.77	$2.79	$2.82
Europe	$3.35	$3.43	$3.50	$3.61	$3.65	$3.72
FSU	$2.65	$2.65	$2.67	$2.68	$2.70	$2.71
Middle East	$2.81	$2.82	$2.84	$2.85	$2.87	$2.88
Oceania	$4.22	$4.23	$4.25	$4.27	$4.29	$4.31
Sakhalin	$2.65	$2.65	$2.67	$2.68	$2.70	$2.71
Southeast Asia	$3.73	$3.74	$3.76	$3.79	$3.81	$3.84
U.S.	$2.13	$2.14	$2.18	$2.25	$2.28	$2.34

2. Regasification

The world regasification plants data is based upon the GIIGNL's annual LNG Industry report, 2010. The dataset includes 84 existing regasification facilities worldwide, totaling to a 28.41 Tcf annual import capacity. Korea and Japan together own 12.58 Tcf or 44% of today's world regasification capacities. The GNGM future regasification facility database includes data collected from multiple sources: the GLE Investment Database September 2011, LNG journal Oct 2011, and GIIGNL's 2010 LNG Industry report. It includes 46 LNG import projects, totaling to 12.12 Tcf of planned import capacity, and covers regasification projects from 2011 to 2020 worldwide. Beyond 2020, each region's regasification capacity is assumed to grow at the average annual growth rate of its natural gas demand.[44]

LNG regasification cost can also be broken down into three components: an operation and maintenance cost of $0.20/MMBtu, a fixed capital cost of $0.46/MMBtu, and a fuel use cost that varies with natural gas demand prices by region and time. The capital cost assumes a 40% capacity utilization factor, and the fuel use component assumes a 1.5% LNG loss in regasification. LNG regasification cost in GNGM is shown in Figure 58.

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[44] Rates adopted from IEO 2011.

Figure 58: Regasification Costs per MMBtu by Region 2010-2035

	2010	2015	2020	2025	2030	2035
C&S America	$0.73	$0.73	$0.73	$0.74	$0.74	$0.75
Canada	$0.73	$0.74	$0.75	$0.76	$0.77	$0.78
China/India	$0.87	$0.88	$0.88	$0.88	$0.89	$0.89
Europe	$0.81	$0.83	$0.84	$0.86	$0.86	$0.87
FSU	$0.74	$0.75	$0.75	$0.76	$0.77	$0.78
Korea/Japan	$0.89	$0.90	$0.90	$0.91	$0.91	$0.91
Middle East	$0.72	$0.72	$0.73	$0.73	$0.73	$0.73
Southeast Asia	$0.71	$0.71	$0.71	$0.72	$0.72	$0.72
U.S.	$0.73	$0.73	$0.74	$0.75	$0.76	$0.77

3. Shipping Cost

GNGM assumes that the shipping capacity constraint is non-binding. There are sufficient LNG carriers to service any potential future route in addition to existing routes.

Shipping cost consists of a tanker cost and a LNG boil-off cost, both of which are a function of the distance between the export and import regions. An extra Panama Canal toll of 13 cents roundtrip is applied to gulf-Asia Pacific shipments.[45] Tanker costs are based on a $65,000 rent per day and average tanker speed of 19.4 knots. Fuel use costs assume a 0.15% per day boil off rate and an average tanker capacity of 149,000 cubic meters of LNG. LNG boil-off cost is valued at city gate prices in importing regions. Shipping distances for existing routes are based upon the GIIGNL's 2010 LNG Industry report while distances for potential routes are calculated with the Sea Rates online widget.[46]

45 $0.13 roundtrip toll calculated based upon a 148,500 cubic meter tanker using approved 2011 rates published at http://www.pancanal.com/eng/maritime/tolls.html.

46 http://www.searates.com/reference/portdistance/.

Figure 59: 2010 Shipping Rates ($/MMBtu)

	Canada	China/ India	C&S America	Europe	Korea/ Japan	Oceania	SE Asia	U.S.
Africa		$1.76	$1.44	$0.46	$2.60		$1.70	$2.60
Canada		$1.51	$1.53		$1.23		$1.55	
China/ India								$2.81
C&S America	$1.53	$2.22	$1.26	$1.39	$2.73			$1.54
Europe								$1.27
FSU			$2.15			$2.39	$2.44	$1.17
Korea/ Japan								$2.54
Middle East		$0.96	$2.36	$1.30	$1.61		$1.15	$2.16
Oceania		$0.74	$2.38		$0.90		$0.63	$2.41
Sakhalin		$0.48			$0.26		$0.84	$2.50
Southeast Asia		$0.52			$0.66		$0.32	$2.63
U.S.		$2.81	$1.53	$1.27	$2.54		$2.61	

The Gulf Coast has a comparative disadvantage in accessing the Asia pacific market due to the long shipping distances and Panama Canal tolls.

4. LNG Pipeline Costs

A pair of pipeline transport costs is also included in LNG delivery process to account for the fact that pipelines are necessary to transport gas from wellheads to liquefaction facilities in supply regions and from regasification facilities to city gates in demand regions.

Figure 60: Costs to Move Natural Gas from Wellheads to Liquefaction Plants through Pipelines ($/MMBtu)

Region	Cost
Africa	$1.00
Canada	$0.70
China/India	$1.50
C&S America	$0.50
Europe	$1.00
FSU	$1.00
Korea/Japan	$1.00
Middle East	$1.42
Oceania	$0.50
Sakhalin	$0.50
Southeast Asia	$1.00
U.S.	$1.00

Figure 61: Costs to Move Natural Gas from Regasification Plants to City Gates through Pipelines ($/MMBtu)

Region	Cost
Africa	$1.00
Canada	$0.50
China/India	$1.50
C&S America	$0.50
Europe	$1.00
FSU	$1.00
Korea/Japan	$0.50
Middle East	$1.42
Oceania	$0.50
Sakhalin	$0.50
Southeast Asia	$1.00
U.S.	$1.00

5. Total LNG Costs

Costs involved in exporting LNG from the Gulf Coast to demand regions are aggregated in Figure 62. The largest cost components are liquefaction and shipping.

Figure 62: Total LNG Transport Cost, 2015 ($/MMBtu)

	China/India	Europe	Korea/Japan
Regas to city gate pipeline cost	$1.50	$1.00	$0.50
Regas cost	$0.88	$0.83	$0.90
Shipping cost	$2.87	$1.33	$2.60
Liquefaction cost	$2.14	$2.14	$2.14
Wellhead to liquefaction pipeline cost	$1.00	$1.00	$1.00
Total LNG transport cost	$8.39	$6.30	$7.14

F. Elasticity

1. Supply Elasticity

All regions are assumed to have a short-run supply elasticity of 0.2 in 2010 and a long-run elasticity of 0.4 in 2035. Elasticities in the intermediate years are interpolated with a straight line method. There are two exceptions to this rule.

The U.S. supply elasticity is computed based upon the price and production fluctuations under different scenarios in the EIA Study. The median elasticity in 2015 and 2035 is recorded and elasticities for the other years are extrapolated with a straight line method.

After numerous test runs, we found that African supply elasticity is appropriately set at 0.1 for all years. Supply elasticity in GNGM is:

Figure 63: Regional Supply Elasticity

	2010	2015	2020	2025	2030	2035
Africa	0.10	0.10	0.10	0.10	0.10	0.10
U.S.	0.17	0.24	0.33	0.46	0.65	0.90
All other regions	0.20	0.23	0.26	0.30	0.35	0.40

2. Demand Elasticity

All regions are assumed to have a short run demand elasticity of -0.10 in 2010 and a long run demand elasticity of -0.20 in 2035 except the U.S. The U.S. demand elasticity is derived based on average delivered price and consumption fluctuations reported in the EIA Study.

Figure 64: Regional Demand Elasticity

	2010	2015	2020	2025	2030	2035
U.S.	-0.33	-0.36	-0.39	-0.42	-0.46	-0.50
All other regions	-0.10	-0.11	-0.13	-0.15	-0.17	-0.20

G. Adders from Model Calibration[47]

Figure 65: Pipeline Cost Adders ($/MMBtu)

Exporters	Importers	2010	2015	2020	2025	2030	2035
Africa	Europe	$7.43	$8.23	$8.88	$9.83	$10.03	$10.62
Canada	Canada	$0.20	$0.20	$0.20	$0.20	$0.20	$0.20
Canada	U.S.	$0.30	$0.12				
FSU	China/India	$8.71	$8.93	$8.58	$8.30	$8.03	$7.31
FSU	Europe	$4.88	$5.47	$5.83	$6.46	$6.32	$6.52
Sakhalin	Sakhalin	$2.04	$2.04	$2.04	$2.04	$2.04	$2.04

47 Appendix B provides details on the generation of cost adders in GNGM.

Figure 66: LNG Cost Adders Applied to Shipping Routes ($/MMBtu)

Exporter	Importer	2010	2015	2020	2025	2030	2035
Africa	China/India	$3.59	$3.97	$3.89	$3.89	$3.93	$3.57
Africa	Europe	$1.73	$2.50	$3.11	$4.01	$4.18	$4.73
Africa	Korea/Japan	$5.09	$5.60	$5.54	$5.59	$5.70	$5.33
Canada	China/India	$5.91	$2.16	$1.71	$0.90	$0.72	-
Canada	Korea/Japan	$8.54	$4.93	$4.52	$3.77	$3.67	$2.44
C&S America	China/India	$4.06	$4.41	$4.29	$4.25	$4.24	$3.85
C&S America	Europe	$1.73	$2.43	$2.97	$3.78	$3.90	$4.36
C&S America	Korea/Japan	$5.89	$6.37	$6.28	$6.30	$6.37	$5.96
Sakhalin	China/India	$6.64	$7.09	$7.07	$7.16	$7.29	$7.01
Sakhalin	Korea/Japan	$9.19	$9.79	$9.81	$9.96	$10.17	$9.89
Middle East	China/India	$5.05	$5.49	$5.47	$5.55	$5.67	$5.40
Middle East	Europe	$1.55	$2.32	$2.96	$3.88	$4.11	$4.70
Middle East	Korea/Japan	$6.74	$7.31	$7.32	$7.46	$7.65	$7.37
U.S.	China/India	$1.51	$1.86	$1.60	$0.92	$0.80	$0.08
U.S.	Europe	-	$0.61	$1.02	$1.21	$1.21	$1.35
U.S.	Korea/Japan	$4.13	$4.62	$4.40	$3.78	$3.74	$3.00
Oceania	China/India	$4.26	$4.66	$4.58	$4.59	$4.64	$4.29
Oceania	Korea/Japan	$6.44	$6.99	$6.94	$7.01	$7.14	$6.77
Southeast Asia	China/India	$4.21	$4.59	$4.48	$4.46	$4.47	$4.08
Southeast Asia	Korea/Japan	$6.42	$6.94	$6.86	$6.91	$7.00	$6.58

H. Scenario Specifications

Figure 67: Domestic Scenario Conditions

	2010	2015	2020	2025	2030	2035
Reference Case						
Production (Tcf)	21.10	22.40	23.40	24.00	25.10	26.40
Wellhead price ($/MMBtu)	$3.72	$3.83	$4.28	$5.10	$5.48	$6.36
Pipeline imports from Canada (Tcf)	2.33	2.33	1.4	0.74	0.64	0.04
High EUR						
Production (Tcf)	21.21	24.68	26.37	27.52	28.61	30.19
Wellhead price ($/MMBtu)	$3.23	$2.90	$3.15	$3.72	$4.14	$4.80
Pipeline imports from Canada (Tcf)	2.18	2.01	0.87	0.01	-0.18	-0.68
Low EUR						
Production (Tcf)	20.93	19.61	19.88	20.06	21.13	21.67
Wellhead price ($/MMBtu)	$4.54	$5.65	$6.37	$7.72	$8.23	$8.85
Pipeline imports from Canada (Tcf)	2.45	2.66	2.06	1.96	1.93	1.66

Figure 68: Incremental Worldwide Natural Gas Demand under Two International Scenarios (in Tcf of Natural Gas Equivalents)

	2010	2015	2020	2025	2030	2035
Demand Shock						
Japan converts nuclear to gas	2.41	3.18	3.41	3.56	3.86	4.19
Supply& Demand Shock						
Japan and Korea convert nuclear to gas and limited international supply expansion	3.82	5.00	5.59	5.88	6.37	6.86

Sources: EIA IEO 2011 Nuclear energy consumption, reference case.

Figure 69: Scenario Export Capacity (Tcf)

	2010	2015	2020	2025	2030	2035
No Export	0	0	0	0	0	0
Low Slow	0	0.37	2.19	2.19	2.19	2.19
High Slow	0	0.37	2.19	4.02	4.38	4.38
Low Rapid	0	1.10	2.19	2.19	2.19	2.19
High Rapid	0	1.10	4.38	4.38	4.38	4.38
Low/Slowest	0	0.18	1.10	2.01	2.19	2.19
No Constraint	∞	∞	∞	∞	∞	∞

Source: EIA Study.

APPENDIX B – DESCRIPTION OF MODELS

A. Global Natural Gas Model

The GNGM is a partial-equilibrium model designed to estimate the amount of natural gas production, consumption, and trade by major world natural gas consuming and/or producing regions. The model maximizes the sum of consumers' and producers' surplus less transportation costs, subject to mass balancing constraints and regasification, liquefaction, and pipeline capacity constraints.

1. Model Calibration

The model is calibrated to match the EIA's IEO and AEO 2011 Reference Case natural gas production, consumption, wellhead, and delivered price forecasts, after adjusting the AEO and IEO production and consumption forecasts so that:

- World supply equaled world demand
- U.S. imports from Canada equaled total U.S. imports as defined by the AEO Reference case, less U.S. LNG imports as defined by the AEO Reference case
- Middle East LNG exports were capped at 4.64 Tcf, which meant that for the Middle East
    - Production ≤ Demand + Min(Liquefaction capacity, LNG export cap)
- FSU pipeline capacity satisfied the expression
    - Production ≤ Demand + pipeline export capacity
- Regasification capacity satisfied the expression for LNG importing regions:
    - Production ≤ Supply + Regasification Capacity
- Sufficient liquefaction capacity exists in LNG exporting regions
    - Production ≤ Demand + liquefaction capacity + pipeline export capacity

The GNGM assumes that the world natural gas market is composed of a perfectly competitive group of countries with a dominant supplier that limits exports. Therefore, if we simply added the competitive transportation costs to transport gas among regions, the model would not find the market values and would be unable to match the EIA's forecasts because the world natural gas market is not perfectly competitive and at its current scale includes important risks and transaction costs. For example, the city gate prices in the Korea/Japan region represent not only the cost of delivering LNG to this region but also this region's willingness to pay a premium above the market price to ensure a stable supply of imports.

Therefore to calibrate the GNGM to the EIA's price and volume forecasts, we had to introduce cost adders that represented the real world cost differentials, including these transaction costs. To derive these cost adders, we developed a least-squares algorithm that solved for these adders. The least-squares algorithm minimized the sum of the inter-region pipeline and LNG shipping cost adders subject to matching the EIA natural gas production, consumption, wellhead, and city gate prices for each region (see Appendix A for the resulting cost adders).

These pipeline and LNG shipping cost adders were added to the original pipeline and LNG shipping costs, respectively, to develop adjusted pipeline and LNG shipping costs. The GNGM made use of these adjusted transportation costs in all the model runs.

These adders can be interpreted in several ways consistent with their function in the GNGM:

- As transaction costs that could disappear as the world market became larger and more liquid, in the process shifting downward the demand curve for assured supplies in the regions where such a premium now exists
- As a leftover from long term contracts and therefore a rent to producers that will disappear as contracts expire and are renegotiated
- As a rent taken by natural gas utilities and traders within the consuming regions, that would either continue to be taken within importing countries or competed away if there were more potential suppliers

Under all of these interpretations, the amount of the adder would not be available to U.S. exporters, nor would it be translated into potentially higher netback prices to the U.S.

2. Input Data Assumptions for the Model Baseline

a. GNGM Regions

The GNGM regional mapping scheme is largely adapted from the EIA IEO regional definitions with modifications to address the LNG-intensive regions.

- OECD Regions: the OECD region of Americas maps to GNGM regions U.S., Canada and Central and South America; OECD Europe maps to GNGM Europe; OECD Asia maps to GNGM Korea-Japan and Oceania.
- Non-OECD Regions: the non-OECD regions of Eurasia and Europe map to GNGM regions Former Soviet Union and Sakhalin; Non-OECD Asia maps to China-India and Southeast Asia; Middle East maps to GNGM Middle East; Africa to GNGM Africa; Non-OECD Central and South America maps to GNGM Central and South America.
- Sakhalin is a Russian island just north of Japan. All Russian or FSU LNG exports in 2010 were produced in Sakhalin.[48] This island is characterized as a pure supply region with zero demand and adopted as a separate GNGM region from the rest of the FSU for its proximity to the demand regions. Its LNG production in 2010 is set equal to the

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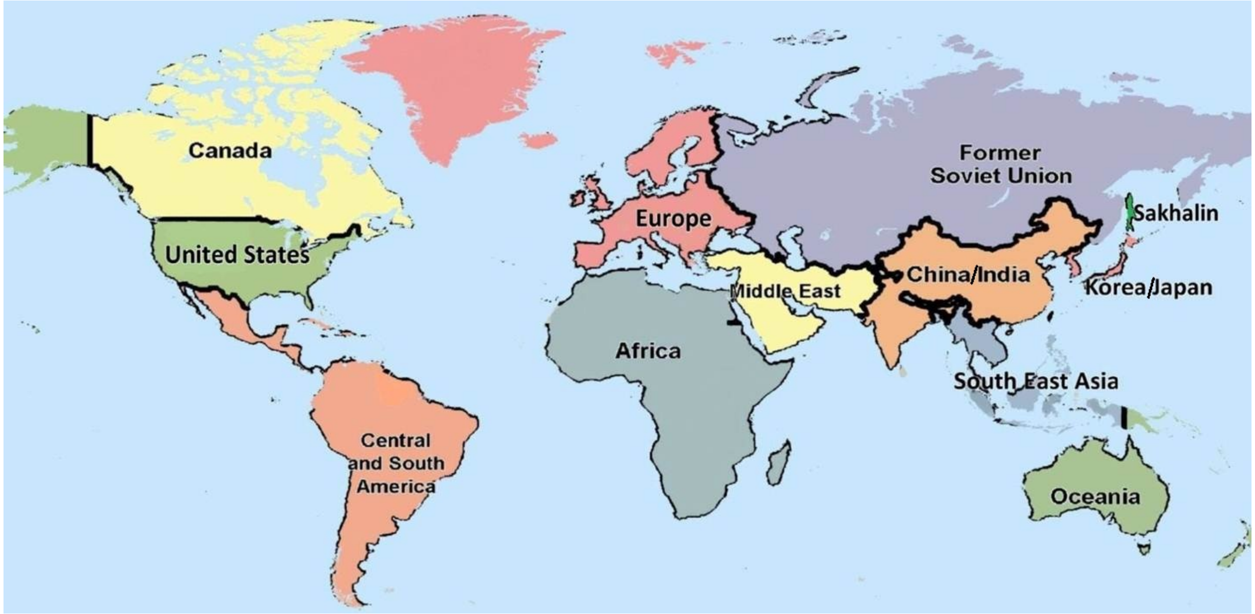
48 "The LNG Industry 2010," GIIGNL. Available at: www.giignl.org/fr/home-page/publications.

FSU's LNG exports in 2010 and grows at a rate of 1.1% per annum for the subsequent years.[49]

Figure 70: Map of the Twelve Regions in the GNGM



b. Time Horizon

GNGM reads in forecast data from each year and outputs the optimized gas trade flows. The model's input data currently covers years 2010 through 2035, but can be readily extended given data availability. For this analysis, we solved the model in five-year time steps starting with 2010.

c. Projected World Natural Gas Production and Consumption

The model's international natural gas consumption and production projections are based upon the IEO 2011 reference case. GNGM assumes four different future U.S. natural gas markets: the AEO 2011 reference case is adopted as the baseline and three other U.S. futures are obtained with the following modifications.

- High Shale EUR: U.S. natural gas production and wellhead prices are replaced by AEO 2011 High Shale EUR projections. All other regions are held constant.
- Low Shale EUR: U.S. natural gas production and wellhead prices are replaced by AEO 2011 Low Shale EUR projections. All other regions are held constant.
- High Economic Growth: U.S. natural gas consumption is replaced by AEO 2011 High Economic Growth projections. All other regions are held constant.

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[49] The 1.1% per annum rate corresponds to IEO 2011 projected Russian natural gas production average annual growth rate for 2008 through 2035.

d. Gas Production and Consumption Prices

NERA has developed a set of world natural gas price projections based upon a number of data sources. The approach focuses on the wellhead price forecasts for net export regions and city gate price forecasts for net import regions. In naturally gas-abundant regions like the Middle East and Africa, the wellhead price is assumed to equal the natural gas extraction cost or lifting cost. City gate prices are estimated by adding a transportation cost to the wellhead prices.

In the major demand markets, natural gas prices are determined on an oil-parity basis using crude oil price forecasts from IEA's WEO 2011. The resultant prices are highly consistent with the relevant historical pipeline import prices[50] and LNG spot market prices as well as various oil and natural gas indices (*i.e.*, JCC, WTI, Henry Hub, AECO Hub indices, and UK National Balancing Point). U.S. wellhead and average city gate prices are adopted from AEO 2011. Canadian wellhead and city gate prices are projected to be $0.35 less than the U.S. prices in the reference case. A region-by-region price forecast description is presented in Section II.

e. Natural Gas Transport Options

Pipelines

GNGM assumes that all intra-regional pipeline capacity constraints are non-binding. Each region is able to transport its indigenously-produced natural gas freely within itself at an appropriate cost.

Four inter-regional pipeline routes are acknowledged in GNGM. The Africa-to-Europe route, including the Greenstream Pipeline, Trans-Mediterranean Pipeline, and Maghreb–Europe Gas Pipeline, is assigned a total capacity of 1.9 Tcf/year (connecting Northern Africa to Spain, Portugal, and Italy). The Turkmenistan–China Gas Pipeline, connecting FSU to China/India, has a maximum discharge of 1.41 Tcf/year. The FSU-Europe pipeline route has a total capacity of 8.3 Tcf/year in 2010 and grows to 10.8 Tcf/year in 2025. Lastly, the U.S.-Canada pipeline route is open and assumed to have unlimited capacity.

LNG Routes

GNGM sets two constraints on LNG transportation. Each export region is subjected to a liquefaction capacity constraint and each import region to a regasification capacity constraint. There are five components in transporting LNG (Figure 71), and capacity constraints on the wellhead to liquefaction pipeline, LNG tankers, and regasification to city gate pipeline are assumed to be non-binding.

LNG transportation costs are generally four to seven times higher than the pipeline alternative since, to satisfy natural gas demand with LNG, shipments incur five segments of costs: 1) pipeline shipping cost to move gas from the wellhead to the liquefaction facility, 2) liquefaction

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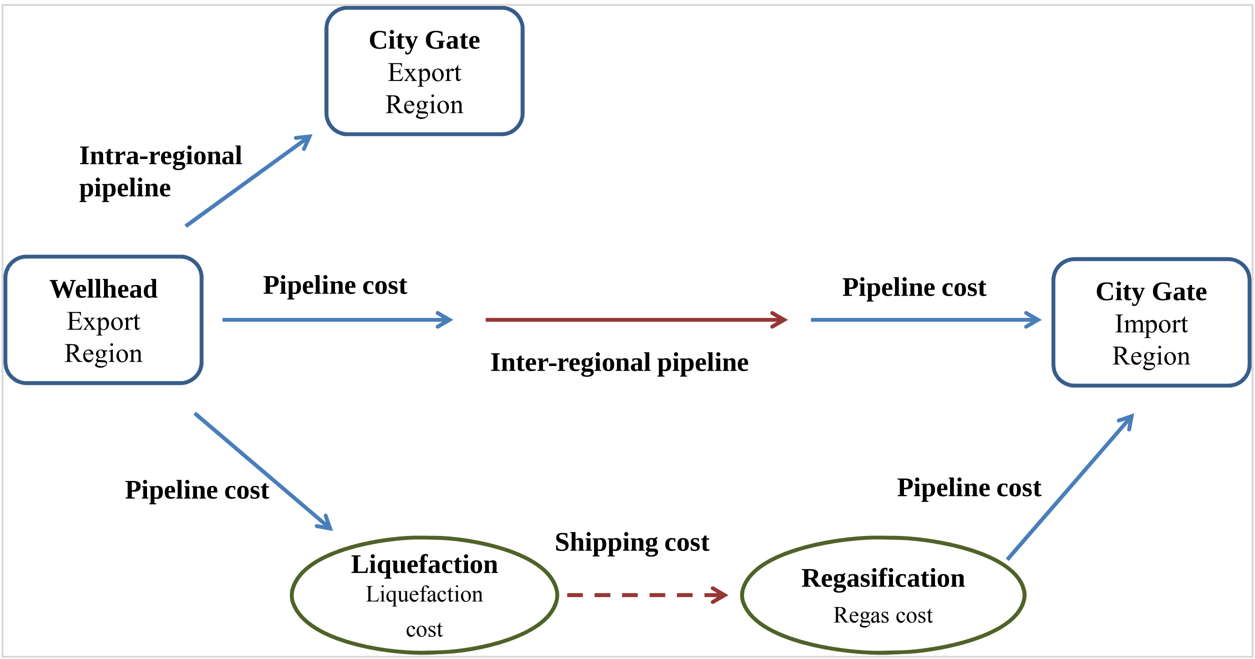
[50] German BAFA natural gas import border price, Belgium Zeebrugge spot prices, TTF Natural Gas Futures contracts, *etc*.

cost, 3) shipping cost between the liquefaction to regasification facilities, 4) regasification cost and 5) the pipeline shipping cost to move gas from the regasification facility to the city gate terminal in the demand region. A detailed cost breakdown for each leg of this process is presented in Appendix A.

Figure 71: Natural Gas Transport Options



## f.	Fuel Supply Curves

The supply of natural gas in each region is represented by a CES supply curve (see Equation 1). The supply curve provides a relationship between the supply of gas (Q) and the wellhead price of gas (P). The elasticity of the supply curves dictates how the price of natural gas changes with changes in production.

Equation 1: CES Supply Curve

$$Q(t) / Q_{0,t} = (P(t) / P_{0,t})^{\text{elasticity of supply}}$$

Each supply curve is calibrated to the benchmark data points ($Q_{0.t}$, $P_{0.t}$) for each year t, where the benchmark data points represent those of the EIA's adjusted forecasts.[51] $Q_{0.t}$ represents the EIA's adjusted forecasted quantity of natural gas production for year t, and $P_{0.t}$ represents the EIA's forecasted wellhead price of gas for year t. The elasticity of supply for all regions is included in Figure 63.

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51 See Section IV.B for a discussion of how the EIA's forecasts are adjusted before the GNGM model is calibrated. Note, only quantities are adjusted.

g. Fuel Demand Curves

The demand curve for natural gas has a similar functional form as the supply curve. As with the supply curves, the demand curve in each region is represented by a CES function (see Equation 2). The demand curve provides a relationship between the demand for gas (Q) and the city gate price of gas (P). The demand curves dictate how the price of natural gas changes with changes in demand in each region.

Equation 2: CES Demand Curve

$$Q(t) / Q_{0,t} = (P(t) / P_{0,t})^{\text{elasticity of demand}}$$

Each demand curve is calibrated to the benchmark data points ($Q_{0.t}$, $P_{0.t}$) for each year t, where the benchmark data points represent those of the EIA's adjusted forecasts. $Q_{0.t}$ represents the EIA's adjusted forecasted demand for natural gas for year t and $P_{0.t}$ represents the EIA's forecasted city gate price of gas for year t. The elasticity of demand for all regions except the U.S. is based on the elasticities used in MIT's Emissions Prediction and Policy Analysis ("EPPA") model.[52] For the U.S., the demand elasticity was estimated by using the percentage changes in natural gas demand and city gate prices between the EIA's AEO 2011 Reference scenario and the different shale gas scenarios.

3. Model Formulation

The GNGM is formulated as a non-linear program. The following text describes at a high level the GNGM's non-linear objective function and linear constraints.

Maximize: Consumer Surplus + Producer Surplus – Transportation Costs

Subject to:

$$Supply(s) = \sum_{d} PipeGas(s,d) + LNG(s,d)$$

$$Demand(d) = \sum_{s} PipeGas(s,d) + LNG(s,d)$$

$$\sum_{d} LNG(s,d) \leq LiquefactionCapacity(s)$$

$$\sum_{s} LNG(s,d) \leq RegasificationCapacity(d)$$

52 "The MIT Emissions Prediction and Policy Analysis ("EPPA") Model: Version 4," Sergey Paltsev, John M. Reilly, Henry D. Jacoby, Richard S. Eckaus, James McFarland, Marcus Sarofim, Malcolm Asadoorian and Mustafa Babiker, August 2004.

$$PipeGas(s,d) \leq PipelineCapacity(s,d)$$

$$PipeGas('Canada','USA') = BaselinePipeGas('Canada','USA')$$

Scenario Constraints

* Quota Constraint

$$\sum_{d} LNG('USA',d) \leq Quota$$

* Supply Shock

$$\sum_{d} LNG('Oceania',\mathrm{d}) + LNG('Africa',d) + LNG('SouthEastAsia',d) \leq MaxExports$$

Consumer Surplus = $\int CityGatePrice(d)\ x\ (\frac{Demand(d)}{Demand0(d)})^{(\frac{1}{ElasOfDemand(d)})}$

Producer Surplus= $\int WellheadPrice(s)\ x\ (\frac{Supply(s)}{Supply0(s)})^{(\frac{1}{ElasOfSupply(s)})}$

Transportation Costs =

$$\sum_{s,d} ShipCost(s,d)\ x\ LNG(s,d) + \sum_{s,d} PipeLineCost(s,d)\ x\ PipeGas(s,d) + \sum_{s,d} RegasCost(d)\ x\ LNG(s,d) + \sum_{s,d} LiquefactionCost(s)\ x\ LNG(s,d)$$

where,

LiquefactionCost(s) = Cost to liquefy natural gas in region s + transport the gas from the wellhead to the liquefaction facility within region s.

RegasCost(d) = Cost to re-gasify natural gas in region d + transport the gas from the regasification facility to the city gate within region d.

PipelineCost(s,d) = Cost to transport natural gas along a pipeline from supply region s to demand region d.

ShipCost(s,d) = Cost to ship natural gas from supply region s to demand region d.

Quota = Maximum allowable amount of U.S. LNG exports. This varies by time period and scenario.

The supply curves capture the technological issues (penetration rate, availability and cost) for natural gas in each region. The demand curves for natural gas capture the change in utility from consuming natural gas.

The main constraints are applied to all cases while scenario constraints are case specific. The demand shocks are modeled by changing the baseline level of natural gas demand ($Demand_0(d)$).

B. N$_{ew}$ERA Model

1. Overview of the N$_{ew}$ERA Macroeconomic Model

The N$_{ew}$ERA macro model is a forward-looking, dynamic, computable general equilibrium model of the United States. The model simulates all economic interactions in the U.S. economy, including those among industry, households, and the government. The economic interactions are based on the IMPLAN[53] 2008 database for a benchmark year, which includes regional detail on economic interactions among 440 different economic sectors. The macroeconomic and energy forecasts that are used to project the benchmark year going forward are calibrated to the most recent AEO produced by the Energy Information Administration (EIA). Because the model is calibrated to an internally-consistent energy forecast, the use of the model is particularly well-suited to analyze economic and energy policies and environmental regulations.

2. Model Data (IMPLAN and EIA)

The economic data is taken from the IMPLAN 2008 database which includes balanced Social Accounting Matrices for all states in 2008. These inter-industry matrices provide a snapshot of the economy. Since the IMPLAN database contains only economic values, we benchmark energy supply, demand, trade, and prices to EIA historical statistics to capture the physical energy flows. The integration of the EIA energy quantities and prices into the IMPLAN economic database results in a balanced energy-economy dataset.

Future economic growth is calibrated to macroeconomic (GDP), energy supply, energy demand, and energy price forecasts from the EIA's AEO 2011. Labor productivity, labor growth, and population forecasts from the Census Bureau are used to project labor endowments along the baseline and ultimately employment by industry.

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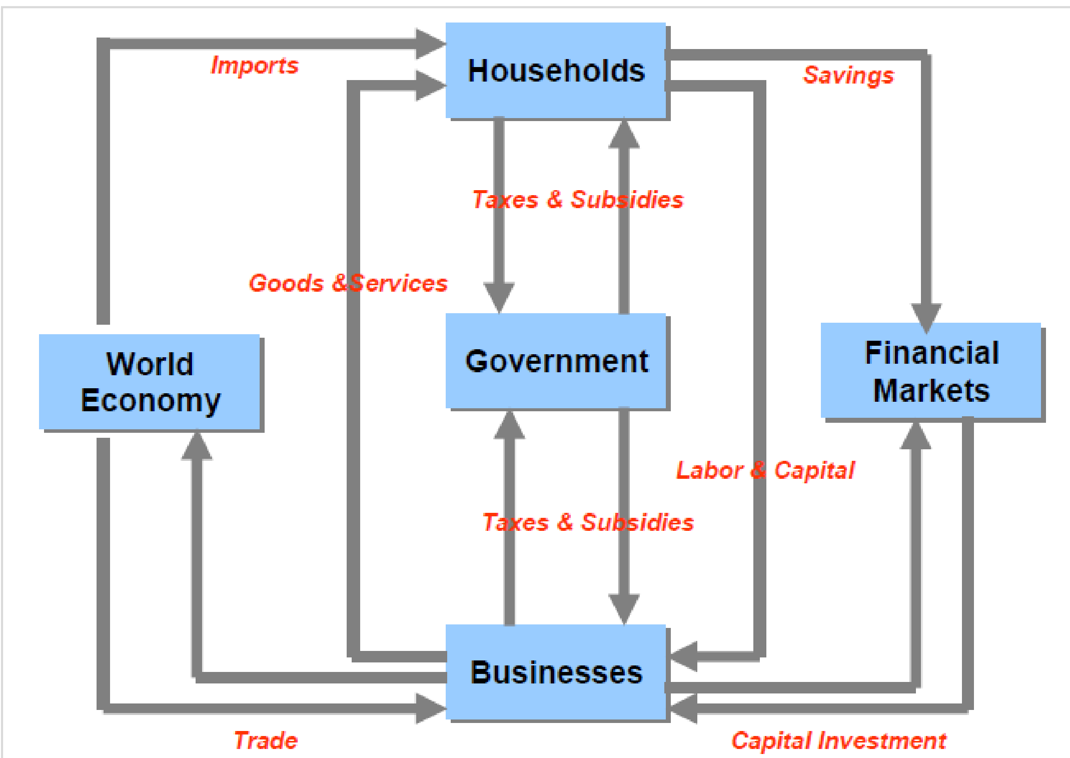
[53] IMPLAN produces unique set of national structural matrices. The structural matrices form the bais for the inter-industry flows which we use to characterize the production, household, and government transactions, see www.implan.com.

3. Brief Discussion of Model Structure

The theoretical construct behind the N_{ew}ERA model is based on the circular flow of goods, services, and payments in the economy (every economic transaction has a buyer and a seller whereby goods/service go from a seller to a buyer and payment goes from the seller to the buyer). As shown in Figure 72, the model includes households, businesses, government, financial markets, and the rest of the world economy as they interact economically in the global economy. Households provide labor and capital to businesses, taxes to the government, and savings to financial markets, while also consuming goods and services and receiving government subsidies. Businesses produce goods and services, pay taxes to the government and use labor and capital. Businesses are both consumers and producers of capital for investment in the rest of the economy. Within the circular flow, equilibrium is found whereby goods and services consumed is equal to those produced and investments are optimized for the long term. Thus, supply is equal to demand in all markets.

The model assumes a perfect foresight, zero profit condition in production of goods and services, no changes in monetary policy, and full employment within the U.S. economy.

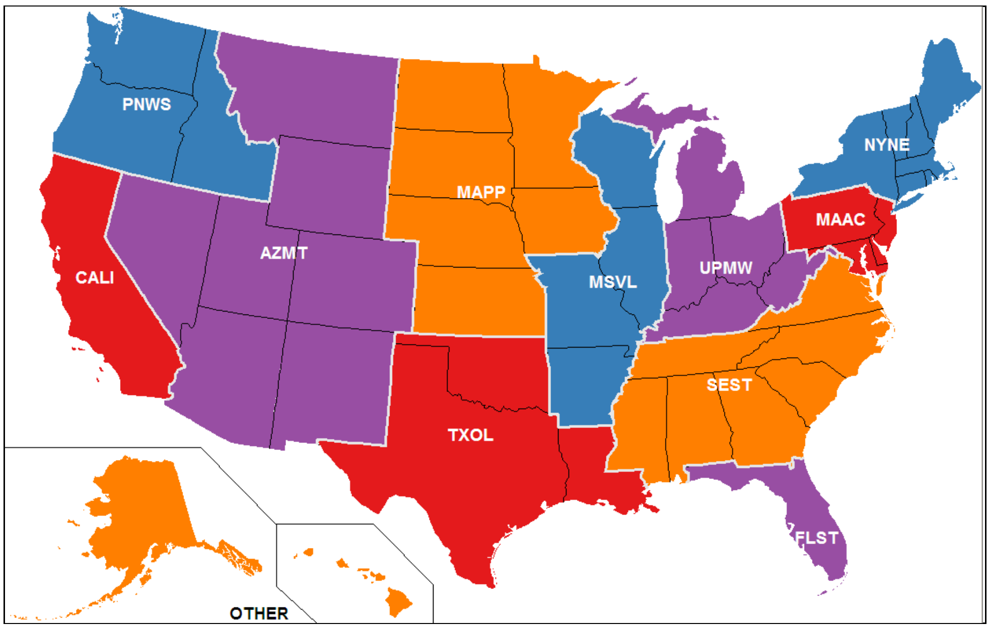
Figure 72: Circular Flow of Income



a. Regional Aggregation

The N_{ew}ERA macro model includes 11 regions: NYNE-New York and New England; MAAC-Mid-Atlantic Coast; UPMW-Upper Mid-West; SEST-South East; FLST-Florida; MSVL-Mississippi Valley; MAPP-Mid America; TXOL-Texas, Oklahoma, and Louisiana; AZMT-Arizona and Mountain states; CALI-California; and PNWS-Pacific Northwest.54 The aggregate model regions are built up from the 50 U.S. states' and the District of Columbia's economic data. The model is flexible enough to create other regional specifications, depending upon the need of the project. The 11 N_{ew}ERA regions and the States within each N_{ew}ERA region are shown in the following figure. For this Study we aggregate the 11 N_{ew}ERA regions into a single U.S. region.

Figure 73: N_{ew}ERA Macroeconomic Regions



b. Sectoral Aggregation

The N_{ew}ERA model includes 12 sectors: five energy (coal, natural gas, crude oil, electricity, and refined petroleum products) and seven non-energy sectors (services, manufacturing, energy-intensive, agriculture, commercial transportation excluding trucking, trucking, and motor vehicles). These sectors are aggregated up from the 440 IMPLAN sectors to 28 sectors, defined as the AEO sector in Figure 74. These 28 sectors' economic and energy data are consistent with IMPLAN and EIA, respectively. For this study, we further aggregate these 28 production sectors into 12 sectors. The mapping of the sectors is show below in Figure 72. The model has the flexibility to represent sectors at any level of aggregation.

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[54] Hawaii and Alaska are included in the PNWS region.

Figure 74: N_{ew}ERA Sectoral Representation

	NewERA	AEO	
Final Demand	C	C	Household consumption
	G	G	Government consumption
	I	I	Investment demand
Energy Sectors	COL	COL	Coal
	GAS	GAS	Natural gas
	OIL	OIL	Refined Petroleum Products
	CRU	CRU	Crude oil
	ELE	ELE	Electricity
Non-Energy Sectors	AGR	AGR	Agriculture
	TRN	TRN	Transportation
	TRK	TRK	Trucking
	M_V	M_V	Motor vehicle
	SRV	SRV	Services
	SRV	DWE	Dwellings
	EIS	PAP	Paper and Pulp
	EIS	CHM	Chemicals
	EIS	GLS	Glass Industry
	EIS	CMT	Cement Industry
	EIS	I_S	Primary Metals
	EIS	ALU	Alumina and Aluminum
	MAN	CNS	Construction
	MAN	MIN	Mining
	MAN	FOO	Food, Beverage and Tobacco Products
	MAN	FAB	Fabricated Metal Products
	MAN	MAC	Machinery
	MAN	CMP	Computer and Electronic Products
	MAN	TRQ	Transportation Equipment
	MAN	ELQ	Electrical Equip., Appliances, and Components
	MAN	WOO	Wood and furniture
	MAN	PLA	Plastics
	MAN	OMA	Other Manufacturing sectors

c. Production and Consumption Characterization

Behavior of households, industries, investment, and government is characterized by nested constant elasticity of substitution production or utility functions. Under such a CES structure, inputs substitute against each other in a nested form. The ease of substitutability is determined by the value of the elasticity of substitution between the inputs. The higher the value of the substitution elasticity between the inputs, the greater the possibility of tradeoffs.

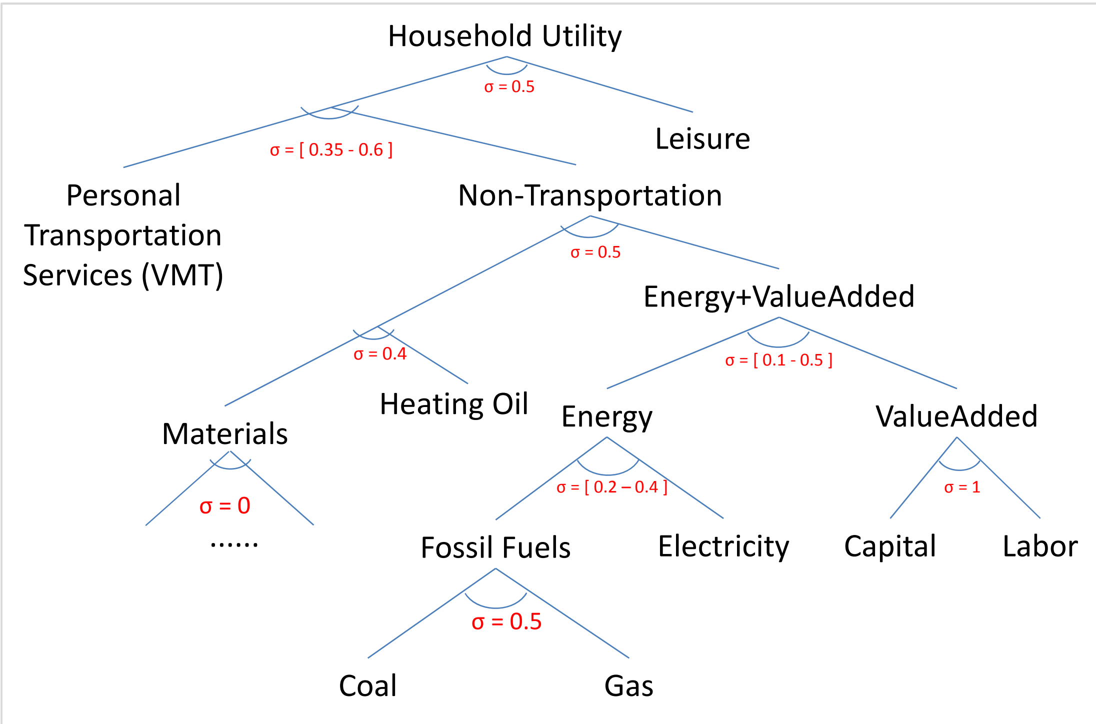
The CES nesting structure defines how inputs to a production activity compete with each other. In the generic production structure, intermediate inputs are aggregated in fixed proportion with a composite of energy and value-added inputs. The energy input aggregates fossil and non-fossil energy sources, and the value-added input combines capital and labor. Sectors with distinctive production characteristics are represented with structures different from the generic form. For alternative transportation fuels, such as ethanol and bio-diesel, inputs are demanded in fixed proportion. The characterization of nonrenewable resource supply adds a fixed resource that is calibrated to a declining resource base over time, so that it implies decreasing returns to scale.

This also implies rising marginal costs of production over time for exhaustible resources. The detailed nesting structure of the households and production sectors, with assumed elasticity of substitution parameters, are shown in figures below.

i. Households

Consumers are represented by a single representative household. The representative household derives utility from both consumption of goods and services, transportation services, and leisure. The utility is represented by a nested CES utility function. The elasticity of substitution parameters between goods are shown in Figure 75.

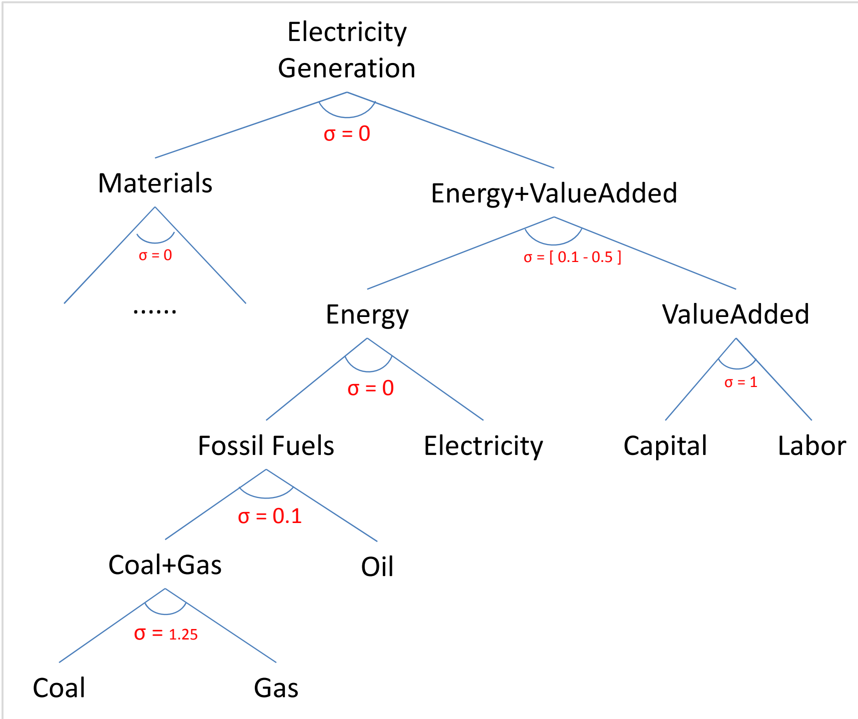
Figure 75: N$_{ew}$ERA Household Representation



ii. Electric Sector

We assume a simple representation of the electric sector. The electric sector models natural gas, coal, and oil-fired generation. The representation of the production is shown below.

Figure 76: N_{ew}ERA Electricity Sector Representation



iii. Other Sectors

The trucking and commercial transportation sector production structure is shown in Figure 77. The trucking sector uses diesel as transportation fuel. This sector has limited ability to substitute other fossil fuels. The other industrial sectors (agriculture, manufacturing, energy-intensive, motor vehicles) and the services sector production structure, with assumed elasticity of substitution, are shown in Figure 78.

Figure 77: N$_{ew}$ERA Trucking and Commercial Transportation Sector Representation

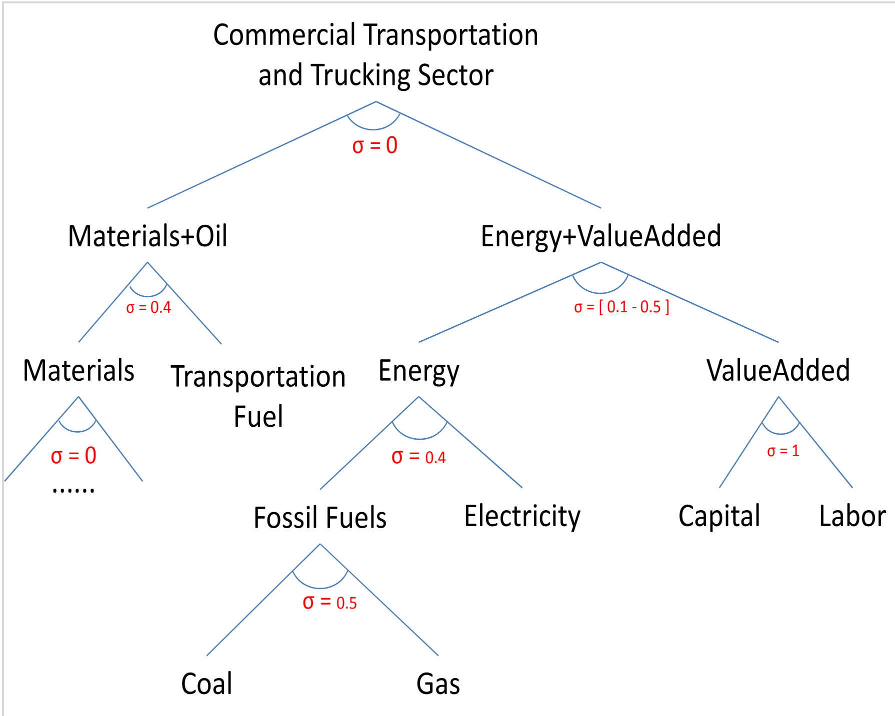
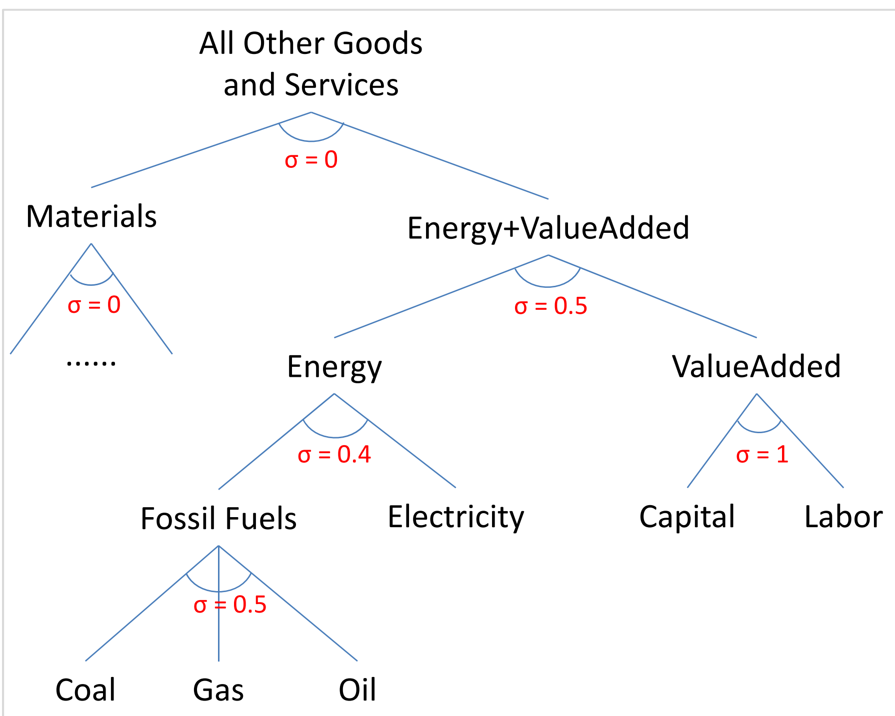


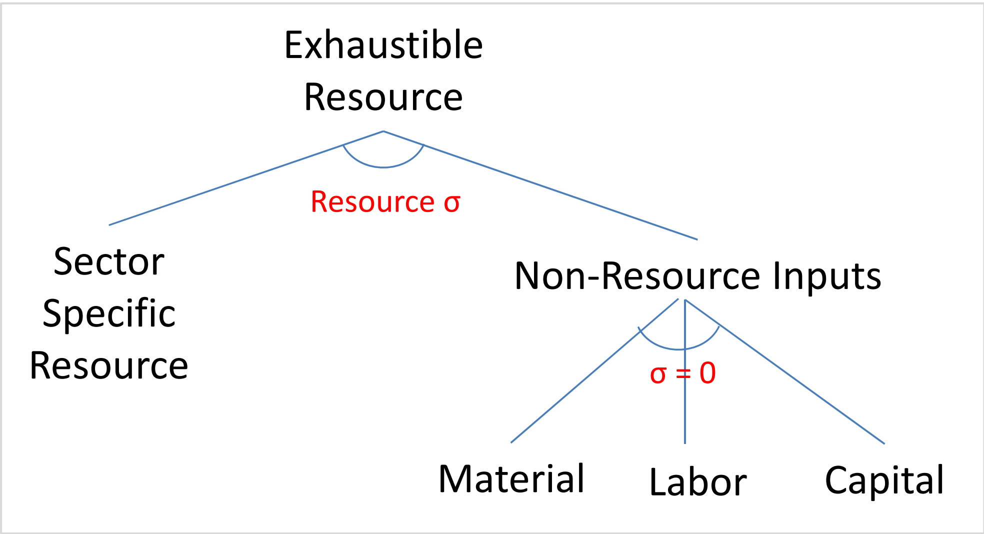
Figure 78: N$_{ew}$ERA Other Production Sector Representation



iv. Exhaustible Resource Sector

The simplest characterization of non-renewable resource supply adds a fixed resource that is calibrated to decline over time, so that the decreasing returns to scale implied for the non-resource inputs lead to rising marginal costs of production over time. The top level elasticity of substitution parameter is calibrated to be consistent with resource supply elasticity. We assume natural gas resource supply elasticity to be 0.25 in the short run (2010) and 1.5 in the long run (2050). Similarly, crude oil supply elasticity is assumed to be 0.3 in 2010 and 1.0 in 2050. Coal supply elasticity is assumed to be 0.4 in 2010 and 1.5 in 2050. The production structure of natural gas, crude oil, and coal is shown below.

Figure 79: N$_{ew}$ERA Resource Sector Representation



d. Trade Structure

All goods and services, except crude oil, are treated as Armington goods, which assumes that domestic and foreign goods are differentiated and thus, are imperfect substitutes. The level of imports depends upon the elasticity of substitution between the imported and domestic goods. The Armington elasticity among imported goods is assumed to be twice as large as the elasticity between domestic and aggregate imported goods, characterizing greater substitutability among imported goods.

We balance the international trade account in the N$_{ew}$ERA model by constraining changes in the current account deficit over the model horizon. The condition is that the net present value of the foreign indebtedness over the model horizon remains at the benchmark year level. This prevents distortions in economic effects that would result from perpetual increases in borrowing, but does not overly constrain the model by requiring current account balances in each year.

This treatment of the current account deficit does not mean that there cannot be trade benefits from LNG exports. Although trade will be in balance over time, the terms of trade shift in favor of the U.S. because of LNG exports. That is, by exporting goods of greater value to overseas customers, the U.S. is able to import larger quantities of goods than it would able to if the same domestic resources were devoted to producing exports of lesser value. Allowing high value exports to proceed has a similar effect on terms of trade as would an increase in the world price of existing exports or an increase in productivity in export industries. In all these cases, the U.S. gains more imported goods in exchange for the same amount of effort being devoted to production of goods for export. The opposite is also possible, in that a fall in the world price of U.S. exports or a subsidy that promoted exports of lesser value would move the terms of trade against the U.S., in that with the same effort put into producing exports the U.S. would receive less imports in exchange and terms of trade would move against the U.S. The fact that LNG will be exported only if there is sufficient market demand ensures that terms of trade will improve if LNG exports take place.

e. Investment Dynamics

Periods in the model are linked by capital and investment dynamics. Capital turnover in the model is represented by the standard process that capital at time t+1 equals capital at time t plus investment at time t minus depreciation. The model optimizes consumption and savings decisions in each period, taking account of changes in the economy over the entire model horizon with perfect foresight. The consumers forego consumption to save for current and future investment.

f. Model Assumptions

The underlying assumptions of labor growth and initial capital stock drive the economy over time in the model.

The model assumes full employment in the labor market. This assumption means total labor demand in a policy scenario would be the same as the baseline labor projection. The baseline labor projections are based on population growth and labor productivity forecasts over time. Hence, the labor projection can be thought to be a forecast of efficient labor units. The model assumes that labor is fungible across sectors. That is, labor can move freely out of a production sector into another sector without any adjustment costs or loss of productivity. Capital, on the other hand, is vintaged in the model. We assume two types of capital stock to portray the current technology and more advanced technologies that develop over time. A non-malleable capital (the clay) is used in fixed proportion in the existing production activity. The clay portion of the capital decays over time as new capital replaces it. A malleable capital (the putty) is used in new production activity. The putty capital in the new production activity can substitute against other inputs. The replacement of the clay capital depends upon the extent of use of new capital. This gradual capital turnover of the fixed capital stock and costs associated with it is represented by the putty-clay formulation.

Energy intensities are calibrated to the EIA projections. The differentiated energy intensities across regions result in different responses in energy supply and demand as energy price changes.

The N_{ew}ERA macroeconomic model includes a simple tax representation. The model includes only two types of input taxes: marginal tax rates on capital and labor. The tax rates are based on the NBER TAXSIM model. Other indirect taxes such as excise and sales are included in the output values and not explicitly modeled.

The N_{ew}ERA macro model is solved through 2050, starting from 2010 in five-year time intervals.

g. Some Key Model Features

There are great uncertainties about how the U.S. natural gas market will evolve, and the N_{ew}ERA model is designed explicitly to address the key factors affecting future natural gas demand supply, and prices. One of the major uncertainties is the availability of shale gas in the United States. To account for this uncertainty and the subsequent effect it could have on the domestic markets, the N_{ew}ERA model includes resource supply curves for U.S. natural gas. The model also accounts for foreign imports, in particular pipeline imports from Canada, and the potential build-up of liquefaction plants for LNG exports. N_{ew}ERA also has a supply (demand) curve for U.S. imports (exports) that represents how the global LNG market price would react to changes in U.S. imports or exports. On a practical level, there are also other important uncertainties about the ownership of LNG plants and how the LNG contracts will be formulated. These have important consequences on how much revenue can be earned by the U.S. and hence overall macroeconomic impacts. In the N_{ew}ERA model it is possible to represent these variations in domestic versus foreign ownership of assets and capture of export revenues to better understand the issues.

In addition, we assume that natural gas is a homogenous good, similar to crude oil price. Hence, if there was a no-export constraint on LNG exports, domestic natural gas price will converge with the world net-back price.

Consumption of electricity as a transportation fuel could also affect the natural gas market. The N_{ew}ERA model is able to simulate impacts on the supply and disposition of transportation fuels (petroleum-based, biofuels, and electricity), along with responses to the personal driving behavior of the consumer. The personal driving or personal transportation services in the model is represented by Vehicle Miles Traveled ("VMT"), which takes vehicles' capital, transportation fuels, and other driving expenditures as inputs. The model chooses among changes in consumption of transportation fuels, changes in vehicle fuel efficiency, and changes in the overall level of travel in response to changes in the transportation fuel prices.

h. Advantages of the Macro Model Framework

The N_{ew}ERA model incorporates EIA energy quantities and energy prices into the IMPLAN Social Accounting Matrices. This in-house developed approach results in a balanced energy-economy dataset that has internally consistent energy benchmark data, as well as IMPLAN consistent economic values.

The macro model incorporates all production sectors and final demanders of the economy and is linked through terms of trade. The effects of policies are transmitted throughout the economy as all sectors and agents in the economy respond until the economy reaches equilibrium. The ability of the model to track these effects and substitution possibilities across sectors and regions makes it a unique tool for analyzing policies, such as those involving energy and environmental regulations. These general equilibrium substitution effects, however, are not fully captured in a partial equilibrium framework or within an input-output modeling framework. The smooth production and consumption functions employed in this general equilibrium model enable gradual substitution of inputs in response to relative price changes, thus, avoiding all or nothing solutions.

Business investment decisions are informed by future policies and outlook. The forward looking characteristic of the model enables businesses and consumers to determine the optimal savings and investment while anticipating future policies with perfect foresight. The alternative approach on savings and investment decisions is to assume agents in the model are myopic, thus, have no expectations for the future. Though both approaches are equally unrealistic to a certain extent, the latter approach can lead the model to produce inconsistent or incorrect impacts from an announced future policy.

The CGE modeling tool such as the N_{ew}ERA macro model can analyze scenarios or policies that call for large shocks outside historical observation. Econometric models are unsuitable for policies that impose large impacts because these models' production and consumption functions remain invariant under the policy. In addition, econometric models assume that the future path depends on the past experience and therefore fail to capture how the economy might respond under a different and new environment. For example, an econometric model cannot represent changes in fuel efficiency in response to increases in energy prices. However, the N_{ew}ERA macro model can consistently capture future policy changes that envisage having large effects.

The N_{ew}ERA macro model is also a unique tool that can iterate over sequential policies to generate consistent equilibrium solutions starting from an internally consistent equilibrium baseline forecast (such as the AEO reference case). This ability of the model is particularly helpful to decompose macroeconomic effects of individual policies. For example, if one desires to perform economic analysis of a policy that includes multiple regulations, the N_{ew}ERA modeling framework can be used as a tool to layer in one regulation at a time to determine the incremental effects of each policy.

i. Model Outputs

The N_{ew}ERA model outputs include supply and demand of all goods and services, prices of all commodities, and terms of trade effects (including changes in imports and exports). The model outputs also include gross regional product, consumption, investment, disposable income, and changes in income from labor, capital, and resources.

APPENDIX C – TABLES AND MODEL RESULTS

In this section, we present the numerical results from both the Global Natural Gas Model and the U.S. macroeconomic model ("N_{ew}ERA") for all the scenarios that were run as part of the study.

A. Global Natural Gas Model

We evaluated a total of 63 cases with all possible combinations of the following:

- Three domestic outlooks: Reference ("USREF"), High Shale EUR ("HEUR"), Low Shale EUR ("LEUR"),
- Three international outlooks: Reference ("INTREF"), Demand Shock ("D"), Supply/Demand Shock ("SD"), and
- Seven quota schedules: No-Export Capacity ("NX"), Low/Slowest ("LSS"), Low/Slow ('LS"), Low/Rapid ("LR"), High/Slow ("HS"), High/Rapid ("HR"), No-Export Constraint ("NC").

Out of the 45 cases where a quota is enforced, 21 are feasible (*i.e.,* projected U.S. LNG exports are at a level comparable to the quota allotted for each year), as shown in Figure 80. Detailed results for each case are shown in Figure 81 through Figure 143.

The U.S. Reference, International Reference, and the No-Export Capacity cases (Figure 81) are the ultimate baselines to which all other GNGM cases are compared. It assumes no U.S. and Canadian export capacities. After allowing for North American exports in the baseline scenario (Figure 87), our model determines that the U.S. does not export LNG, despite unlimited liquefaction capacities. Running the International Reference outlook with all three domestic outlooks, GNGM found that the U.S. is only able to export under the High Shale EUR scenario (Figure 87, Figure 108, and Figure 129). The projected level of exports is short of the high quotas specified by the EIA, even in the High Shale EUR case. We have thus developed two international shocks that favor U.S. LNG export.

The No-Export Constraint series shows the optimal amounts of U.S. exports under each domestic and international outlook as determined in GNGM. Since GNGM assumes a perfectly-competitive natural gas market, all quota rents are zero if the No-Export Constraint is in effect. A positive rent is collected, however, when the country supplies less than its perfectly-competitive volumes – Figure 105 is one example. When the number of export licenses available is greater than the optimal export level as determined by the natural gas market, the remaining licenses are unutilized and export rent drops to zero (Figure 93). The quota rent per MMBtu reaches the maximum under the High Shale EUR, Supply/Demand Shock, Low/Slowest quota scenario, where the conditions for U.S. exports are most favorable. However, the quota is highly restrictive (Figure 117). A high marginal price on an additional unit of export quota is thus generated.

Figure 80: Scenario Tree with Feasible Cases Highlighted

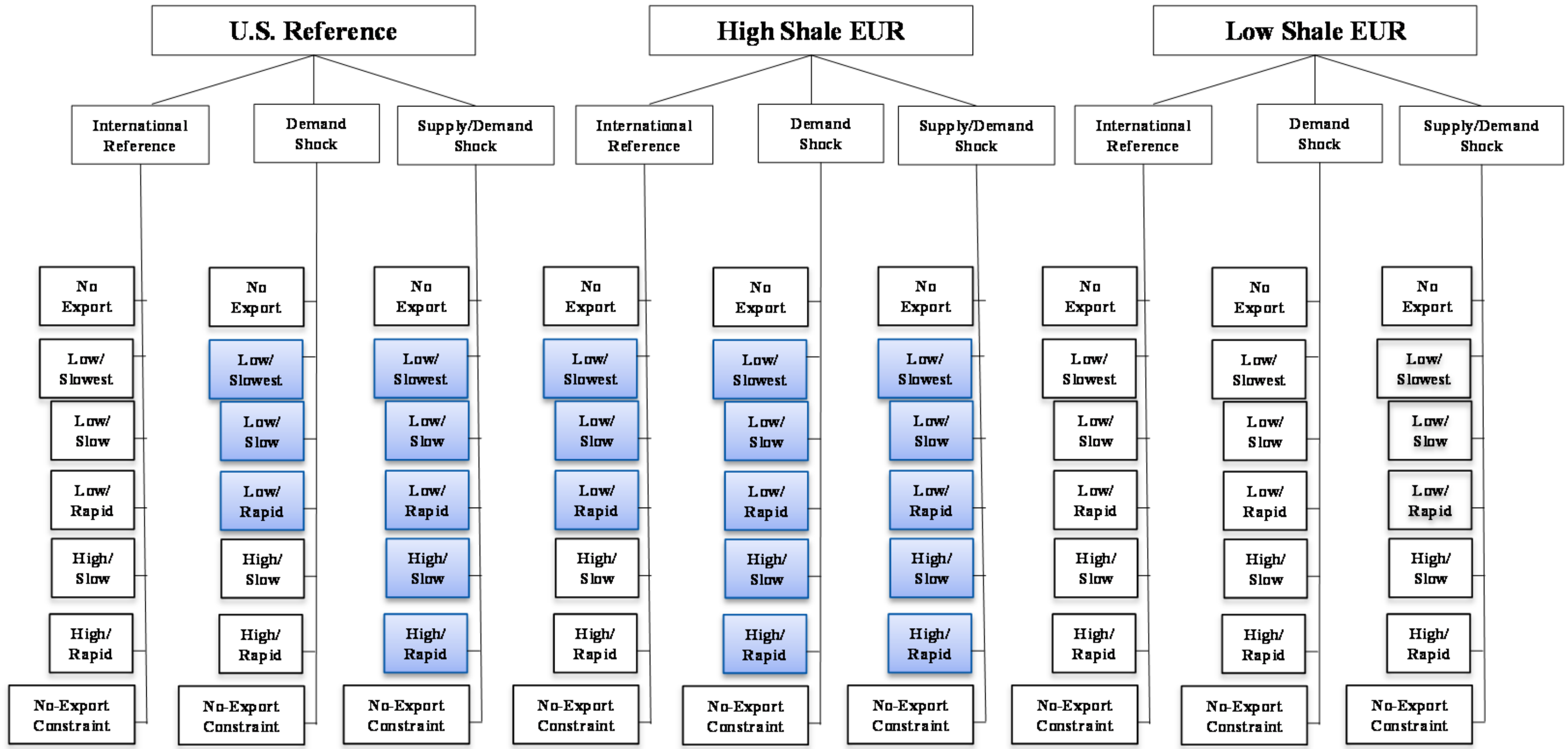


Figure 81: Detailed Results from Global Natural Gas Model, USREF_INTREF_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.09**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.09	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.09**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.10	22.39	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.23**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent (2010$/Mcf)	**-**	**$0.07**	**-**	**-**	**-**	**-**

Figure 82: Detailed Results from Global Natural Gas Model, USREF_INTREF_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.00	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.14	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	0.14	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.1	22.45	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.28**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$//Mcf)	**-**	**$4.28**	**$4.33**	**$5.11**	**$5.13**	**$5.45**
Quota Rent (2010$//Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 83: Detailed Results from Global Natural Gas Model, USREF_INTREF_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.00	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.14	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	0.14	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.1	22.45	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$//Mcf)	**$4.08**	**$4.28**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$//Mcf)	**-**	**$4.28**	**$4.33**	**$5.11**	**$5.13**	**$5.45**
Quota Rent (2010$//Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 84: Detailed Results from Global Natural Gas Model, USREF_INTREF_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.00	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.14	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	0.14	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.1	22.45	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.28**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$//Mcf)	**-**	**$4.28**	**$4.33**	**$5.11**	**$5.13**	**$5.45**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 85: Detailed Results from Global Natural Gas Model, USREF_INTREF_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.00	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.14	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	0.14	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.1	22.45	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.28**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$/Mcf)	**-**	**$4.28**	**$4.33**	**$5.11**	**$5.13**	**$5.45**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 86: Detailed Results from Global Natural Gas Model, USREF_INTREF_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.00	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.14	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	0.14	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.1	22.45	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.28**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$/Mcf)	**-**	**$4.28**	**$4.33**	**$5.11**	**$5.13**	**$5.45**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 87: Detailed Results from Global Natural Gas Model, USREF_INTREF_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.00	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.14	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	0.14	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.15**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.10	22.45	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.28**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$/Mcf)	**-**	**$4.28**	**$4.33**	**$5.11**	**$5.13**	**$5.45**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 88: Detailed Results from Global Natural Gas Model, USREF_D_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.09**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.09	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.09**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.1	22.39	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.23**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$/Mcf)	**-**	**$4.85**	**$5.11**	**$6.23**	**$6.48**	**$7.18**
Quota Rent (2010$/Mcf)	**-**	**$0.62**	**$0.53**	**$0.81**	**$0.68**	**$0.77**

Figure 89: Detailed Results from Global Natural Gas Model, USREF_D_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.16**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Demand	23.86	24.98	24.80	24.51	25.43	26.04
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.18	0.96	1.30	1.19	1.37
China/India	-	0.06	0.26	0.40	0.38	0.41
Europe	-	0.07	0.25	0.47	0.39	0.50
Korea/Japan	-	0.06	0.45	0.43	0.41	0.46
Total Supply (Tcf)	**23.86**	**25.16**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Production	21.1	22.46	23.86	24.71	25.81	27.30
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.29**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Netback Price (2010$/Mcf)	**-**	**$4.75**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Quota Rent (2010$/Mcf)	**-**	**$0.46**	**-**	**-**	**-**	**-**

Figure 90: Detailed Results from Global Natural Gas Model, USREF_D_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.24**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Demand	23.86	24.87	24.80	24.51	25.43	26.04
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.37	0.96	1.30	1.19	1.37
China/India	-	0.11	0.26	0.40	0.38	0.41
Europe	-	0.15	0.24	0.47	0.39	0.50
Korea/Japan	-	0.11	0.46	0.43	0.41	0.46
Total Supply (Tcf)	**23.86**	**25.24**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Production	21.1	22.54	23.86	24.71	25.81	27.30
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.35**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Netback Price (2010$/Mcf)	**-**	**$4.71**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Quota Rent (2010$/Mcf)	**-**	**$0.35**	**-**	**-**	**-**	**-**

Figure 91: Detailed Results from Global Natural Gas Model, USREF_D_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.52**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Demand	23.86	24.50	24.80	24.51	25.43	26.04
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	1.02	0.96	1.30	1.19	1.37
China/India	-	0.22	0.26	0.40	0.38	0.41
Europe	-	0.55	0.24	0.47	0.39	0.50
Korea/Japan	-	0.25	0.46	0.43	0.41	0.46
Total Supply (Tcf)	**23.86**	**25.52**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Production	21.1	22.82	23.86	24.71	25.81	27.30
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.58**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Netback Price (2010$/Mcf)	**-**	**$4.58**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 92: Detailed Results from Global Natural Gas Model, USREF_D_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.24**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Demand	23.86	24.87	24.80	24.51	25.43	26.04
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.37	0.96	1.30	1.19	1.37
China/India	-	0.11	0.26	0.40	0.38	0.41
Europe	-	0.15	0.24	0.47	0.39	0.50
Korea/Japan	-	0.11	0.46	0.43	0.41	0.46
Total Supply (Tcf)	**23.86**	**25.24**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Production	21.1	22.54	23.86	24.71	25.81	27.30
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.35**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Netback Price (2010$/Mcf)	**-**	**$4.71**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Quota Rent (2010$/Mcf)	**-**	**$0.35**	**-**	**-**	**-**	**-**

Figure 93: Detailed Results from Global Natural Gas Model, USREF_D_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.52**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Demand	23.86	24.50	24.80	24.51	25.43	26.04
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	1.02	0.96	1.30	1.19	1.37
China/India	-	0.22	0.26	0.40	0.38	0.41
Europe	-	0.55	0.25	0.47	0.39	0.50
Korea/Japan	-	0.25	0.45	0.43	0.41	0.46
Total Supply (Tcf)	**23.86**	**25.52**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Production	21.10	22.82	23.86	24.71	25.81	27.30
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.58**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Netback Price (2010$/Mcf)	**-**	**$4.58**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 94: Detailed Results from Global Natural Gas Model, USREF_D_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.52**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Demand	23.86	24.50	24.80	24.51	25.43	26.04
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	1.02	0.96	1.30	1.19	1.37
China/India	-	0.22	0.26	0.40	0.38	0.41
Europe	-	0.55	0.24	0.47	0.39	0.50
Korea/Japan	-	0.25	0.46	0.43	0.41	0.46
Total Supply (Tcf)	**23.86**	**25.52**	**25.76**	**25.81**	**26.61**	**27.40**
Domestic Production	21.10	22.82	23.86	24.71	25.81	27.30
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.58**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Netback Price (2010$/Mcf)	**-**	**$4.58**	**$4.86**	**$5.78**	**$6.07**	**$6.66**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 95: Detailed Results from Global Natural Gas Model, USREF_SD_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.09**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Demand	23.86	25.09	25.28	25.08	25.88	26.48
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**25.09**	**25.28**	**25.08**	**25.88**	**26.48**
Domestic Production	21.1	22.39	23.38	23.98	25.08	26.38
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.23**	**$4.58**	**$5.42**	**$5.80**	**$6.41**
Netback Price (2010$/Mcf)	**-**	**$5.83**	**$9.20**	**$10.04**	**$8.63**	**$9.33**
Quota Rent (2010$/Mcf)	**-**	**$1.60**	**$4.62**	**$4.61**	**$2.83**	**$2.92**

Figure 96: Detailed Results from Global Natural Gas Model, USREF_SD_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.16**	**25.83**	**26.21**	**27.25**	**27.97**
Domestic Demand	23.86	24.98	24.73	24.20	25.06	25.78
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.18	1.10	2.01	2.19	2.19
China/India	-	0.06	0.24	0.51	0.55	0.46
Europe	-	0.06	0.24	0.48	0.14	0.37
Korea/Japan	-	0.06	0.62	1.02	1.50	1.36
Total Supply (Tcf)	**23.86**	**25.16**	**25.83**	**26.21**	**27.25**	**27.97**
Domestic Production	21.1	22.46	23.93	25.11	26.45	27.87
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.29**	**$4.91**	**$5.99**	**$6.30**	**$6.82**
Netback Price (2010$/Mcf)	**-**	**$5.65**	**$6.29**	**$7.22**	**$7.50**	**$8.43**
Quota Rent (2010$/Mcf)	**-**	**$1.36**	**$1.38**	**$1.23**	**$1.20**	**$1.62**

Figure 97: Detailed Results from Global Natural Gas Model, USREF_SD_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.24**	**26.38**	**26.32**	**27.25**	**27.97**
Domestic Demand	23.86	24.87	24.19	24.13	25.06	25.78
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.37	2.19	2.19	2.19	2.19
China/India	-	0.11	0.33	0.54	0.55	0.46
Europe	-	0.13	0.35	0.51	0.14	0.37
Korea/Japan	-	0.13	1.51	1.14	1.50	1.36
Total Supply (Tcf)	**23.86**	**25.24**	**26.38**	**26.32**	**27.25**	**27.97**
Domestic Production	21.1	22.54	24.48	25.22	26.45	27.87
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.35**	**$5.25**	**$6.04**	**$6.30**	**$6.82**
Netback Price (2010$/Mcf)	**-**	**$5.59**	**$5.77**	**$7.15**	**$7.50**	**$8.43**
Quota Rent (2010$/Mcf)	**-**	**$1.24**	**$0.52**	**$1.11**	**$1.20**	**$1.62**

Figure 98: Detailed Results from Global Natural Gas Model, USREF_SD_LR

	EIA Ref	NERA Projections				
	2010	**2015**	**2020**	**2025**	**2030**	**2035**
Total Demand (Tcf)	**23.86**	**25.56**	**26.38**	**26.32**	**27.25**	**27.97**
Domestic Demand	23.86	24.46	24.19	24.13	25.06	25.78
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	1.10	2.19	2.19	2.19	2.19
China/India	-	0.26	0.33	0.54	0.55	0.46
Europe	-	0.43	0.35	0.51	0.14	0.37
Korea/Japan	-	0.40	1.51	1.14	1.50	1.36
Total Supply (Tcf)	**23.86**	**25.56**	**26.38**	**26.32**	**27.25**	**27.97**
Domestic Production	21.1	22.86	24.48	25.22	26.45	27.87
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.61**	**$5.25**	**$6.04**	**$6.30**	**$6.82**
Netback Price (2010$/Mcf)	**-**	**$5.35**	**$5.77**	**$7.15**	**$7.50**	**$8.43**
Quota Rent (2010$/Mcf)	**-**	**$0.74**	**$0.52**	**$1.11**	**$1.20**	**$1.62**

Figure 99: Detailed Results from Global Natural Gas Model, USREF_SD_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.24**	**26.38**	**27.32**	**28.65**	**29.50**
Domestic Demand	23.86	24.87	24.19	23.39	24.27	25.12
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	0.37	2.19	3.93	4.38	4.38
China/India	-	0.11	0.33	0.83	0.93	0.75
Europe	-	0.13	0.35	0.77	0.27	0.59
Korea/Japan	-	0.13	1.51	2.34	3.17	3.03
Total Supply (Tcf)	**23.86**	**25.24**	**26.38**	**27.32**	**28.65**	**29.50**
Domestic Production	21.1	22.54	24.48	26.22	27.85	29.40
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.35**	**$5.25**	**$6.57**	**$6.82**	**$7.24**
Netback Price (2010$/Mcf)	**-**	**$5.59**	**$5.77**	**$6.57**	**$6.91**	**$7.91**
Quota Rent (2010$/Mcf)	**-**	**$1.24**	**$0.52**	**-**	**$0.08**	**$0.67**

Figure 100: Detailed Results from Global Natural Gas Model, USREF_SD_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**25.56**	**26.75**	**27.32**	**28.65**	**29.50**
Domestic Demand	23.86	24.46	23.83	23.39	24.27	25.12
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	1.10	2.92	3.93	4.38	4.38
China/India	-	0.26	0.46	0.83	0.93	0.75
Europe	-	0.43	0.74	0.77	0.27	0.59
Korea/Japan	-	0.40	1.72	2.34	3.17	3.03
Total Supply (Tcf)	**23.86**	**25.56**	**26.75**	**27.32**	**28.65**	**29.50**
Domestic Production	21.10	22.86	24.85	26.22	27.85	29.40
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.61**	**$5.49**	**$6.57**	**$6.82**	**$7.24**
Netback Price (2010$/Mcf)	**-**	**$5.35**	**$5.49**	**$6.57**	**$6.91**	**$7.91**
Quota Rent (2010$/Mcf)	**-**	**$0.74**	**-**	**-**	**$0.08**	**$0.67**

Figure 101: Detailed Results from Global Natural Gas Model, USREF_SD_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**26.02**	**26.75**	**27.32**	**28.76**	**30.47**
Domestic Demand	23.86	23.85	23.83	23.39	24.21	24.73
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	2.17	2.92	3.93	4.54	5.75
China/India	-	0.39	0.39	0.83	0.97	1.04
Europe	-	0.99	0.41	0.77	0.29	0.74
Korea/Japan	-	0.80	2.12	2.34	3.28	3.97
Total Supply (Tcf)	**23.86**	**26.02**	**26.75**	**27.32**	**28.76**	**30.47**
Domestic Production	21.10	23.32	24.85	26.22	27.96	30.37
Pipeline Imports from Canada	2.33	2.33	1.40	0.74	0.64	0.04
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$5.02**	**$5.49**	**$6.57**	**$6.86**	**$7.50**
Netback Price (2010$/Mcf)	**-**	**$5.02**	**$5.49**	**$6.57**	**$6.86**	**$7.50**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 102: Detailed Results from Global Natural Gas Model, HEUR_INTREF_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**26.98**	**27.66**	**27.82**	**28.78**	**30.39**
Domestic Demand	23.86	26.98	27.66	27.82	28.60	29.71
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**26.98**	**27.66**	**27.82**	**28.78**	**30.39**
Domestic Production	21.1	24.60	26.29	27.45	28.62	30.33
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.27**	**$3.43**	**$4.03**	**$4.47**	**$4.88**
Netback Price (2010$/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent (2010$/Mcf)	**-**	**$1.03**	**$1.02**	**$1.21**	**$0.91**	**$0.92**

Figure 103: Detailed Results from Global Natural Gas Model, HEUR_INTREF_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.06**	**28.23**	**28.99**	**30.18**	**31.91**
Domestic Demand	23.86	26.88	27.13	26.98	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.18	1.10	2.01	2.19	2.19
China/India	-	-	0.11	0.65	0.74	0.69
Europe	-	0.18	0.99	1.02	1.30	1.35
Korea/Japan	-	-	0.00	0.34	0.14	0.15
Total Supply (Tcf)	**23.86**	**27.06**	**28.23**	**28.99**	**30.18**	**31.91**
Domestic Production	21.1	24.68	26.86	28.62	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	0.06
C & S America	0.21	0.37	0.49	-	0.16	-
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	0.01	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.31**	**$3.66**	**$4.41**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$4.24**	**$4.23**	**$4.94**	**$5.00**	**$5.48**
Quota Rent (2010$/Mcf)	**-**	**$0.93**	**$0.57**	**$0.53**	**$0.18**	**$0.32**

Figure 104: Detailed Results from Global Natural Gas Model, HEUR_INTREF_LS

	EIA Ref	NERA Projections				
	2010	**2015**	**2020**	**2025**	**2030**	**2035**
Total Demand (Tcf)	**23.86**	**27.15**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Demand	23.86	26.78	26.61	26.90	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.37	2.19	2.19	2.19	2.19
China/India	-	-	0.38	0.70	0.74	0.69
Europe	-	0.37	1.71	1.12	1.30	1.35
Korea/Japan	-	-	0.10	0.37	0.14	0.15
Total Supply (Tcf)	**23.86**	**27.15**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Production	21.1	24.77	27.43	28.72	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	0.06
C & S America	0.21	0.37	0.41	-	0.16	-
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	0.09	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.36**	**$3.89**	**$4.44**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$4.21**	**$4.13**	**$4.92**	**$5.00**	**$5.48**
Quota Rent (2010$/Mcf)	**-**	**$0.85**	**$0.24**	**$0.48**	**$0.18**	**$0.32**

Figure 105: Detailed Results from Global Natural Gas Model, HEUR_INTREF_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.47**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Demand	23.86	26.37	26.61	26.90	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	1.10	2.19	2.19	2.19	2.19
China/India	-	-	0.38	0.70	0.74	0.69
Europe	-	1.10	1.71	1.12	1.30	1.35
Korea/Japan	-	-	0.10	0.37	0.14	0.15
Total Supply (Tcf)	**23.86**	**27.47**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Production	21.10	25.09	27.43	28.72	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	0.06
C & S America	0.21	0.37	0.41	-	0.16	-
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	0.09	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.55**	**$3.89**	**$4.44**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$4.08**	**$4.13**	**$4.92**	**$5.00**	**$5.48**
Quota Rent (2010$/Mcf)	**-**	**$0.53**	**$0.24**	**$0.48**	**$0.18**	**$0.32**

Figure 106: Detailed Results from Global Natural Gas Model, HEUR_INTREF_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.15**	**28.80**	**30.04**	**30.56**	**32.75**
Domestic Demand	23.86	26.78	26.61	26.26	27.60	28.69
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.37	2.19	3.77	2.78	3.38
China/India	-	-	0.38	1.06	0.89	1.01
Europe	-	0.37	1.71	1.99	1.73	2.22
Korea/Japan	-	-	0.10	0.72	0.16	0.16
Total Supply (Tcf)	**23.86**	**27.15**	**28.80**	**30.04**	**30.56**	**32.75**
Domestic Production	21.1	24.77	27.43	29.67	30.40	32.69
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	0.06
C & S America	0.21	0.37	0.41	-	0.16	-
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	0.09	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.36**	**$3.89**	**$4.76**	**$4.91**	**$5.31**
Netback Price (2010$/Mcf)	**-**	**$4.21**	**$4.13**	**$4.76**	**$4.91**	**$5.31**
Quota Rent (2010$/Mcf)	**-**	**$0.85**	**$0.24**	**-**	**-**	**-**

Figure 107: Detailed Results from Global Natural Gas Model, HEUR_INTREF_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.47**	**29.21**	**30.04**	**30.56**	**32.75**
Domestic Demand	23.86	26.37	26.24	26.26	27.60	28.69
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	1.10	2.97	3.77	2.78	3.38
China/India	-	-	0.72	1.06	0.89	1.01
Europe	-	1.10	1.96	1.99	1.73	2.22
Korea/Japan	-	-	0.28	0.72	0.16	0.16
Total Supply (Tcf)	**23.86**	**27.47**	**29.21**	**30.04**	**30.56**	**32.75**
Domestic Production	21.1	25.09	27.84	29.67	30.40	32.69
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	0.06
C & S America	0.21	0.37	0.35	-	0.16	-
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	0.15	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.55**	**$4.07**	**$4.76**	**$4.91**	**$5.31**
Netback Price (2010$/Mcf)	**-**	**$4.08**	**$4.07**	**$4.76**	**$4.91**	**$5.31**
Quota Rent (2010$/Mcf)	**-**	**$0.53**	**-**	**-**	**-**	**-**

Figure 108: Detailed Results from Global Natural Gas Model, HEUR_INTREF_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.98**	**29.21**	**30.04**	**30.56**	**32.75**
Domestic Demand	23.86	25.76	26.24	26.26	27.60	28.69
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	2.23	2.97	3.77	2.78	3.38
China/India	-	0.08	0.71	1.06	0.89	1.01
Europe	-	2.14	1.99	1.99	1.73	2.22
Korea/Japan	-	0.00	0.27	0.72	0.16	0.16
Total Supply (Tcf)	**23.86**	**27.98**	**29.21**	**30.04**	**30.56**	**32.75**
Domestic Production	21.10	25.60	27.84	29.67	30.40	32.69
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	0.06
C & S America	0.21	0.37	0.35	-	0.16	-
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	0.15	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.86**	**$4.07**	**$4.76**	**$4.91**	**$5.31**
Netback Price (2010$/Mcf)	**-**	**$3.86**	**$4.07**	**$4.76**	**$4.91**	**$5.31**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 109: Detailed Results from Global Natural Gas Model, HEUR_D_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**26.98**	**27.66**	**27.82**	**28.78**	**30.39**
Domestic Demand	23.86	26.98	27.66	27.82	28.60	29.71
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**26.98**	**27.66**	**27.82**	**28.78**	**30.39**
Domestic Production	21.1	24.60	26.29	27.45	28.62	30.33
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	0.00	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.27**	**$3.43**	**$4.03**	**$4.47**	**$4.88**
Netback Price (2010$/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent (2010$/Mcf)	**-**	**$1.58**	**$1.67**	**$2.20**	**$2.01**	**$2.30**

Figure 110: Detailed Results from Global Natural Gas Model, HEUR_D_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.06**	**28.23**	**28.99**	**30.18**	**31.91**
Domestic Demand	23.86	26.88	27.13	26.98	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.18	1.10	2.01	2.19	2.19
China/India	-	0.06	0.28	0.59	0.68	0.63
Europe	-	0.07	0.28	0.75	0.72	0.84
Korea/Japan	-	0.06	0.54	0.67	0.79	0.72
Total Supply (Tcf)	**23.86**	**27.06**	**28.23**	**28.99**	**30.18**	**31.91**
Domestic Production	21.1	24.68	26.86	28.62	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.31**	**$3.66**	**$4.41**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$4.75**	**$4.80**	**$5.55**	**$5.61**	**$6.31**
Quota Rent (2010$/Mcf)	**-**	**$1.44**	**$1.15**	**$1.15**	**$0.80**	**$1.15**

Figure 111: Detailed Results from Global Natural Gas Model, HEUR_D_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.15**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Demand	23.86	26.78	26.61	26.90	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.37	2.19	2.19	2.19	2.19
China/India	-	0.11	0.47	0.64	0.68	0.63
Europe	-	0.15	0.63	0.81	0.72	0.84
Korea/Japan	-	0.11	1.10	0.73	0.79	0.72
Total Supply (Tcf)	**23.86**	**27.15**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Production	21.1	24.77	27.43	28.72	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.36**	**$3.89**	**$4.44**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$4.71**	**$4.60**	**$5.51**	**$5.61**	**$6.31**
Quota Rent (2010$/Mcf)	**-**	**$1.35**	**$0.71**	**$1.07**	**$0.80**	**$1.15**

Figure 112: Detailed Results from Global Natural Gas Model, HEUR_D_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.47**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Demand	23.86	26.37	26.61	26.90	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	1.10	2.19	2.19	2.19	2.19
China/India	-	0.23	0.47	0.64	0.68	0.63
Europe	-	0.61	0.63	0.81	0.72	0.84
Korea/Japan	-	0.26	1.10	0.73	0.79	0.72
Total Supply (Tcf)	**23.86**	**27.47**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Production	21.1	25.09	27.43	28.72	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.55**	**$3.89**	**$4.44**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$4.56**	**$4.60**	**$5.51**	**$5.61**	**$6.31**
Quota Rent (2010$/Mcf)	**-**	**$1.01**	**$0.71**	**$1.07**	**$0.80**	**$1.15**

Figure 113: Detailed Results from Global Natural Gas Model, HEUR_D_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.15**	**28.80**	**30.18**	**31.61**	**33.46**
Domestic Demand	23.86	26.78	26.61	26.16	27.05	28.40
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.37	2.19	4.02	4.38	4.38
China/India	-	0.11	0.47	1.08	1.28	1.18
Europe	-	0.15	0.63	1.54	1.61	1.67
Korea/Japan	-	0.11	1.10	1.41	1.49	1.52
Total Supply (Tcf)	**23.86**	**27.15**	**28.80**	**30.18**	**31.61**	**33.46**
Domestic Production	21.1	24.77	27.43	29.81	31.45	33.40
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.01	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.35	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.36**	**$3.89**	**$4.81**	**$5.18**	**$5.44**
Netback Price (2010$/Mcf)	**-**	**$4.71**	**$4.60**	**$5.08**	**$5.24**	**$5.77**
Quota Rent (2010$/Mcf)	**-**	**$1.35**	**$0.71**	**$0.27**	**$0.07**	**$0.33**

Figure 114: Detailed Results from Global Natural Gas Model, HEUR_D_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.47**	**29.73**	**30.40**	**31.61**	**33.46**
Domestic Demand	23.86	26.37	25.79	26.02	27.05	28.40
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	1.10	3.94	4.38	4.38	4.38
China/India	-	0.23	0.71	1.13	1.28	1.18
Europe	-	0.61	1.57	1.69	1.61	1.67
Korea/Japan	-	0.26	1.66	1.56	1.49	1.52
Total Supply (Tcf)	**23.86**	**27.47**	**29.73**	**30.40**	**31.61**	**33.46**
Domestic Production	21.1	25.09	28.36	30.03	31.45	33.40
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.00	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.55**	**$4.30**	**$4.89**	**$5.18**	**$5.44**
Netback Price (2010$/Mcf)	**-**	**$4.56**	**$4.30**	**$5.04**	**$5.24**	**$5.77**
Quota Rent (2010$/Mcf)	**-**	**$1.01**	**-**	**$0.15**	**$0.07**	**$0.33**

Figure 115: Detailed Results from Global Natural Gas Model, HEUR_D_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**28.47**	**29.73**	**30.69**	**31.75**	**34.35**
Domestic Demand	23.86	25.18	25.79	25.83	26.98	28.06
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	3.30	3.94	4.87	4.59	5.61
China/India	-	0.43	0.70	1.20	1.33	1.52
Europe	-	2.30	1.79	1.88	1.71	2.19
Korea/Japan	-	0.58	1.45	1.79	1.55	1.90
Total Supply (Tcf)	**23.86**	**28.47**	**29.73**	**30.69**	**31.75**	**34.35**
Domestic Production	21.10	26.09	28.36	30.32	31.59	34.29
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	0.06
C & S America	0.21	0.37	0.50	-	0.16	-
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.36	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.18**	**$4.30**	**$4.99**	**$5.21**	**$5.60**
Netback Price (2010$/Mcf)	**-**	**$4.18**	**$4.30**	**$4.99**	**$5.21**	**$5.60**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 116: Detailed Results from Global Natural Gas Model, HEUR_SD_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**26.98**	**27.66**	**27.82**	**28.78**	**30.39**
Domestic Demand	23.86	26.98	27.66	27.82	28.60	29.71
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**26.98**	**27.66**	**27.82**	**28.78**	**30.39**
Domestic Production	21.1	24.60	26.29	27.45	28.62	30.33
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.27**	**$3.43**	**$4.03**	**$4.47**	**$4.88**
Netback Price (2010$/Mcf)	**-**	**$5.83**	**$9.20**	**$10.04**	**$8.63**	**$9.33**
Quota Rent (2010$/Mcf)	**-**	**$2.56**	**$5.77**	**$6.01**	**$4.16**	**$4.45**

Figure 117: Detailed Results from Global Natural Gas Model, HEUR_SD_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.06**	**28.23**	**28.99**	**30.18**	**31.91**
Domestic Demand	23.86	26.88	27.13	26.98	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.18	1.10	2.01	2.19	2.19
China/India	-	0.06	0.23	0.51	0.55	0.46
Europe	-	0.06	0.24	0.48	0.14	0.37
Korea/Japan	-	0.06	0.63	1.02	1.50	1.36
Total Supply (Tcf)	**23.86**	**27.06**	**28.23**	**28.99**	**30.18**	**31.91**
Domestic Production	21.10	24.68	26.86	28.62	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.31**	**$3.66**	**$4.41**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$5.65**	**$6.29**	**$7.22**	**$7.50**	**$8.43**
Quota Rent (2010$/Mcf)	**-**	**$2.34**	**$2.63**	**$2.81**	**$2.69**	**$3.28**

Figure 118: Detailed Results from Global Natural Gas Model, HEUR_SD_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.15**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Demand	23.86	26.78	26.61	26.90	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.37	2.19	2.19	2.19	2.19
China/India	-	0.11	0.33	0.54	0.55	0.46
Europe	-	0.13	0.35	0.51	0.14	0.37
Korea/Japan	-	0.13	1.51	1.14	1.50	1.36
Total Supply (Tcf)	**23.86**	**27.15**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Production	21.1	24.77	27.43	28.72	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.36**	**$3.89**	**$4.44**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$5.59**	**$5.77**	**$7.15**	**$7.50**	**$8.43**
Quota Rent (2010$/Mcf)	**-**	**$2.23**	**$1.88**	**$2.71**	**$2.69**	**$3.28**

Figure 119: Detailed Results from Global Natural Gas Model, HEUR_SD_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.47**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Demand	23.86	26.37	26.61	26.90	27.81	29.04
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	1.10	2.19	2.19	2.19	2.19
China/India	-	0.26	0.33	0.54	0.55	0.46
Europe	-	0.43	0.35	0.51	0.14	0.37
Korea/Japan	-	0.40	1.51	1.14	1.50	1.36
Total Supply (Tcf)	**23.86**	**27.47**	**28.80**	**29.09**	**30.18**	**31.91**
Domestic Production	21.1	25.09	27.43	28.72	30.02	31.85
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.55**	**$3.89**	**$4.44**	**$4.82**	**$5.16**
Netback Price (2010$/Mcf)	**-**	**$5.35**	**$5.77**	**$7.15**	**$7.50**	**$8.43**
Quota Rent (2010$/Mcf)	**-**	**$1.80**	**$1.88**	**$2.71**	**$2.69**	**$3.28**

Figure 120: Detailed Results from Global Natural Gas Model, HEUR_SD_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**27.15**	**28.80**	**30.18**	**31.61**	**33.46**
Domestic Demand	23.86	26.78	26.61	26.16	27.05	28.40
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	0.37	2.19	4.02	4.38	4.38
China/India	-	0.11	0.33	0.84	0.93	0.75
Europe	-	0.13	0.35	0.78	0.27	0.59
Korea/Japan	-	0.13	1.51	2.39	3.17	3.03
Total Supply (Tcf)	**23.86**	**27.15**	**28.80**	**30.18**	**31.61**	**33.46**
Domestic Production	21.1	24.77	27.43	29.81	31.45	33.40
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.36**	**$3.89**	**$4.81**	**$5.18**	**$5.44**
Netback Price (2010$/Mcf)	**-**	**$5.59**	**$5.77**	**$6.54**	**$6.91**	**$7.91**
Quota Rent (2010$/Mcf)	**-**	**$2.23**	**$1.88**	**$1.73**	**$1.73**	**$2.47**

Figure 121: Detailed Results from Global Natural Gas Model, HEUR_SD_HR

	EIA Ref	NERA Projections				
	2010	**2015**	**2020**	**2025**	**2030**	**2035**
Total Demand (Tcf)	**23.86**	**27.47**	**29.97**	**30.40**	**31.61**	**33.46**
Domestic Demand	23.86	26.37	25.59	26.02	27.05	28.40
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	1.10	4.38	4.38	4.38	4.38
China/India	-	0.26	0.55	0.91	0.93	0.75
Europe	-	0.43	0.65	0.83	0.27	0.59
Korea/Japan	-	0.40	3.18	2.63	3.17	3.03
Total Supply (Tcf)	**23.86**	**27.47**	**29.97**	**30.40**	**31.61**	**33.46**
Domestic Production	21.1	25.09	28.60	30.03	31.45	33.40
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$3.55**	**$4.41**	**$4.89**	**$5.18**	**$5.44**
Netback Price (2010$/Mcf)	**-**	**$5.35**	**$4.93**	**$6.41**	**$6.91**	**$7.91**
Quota Rent (2010$/Mcf)	**-**	**$1.80**	**$0.52**	**$1.53**	**$1.73**	**$2.47**

Figure 122: Detailed Results from Global Natural Gas Model, HEUR_SD_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**28.91**	**30.54**	**31.84**	**33.29**	**36.38**
Domestic Demand	23.86	24.68	25.10	25.11	26.22	27.31
Pipeline Exports to Canada	-	-	-	-	0.18	0.68
Total LNG Exports	-	4.23	5.44	6.72	6.89	8.39
China/India	-	0.51	0.69	1.60	1.75	2.00
Europe	-	2.23	1.04	1.09	0.57	1.18
Korea/Japan	-	1.49	3.71	4.03	4.57	5.21
Total Supply (Tcf)	**23.86**	**28.91**	**30.54**	**31.84**	**33.29**	**36.38**
Domestic Production	21.10	26.53	29.17	31.47	33.13	36.32
Pipeline Imports from Canada	2.33	2.01	0.87	0.01	-	-
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.00	-	-
Wellhead Price (2010$/Mcf)	**$4.08**	**$4.47**	**$4.68**	**$5.40**	**$5.61**	**$5.97**
Netback Price (2010$/Mcf)	**-**	**$4.47**	**$4.68**	**$5.40**	**$5.61**	**$5.97**
Quota Rent (2010$/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 123: Detailed Results from Global Natural Gas Model, LEUR_INTREF_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 124: Detailed Results from Global Natural Gas Model, LEUR_INTREF_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 125: Detailed Results from Global Natural Gas Model, LEUR_INTREF_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 126: Detailed Results from Global Natural Gas Model, LEUR_INTREF_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 127: Detailed Results from Global Natural Gas Model, LEUR_INTREF_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 128: Detailed Results from Global Natural Gas Model, LEUR_INTREF_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 129: Detailed Results from Global Natural Gas Model, LEUR_INTREF_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.19	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	0.17	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.30**	**$4.45**	**$5.23**	**$5.38**	**$5.80**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 130: Detailed Results from Global Natural Gas Model, LEUR_D_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 131: Detailed Results from Global Natural Gas Model, LEUR_D_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 132: Detailed Results from Global Natural Gas Model, LEUR_D_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 133: Detailed Results from Global Natural Gas Model, LEUR_D_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 134: Detailed Results from Global Natural Gas Model, LEUR_D_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 135: Detailed Results from Global Natural Gas Model, LEUR_D_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 136: Detailed Results from Global Natural Gas Model, LEUR_D_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$4.85**	**$5.10**	**$6.23**	**$6.48**	**$7.18**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 137: Detailed Results from Global Natural Gas Model, LEUR_SD_NX

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Demand	23.86	22.77	22.54	22.21	22.79	23.15
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	-	-	-	-
China/India	-	-	-	-	-	-
Europe	-	-	-	-	-	-
Korea/Japan	-	-	-	-	-	-
Total Supply (Tcf)	**23.86**	**22.77**	**22.54**	**22.21**	**22.79**	**23.15**
Domestic Production	21.1	19.74	19.98	19.89	20.70	21.43
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.49**	**$7.56**	**$7.97**	**$8.70**
Netback Price ($2010/Mcf)	**-**	**$5.83**	**$9.20**	**$10.04**	**$8.63**	**$9.33**
Quota Rent ($2010/Mcf)	**-**	**-**	**$2.70**	**$2.47**	**$0.66**	**$0.63**

Figure 138: Detailed Results from Global Natural Gas Model, LEUR_SD_LSS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Demand	23.86	22.77	22.12	21.78	22.68	22.97
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	0.78	0.90	0.27	0.52
China/India	-	-	-	-	0.13	-
Europe	-	-	-	0.46	0.01	0.14
Korea/Japan	-	-	0.78	0.44	0.13	0.37
Total Supply (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Production	21.1	19.74	20.35	20.37	20.86	21.77
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Netback Price ($2010/Mcf)	**-**	**$5.71**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 139: Detailed Results from Global Natural Gas Model, LEUR_SD_LS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Demand	23.86	22.77	22.12	21.78	22.68	22.97
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	0.78	0.90	0.27	0.52
China/India	-	-	-	-	0.13	-
Europe	-	-	-	0.46	0.01	0.14
Korea/Japan	-	-	0.78	0.44	0.13	0.37
Total Supply (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Production	21.1	19.74	20.35	20.37	20.86	21.77
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Netback Price ($2010/Mcf)	**-**	**$5.71**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 140: Detailed Results from Global Natural Gas Model, LEUR_SD_LR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Demand	23.86	22.77	22.12	21.78	22.68	22.97
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	0.78	0.90	0.27	0.52
China/India	-	-	-	-	0.13	-
Europe	-	-	-	0.46	0.01	0.14
Korea/Japan	-	-	0.78	0.44	0.13	0.37
Total Supply (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Production	21.1	19.74	20.35	20.37	20.86	21.77
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Netback Price ($2010/Mcf)	**-**	**$5.71**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 141: Detailed Results from Global Natural Gas Model, LEUR_SD_HS

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Demand	23.86	22.77	22.12	21.78	22.68	22.97
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	0.78	0.90	0.27	0.52
China/India	-	-	-	-	0.13	-
Europe	-	-	-	0.46	0.01	0.14
Korea/Japan	-	-	0.78	0.44	0.13	0.37
Total Supply (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Production	21.1	19.74	20.35	20.37	20.86	21.77
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Netback Price ($2010/Mcf)	**-**	**$5.71**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 142: Detailed Results from Global Natural Gas Model, LEUR_SD_HR

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Demand	23.86	22.77	22.12	21.78	22.68	22.97
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	0.78	0.90	0.27	0.52
China/India	-	-	-	-	0.13	-
Europe	-	-	-	0.46	0.01	0.14
Korea/Japan	-	-	0.78	0.44	0.13	0.37
Total Supply (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Production	21.1	19.74	20.35	20.37	20.86	21.77
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Netback Price ($2010/Mcf)	**-**	**$5.71**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

Figure 143: Detailed Results from Global Natural Gas Model, LEUR_SD_NC

	EIA Ref	NERA Projections				
	2010	2015	2020	2025	2030	2035
Total Demand (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Demand	23.86	22.77	22.12	21.78	22.68	22.97
Pipeline Exports to Canada	-	-	-	-	-	-
Total LNG Exports	-	-	0.78	0.90	0.27	0.52
China/India	-	-	-	-	0.13	-
Europe	-	-	-	0.46	0.01	0.14
Korea/Japan	-	-	0.78	0.44	0.13	0.37
Total Supply (Tcf)	**23.86**	**22.77**	**22.91**	**22.69**	**22.95**	**23.49**
Domestic Production	21.1	19.74	20.35	20.37	20.86	21.77
Pipeline Imports from Canada	2.33	2.66	2.06	1.96	1.93	1.66
Total LNG Imports	0.43	0.37	0.50	0.36	0.16	0.06
Africa	0.11	-	-	-	-	-
C & S America	0.21	0.37	0.50	0.36	0.16	0.06
Europe	0.03	-	-	-	-	-
Middle East	0.08	-	-	-	-	-
Wellhead Price ($2010/Mcf)	**$4.08**	**$5.85**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Netback Price ($2010/Mcf)	**-**	**$5.71**	**$6.86**	**$7.96**	**$8.07**	**$8.86**
Quota Rent ($2010/Mcf)	**-**	**-**	**-**	**-**	**-**	**-**

B. N$_{ew}$ERA Model Results

The following figures (Figure 144 through Figure 164) contain detailed macroeconomic outputs for all modeled baselines, scenarios, and sensitivities. For each figure, the "Level Values" section depicts the numerical results from the scenario or baseline, and the "Percentage Change" section shows the percentage change in the Level Values for a given scenario relative to its baseline case. Figure 144 through Figure 162 contain detailed results for the scenarios. Figure 163 through Figure 164 contain results for the sensitivity tests. All tables use the following acronyms defined in the following list:

AGR – agriculture sector
COL – coal sector
CRU – crude oil sector
EIS – energy-intensive sector
ELE – electricity sector
GAS – natural gas sector
M_V – motor vehicle manufacturing sector
MAN – other manufacturing sector
OIL – refining sector
SRV – commercial sector
TRK – commercial trucking sector
TRN – other commercial transportation sector
C – household sector
G – government sector

Figure 144: Detailed Results for U.S. Reference Baseline Case

Reference Baseline Case (USREF)								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,883	$17,862	$20,277	$22,880	$25,756
	Consumption		Billion 2010$	$12,404	$13,969	$15,972	$18,153	$20,521
	Investment		Billion 2010$	$2,467	$2,791	$3,161	$3,517	$3,977
Natural Gas	Wellhead Price		2010$ per Mcf	$4.29	$4.65	$5.49	$5.89	$6.50
	Production		Tcf	22.42	23.44	24.04	25.21	26.58
	Exports		Tcf	-	-	-	-	-
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	25.03	25.28	25.09	25.97	26.76
	Sectoral Demand	AGR	Tcf	0.16	0.16	0.16	0.16	0.17
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.33	3.35	3.27	3.16	3.08
		ELE	Tcf	6.94	6.82	6.65	7.35	7.93
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.18	0.17	0.18	0.18
		MAN	Tcf	4.23	4.32	4.34	4.41	4.54
		OIL	Tcf	1.32	1.41	1.36	1.40	1.38
		SRV	Tcf	2.44	2.53	2.58	2.67	2.79
		TRK	Tcf	0.47	0.48	0.49	0.53	0.56
		TRN	Tcf	0.22	0.22	0.23	0.24	0.26
		C	Tcf	4.80	4.84	4.84	4.84	4.82
		G	Tcf	0.93	0.96	0.99	1.02	1.06
	Export Revenues [1]		Billion 2010$	$0.00	$0.00	$0.00	$0.00	$0.00
Percentage Change								
Macro	Gross Domestic Product		%					
	Gross Capital Income		%					
	Gross Labor Income		%					
	Gross Resource Income		%					
	Consumption		%					
	Investment		%					
Natural Gas	Wellhead Price		%					
	Production		%					
	Pipeline Imports		%					
	Total Demand		%					
	Sectoral Demand	AGR	%					
		COL	%					
		CRU	%					
		EIS	%					
		ELE	%					
		GAS	%					
		M_V	%					
		MAN	%					
		OIL	%					
		SRV	%					
		TRK	%					
		TRN	%					
		C	%					
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 145: Detailed Results for High Shale EUR Baseline Case

High Shale EUR Baseline Case (HEUR)								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,960	$17,964	$20,411	$23,002	$25,902
	Consumption		Billion 2010$	$12,429	$13,999	$16,013	$18,184	$20,565
	Investment		Billion 2010$	$2,483	$2,811	$3,177	$3,532	$3,995
Natural Gas	Wellhead Price		2010$ per Mcf	$3.35	$3.50	$4.09	$4.53	$4.92
	Production		Tcf	24.69	26.46	27.72	28.70	29.73
	Exports		Tcf	-	-	-	-	-
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.96	27.73	27.97	28.84	29.86
	Sectoral Demand	AGR	Tcf	0.16	0.16	0.16	0.17	0.17
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.47	3.58	3.55	3.48	3.39
		ELE	Tcf	8.27	8.38	8.35	8.90	9.69
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.21	0.20	0.19	0.19	0.20
		MAN	Tcf	4.44	4.64	4.75	4.87	5.01
		OIL	Tcf	1.32	1.40	1.37	1.44	1.40
		SRV	Tcf	2.53	2.65	2.75	2.85	2.97
		TRK	Tcf	0.48	0.51	0.55	0.60	0.65
		TRN	Tcf	0.23	0.24	0.26	0.28	0.30
		C	Tcf	4.89	4.96	5.00	4.99	4.95
		G	Tcf	0.97	1.01	1.05	1.09	1.13
	Export Revenues 1		Billion 2010$	$0.00	$0.00	$0.00	$0.00	$0.00
Percentage Change								
Macro	Gross Domestic Product		%					
	Gross Capital Income		%					
	Gross Labor Income		%					
	Gross Resource Income		%					
	Consumption		%					
	Investment		%					
Natural Gas	Wellhead Price		%					
	Production		%					
	Pipeline Imports		%					
	Total Demand		%					
	Sectoral Demand	AGR	%					
		COL	%					
		CRU	%					
		EIS	%					
		ELE	%					
		GAS	%					
		M_V	%					
		MAN	%					
		OIL	%					
		SRV	%					
		TRK	%					
		TRN	%					
		C	%					
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 146: Detailed Results for Low Shale EUR Baseline Case

Low Shale EUR Baseline Case (LEUR)								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,790	$17,716	$20,061	$22,693	$25,567
	Consumption		Billion 2010$	$12,379	$13,920	$15,862	$18,093	$20,476
	Investment		Billion 2010$	$2,442	$2,759	$3,138	$3,493	$3,953
Natural Gas	Wellhead Price		2010$ per Mcf	$5.73	$6.45	$7.83	$8.33	$8.96
	Production		Tcf	19.60	19.88	20.04	21.13	21.70
	Exports		Tcf	-	-	-	-	-
	Pipeline Imports		Tcf	3.00	2.61	2.37	2.01	1.75
	Total Demand		Tcf	22.60	22.50	22.41	23.14	23.45
	Sectoral Demand	AGR	Tcf	0.16	0.16	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.18	3.15	3.02	2.86	2.76
		ELE	Tcf	5.23	5.00	5.16	5.91	6.12
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.17	0.16	0.16	0.16
		MAN	Tcf	3.99	3.99	3.92	3.95	4.00
		OIL	Tcf	1.32	1.41	1.39	1.36	1.39
		SRV	Tcf	2.32	2.37	2.38	2.45	2.55
		TRK	Tcf	0.45	0.46	0.47	0.49	0.51
		TRN	Tcf	0.21	0.21	0.22	0.23	0.24
		C	Tcf	4.68	4.68	4.64	4.63	4.59
		G	Tcf	0.89	0.90	0.91	0.94	0.97
	Export Revenues 1		Billion 2010$	$0.00	$0.00	$0.00	$0.00	$0.00
Percentage Change								
Macro	Gross Domestic Product		%					
	Gross Capital Income		%					
	Gross Labor Income		%					
	Gross Resource Income		%					
	Consumption		%					
	Investment		%					
Natural Gas	Wellhead Price		%					
	Production		%					
	Pipeline Imports		%					
	Total Demand		%					
	Sectoral Demand	AGR	%					
		COL	%					
		CRU	%					
		EIS	%					
		ELE	%					
		GAS	%					
		M_V	%					
		MAN	%					
		OIL	%					
		SRV	%					
		TRK	%					
		TRN	%					
		C	%					
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 147: Detailed Results for USREF_D_LSS

Scenario: USREF_D_LSS								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,884	$17,868	$20,281	$22,883	$25,759
	Consumption		Billion 2010$	$12,408	$13,971	$15,972	$18,152	$20,520
	Investment		Billion 2010$	$2,468	$2,790	$3,160	$3,518	$3,978
Natural Gas	Wellhead Price		2010$ per Mcf	$4.34	$4.92	$5.82	$6.13	$6.75
	Production		Tcf	22.49	23.84	24.80	25.87	27.40
	Exports		Tcf	0.18	0.98	1.43	1.19	1.37
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	24.92	24.71	24.41	25.44	26.20
	Sectoral Demand	AGR	Tcf	0.16	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.30	3.24	3.16	3.09	3.00
		ELE	Tcf	6.91	6.65	6.45	7.18	7.74
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.18	0.17	0.17	0.18
		MAN	Tcf	4.21	4.20	4.20	4.31	4.43
		OIL	Tcf	1.31	1.37	1.32	1.37	1.35
		SRV	Tcf	2.43	2.48	2.53	2.63	2.74
		TRK	Tcf	0.47	0.47	0.49	0.52	0.55
		TRN	Tcf	0.22	0.22	0.23	0.24	0.26
		C	Tcf	4.79	4.77	4.76	4.77	4.75
		G	Tcf	0.93	0.95	0.96	1.00	1.04
	Export Revenues [1]		Billion 2010$	$0.72	$4.47	$7.72	$6.76	$8.58
Percentage Change								
Macro	Gross Domestic Product		%	0.01	0.03	0.02	0.01	0.01
	Gross Capital Income		%	(0.01)	(0.07)	(0.08)	(0.06)	(0.05)
	Gross Labor Income		%	(0.01)	(0.05)	(0.07)	(0.05)	(0.04)
	Gross Resource Income		%	2.37	8.70	7.64	4.95	4.62
	Consumption		%	0.03	0.01	(0.00)	(0.00)	(0.00)
	Investment		%	0.05	(0.02)	(0.06)	0.03	0.04
Natural Gas	Wellhead Price		%	1.17	5.75	5.93	4.12	3.88
	Production		%	0.32	1.73	3.15	2.63	3.07
	Pipeline Imports		%					
	Total Demand		%	(0.43)	(2.28)	(2.68)	(2.03)	(2.07)
	Sectoral Demand	AGR	%	(0.66)	(3.11)	(3.44)	(2.51)	(2.46)
		COL	%					
		CRU	%					
		EIS	%	(0.65)	(3.07)	(3.41)	(2.50)	(2.45)
		ELE	%	(0.43)	(2.46)	(3.00)	(2.34)	(2.43)
		GAS	%					
		M_V	%	(0.42)	(2.23)	(2.70)	(2.06)	(2.10)
		MAN	%	(0.58)	(2.83)	(3.18)	(2.33)	(2.30)
		OIL	%	(0.59)	(2.89)	(3.21)	(2.34)	(2.30)
		SRV	%	(0.28)	(1.61)	(2.02)	(1.56)	(1.61)
		TRK	%	(0.17)	(1.03)	(1.45)	(1.16)	(1.26)
		TRN	%	(0.18)	(1.06)	(1.49)	(1.20)	(1.29)
		C	%	(0.23)	(1.38)	(1.76)	(1.36)	(1.42)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 148: Detailed Results for USREF_D_LS

Scenario: USREF_D_LS								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,886	$17,867	$20,281	$22,883	$25,759
	Consumption		Billion 2010$	$12,408	$13,970	$15,972	$18,152	$20,520
	Investment		Billion 2010$	$2,467	$2,791	$3,160	$3,518	$3,978
Natural Gas	Wellhead Price		2010$ per Mcf	$4.40	$4.92	$5.82	$6.13	$6.75
	Production		Tcf	22.56	23.84	24.80	25.87	27.40
	Exports		Tcf	0.37	0.98	1.43	1.19	1.37
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	24.81	24.71	24.41	25.44	26.20
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.28	3.24	3.16	3.09	3.00
		ELE	Tcf	6.88	6.65	6.45	7.18	7.74
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.18	0.17	0.17	0.18
		MAN	Tcf	4.18	4.20	4.20	4.31	4.43
		OIL	Tcf	1.30	1.37	1.32	1.37	1.35
		SRV	Tcf	2.42	2.48	2.53	2.63	2.74
		TRK	Tcf	0.47	0.47	0.49	0.52	0.55
		TRN	Tcf	0.22	0.22	0.23	0.24	0.26
		C	Tcf	4.77	4.77	4.76	4.77	4.75
		G	Tcf	0.92	0.95	0.96	1.00	1.04
	Export Revenues [1]		Billion 2010$	$1.51	$4.47	$7.72	$6.76	$8.58
Percentage Change								
Macro	Gross Domestic Product		%	0.02	0.03	0.02	0.01	0.01
	Gross Capital Income		%	(0.03)	(0.07)	(0.08)	(0.06)	(0.05)
	Gross Labor Income		%	(0.02)	(0.05)	(0.07)	(0.05)	(0.04)
	Gross Resource Income		%	5.00	8.68	7.64	4.95	4.62
	Consumption		%	0.03	0.01	(0.00)	(0.00)	(0.00)
	Investment		%	0.01	(0.00)	(0.05)	0.03	0.04
Natural Gas	Wellhead Price		%	2.44	5.75	5.93	4.12	3.88
	Production		%	0.65	1.72	3.15	2.63	3.07
	Pipeline Imports		%					
	Total Demand		%	(0.90)	(2.28)	(2.69)	(2.03)	(2.07)
	Sectoral Demand	AGR	%	(1.34)	(3.12)	(3.44)	(2.51)	(2.46)
		COL	%					
		CRU	%					
		EIS	%	(1.31)	(3.07)	(3.41)	(2.50)	(2.45)
		ELE	%	(0.91)	(2.46)	(3.00)	(2.34)	(2.43)
		GAS	%					
		M_V	%	(0.85)	(2.23)	(2.70)	(2.06)	(2.10)
		MAN	%	(1.19)	(2.83)	(3.18)	(2.33)	(2.30)
		OIL	%	(1.21)	(2.89)	(3.21)	(2.34)	(2.30)
		SRV	%	(0.59)	(1.61)	(2.02)	(1.56)	(1.61)
		TRK	%	(0.35)	(1.03)	(1.45)	(1.17)	(1.26)
		TRN	%	(0.36)	(1.07)	(1.49)	(1.20)	(1.29)
		C	%	(0.50)	(1.38)	(1.76)	(1.36)	(1.42)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 149: Detailed Results for USREF_D_LR

Scenario: USREF_D_LR								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,890	$17,866	$20,280	$22,882	$25,758
	Consumption		Billion 2010$	$12,408	$13,970	$15,972	$18,153	$20,521
	Investment		Billion 2010$	$2,464	$2,792	$3,160	$3,518	$3,978
Natural Gas	Wellhead Price		2010$ per Mcf	$4.60	$4.92	$5.82	$6.13	$6.75
	Production		Tcf	22.81	23.84	24.80	25.87	27.40
	Exports		Tcf	1.02	0.98	1.43	1.19	1.37
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	24.40	24.71	24.41	25.44	26.20
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.21	3.24	3.16	3.09	3.00
		ELE	Tcf	6.77	6.65	6.45	7.18	7.74
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.18	0.17	0.17	0.18
		MAN	Tcf	4.09	4.20	4.20	4.31	4.43
		OIL	Tcf	1.27	1.37	1.32	1.37	1.35
		SRV	Tcf	2.40	2.48	2.53	2.63	2.74
		TRK	Tcf	0.47	0.47	0.49	0.52	0.55
		TRN	Tcf	0.22	0.22	0.23	0.24	0.26
		C	Tcf	4.73	4.77	4.76	4.77	4.75
		G	Tcf	0.91	0.95	0.96	1.00	1.04
	Export Revenues [1]		Billion 2010$	$4.35	$4.47	$7.72	$6.76	$8.58
Percentage Change								
Macro	Gross Domestic Product		%	0.04	0.03	0.02	0.01	0.01
	Gross Capital Income		%	(0.09)	(0.08)	(0.09)	(0.06)	(0.05)
	Gross Labor Income		%	(0.07)	(0.06)	(0.07)	(0.05)	(0.04)
	Gross Resource Income		%	14.69	8.61	7.62	4.94	4.62
	Consumption		%	0.03	0.00	(0.00)	0.00	0.00
	Investment		%	(0.12)	0.04	(0.05)	0.03	0.04
Natural Gas	Wellhead Price		%	7.13	5.74	5.93	4.12	3.88
	Production		%	1.73	1.72	3.14	2.62	3.07
	Pipeline Imports		%					
	Total Demand		%	(2.52)	(2.28)	(2.69)	(2.03)	(2.07)
	Sectoral Demand	AGR	%	(3.72)	(3.13)	(3.45)	(2.52)	(2.46)
		COL	%					
		CRU	%					
		EIS	%	(3.62)	(3.09)	(3.42)	(2.51)	(2.46)
		ELE	%	(2.57)	(2.46)	(3.00)	(2.34)	(2.43)
		GAS	%					
		M_V	%	(2.37)	(2.24)	(2.70)	(2.07)	(2.10)
		MAN	%	(3.30)	(2.83)	(3.18)	(2.34)	(2.31)
		OIL	%	(3.42)	(2.89)	(3.21)	(2.34)	(2.30)
		SRV	%	(1.70)	(1.61)	(2.02)	(1.56)	(1.61)
		TRK	%	(0.99)	(1.04)	(1.45)	(1.17)	(1.26)
		TRN	%	(1.01)	(1.08)	(1.49)	(1.20)	(1.30)
		C	%	(1.46)	(1.38)	(1.76)	(1.35)	(1.42)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 150: Detailed Results for USREF_SD_LS

Scenario: USREF_SD_LS								
	Description		Units	2015	2020	2025	2030	2035
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,886	$17,876	$20,283	$22,885	$25,759
	Consumption		Billion 2010$	$12,411	$13,970	$15,971	$18,152	$20,520
	Investment		Billion 2010$	$2,469	$2,787	$3,161	$3,517	$3,977
Natural Gas	Wellhead Price		2010$ per Mcf	$4.40	$5.30	$6.01	$6.35	$6.92
	Production		Tcf	22.56	24.30	25.18	26.41	27.88
	Exports		Tcf	0.37	2.19	2.19	2.19	2.19
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	24.81	23.95	24.04	24.98	25.86
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.15	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.28	3.11	3.10	3.02	2.95
		ELE	Tcf	6.88	6.43	6.34	7.03	7.62
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.17	0.16	0.17	0.18
		MAN	Tcf	4.18	4.04	4.12	4.22	4.37
		OIL	Tcf	1.30	1.32	1.29	1.34	1.33
		SRV	Tcf	2.42	2.43	2.50	2.59	2.71
		TRK	Tcf	0.47	0.47	0.48	0.51	0.55
		TRN	Tcf	0.22	0.22	0.22	0.24	0.25
		C	Tcf	4.78	4.68	4.71	4.72	4.71
		G	Tcf	0.92	0.92	0.95	0.99	1.03
	Export Revenues [1]		Billion 2010$	$1.51	$10.76	$12.21	$12.90	$14.04
Percentage Change								
Macro	Gross Domestic Product		%	0.02	0.08	0.03	0.02	0.01
	Gross Capital Income		%	(0.02)	(0.17)	(0.14)	(0.11)	(0.09)
	Gross Labor Income		%	(0.02)	(0.13)	(0.11)	(0.09)	(0.08)
	Gross Resource Income		%	4.97	21.48	12.23	9.64	7.64
	Consumption		%	0.05	0.01	(0.01)	(0.01)	(0.00)
	Investment		%	0.09	(0.15)	(0.01)	0.01	0.01
Natural Gas	Wellhead Price		%	2.44	14.04	9.45	7.92	6.37
	Production		%	0.65	3.67	4.75	4.77	4.87
	Pipeline Imports		%					
	Total Demand		%	(0.90)	(5.26)	(4.18)	(3.80)	(3.35)
	Sectoral Demand	AGR	%	(1.37)	(7.14)	(5.35)	(4.68)	(3.97)
		COL	%					
		CRU	%					
		EIS	%	(1.35)	(7.03)	(5.31)	(4.65)	(3.96)
		ELE	%	(0.90)	(5.67)	(4.66)	(4.36)	(3.91)
		GAS	%					
		M_V	%	(0.88)	(5.15)	(4.19)	(3.86)	(3.40)
		MAN	%	(1.21)	(6.51)	(4.92)	(4.35)	(3.73)
		OIL	%	(1.21)	(6.64)	(4.98)	(4.36)	(3.71)
		SRV	%	(0.59)	(3.76)	(3.16)	(2.92)	(2.61)
		TRK	%	(0.35)	(2.42)	(2.27)	(2.19)	(2.05)
		TRN	%	(0.38)	(2.49)	(2.34)	(2.26)	(2.10)
		C	%	(0.47)	(3.24)	(2.76)	(2.55)	(2.30)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 151: Detailed Results for USREF_SD_LR

Scenario: USREF_SD_LR								
	Description		Units	2015	2020	2025	2030	2035
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,891	$17,874	$20,282	$22,885	$25,758
	Consumption		Billion 2010$	$12,411	$13,970	$15,971	$18,152	$20,521
	Investment		Billion 2010$	$2,465	$2,788	$3,161	$3,517	$3,977
Natural Gas	Wellhead Price		2010$ per Mcf	$4.62	$5.30	$6.01	$6.35	$6.92
	Production		Tcf	22.83	24.30	25.18	26.41	27.88
	Exports		Tcf	1.10	2.19	2.19	2.19	2.19
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	24.35	23.95	24.04	24.98	25.86
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.15	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.19	3.11	3.10	3.02	2.95
		ELE	Tcf	6.75	6.43	6.34	7.03	7.62
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.17	0.16	0.17	0.18
		MAN	Tcf	4.08	4.04	4.12	4.22	4.37
		OIL	Tcf	1.27	1.32	1.29	1.34	1.33
		SRV	Tcf	2.39	2.43	2.50	2.59	2.71
		TRK	Tcf	0.46	0.47	0.48	0.51	0.55
		TRN	Tcf	0.22	0.22	0.22	0.24	0.25
		C	Tcf	4.72	4.68	4.71	4.72	4.71
		G	Tcf	0.91	0.92	0.95	0.99	1.03
	Export Revenues [1]		Billion 2010$	$4.72	$10.76	$12.21	$12.90	$14.04
Percentage Change								
Macro	Gross Domestic Product		%	0.05	0.07	0.03	0.02	0.01
	Gross Capital Income		%	(0.09)	(0.18)	(0.14)	(0.12)	(0.09)
	Gross Labor Income		%	(0.08)	(0.14)	(0.11)	(0.09)	(0.08)
	Gross Resource Income		%	15.94	21.40	12.22	9.63	7.64
	Consumption		%	0.05	0.00	(0.01)	(0.00)	0.00
	Investment		%	(0.05)	(0.10)	(0.01)	0.01	0.01
Natural Gas	Wellhead Price		%	7.73	14.03	9.44	7.92	6.37
	Production		%	1.86	3.67	4.75	4.77	4.87
	Pipeline Imports		%					
	Total Demand		%	(2.73)	(5.26)	(4.18)	(3.80)	(3.35)
	Sectoral Demand	AGR	%	(4.04)	(7.15)	(5.36)	(4.68)	(3.98)
		COL	%					
		CRU	%					
		EIS	%	(3.94)	(7.05)	(5.32)	(4.66)	(3.97)
		ELE	%	(2.77)	(5.67)	(4.66)	(4.36)	(3.91)
		GAS	%					
		M_V	%	(2.58)	(5.15)	(4.20)	(3.86)	(3.40)
		MAN	%	(3.59)	(6.50)	(4.93)	(4.36)	(3.73)
		OIL	%	(3.69)	(6.64)	(4.98)	(4.36)	(3.71)
		SRV	%	(1.83)	(3.77)	(3.16)	(2.92)	(2.61)
		TRK	%	(1.07)	(2.43)	(2.27)	(2.20)	(2.05)
		TRN	%	(1.10)	(2.50)	(2.34)	(2.26)	(2.11)
		C	%	(1.55)	(3.25)	(2.76)	(2.55)	(2.29)

[1] Export revenues are based on LNG exports net of liquefaction loss.

Figure 152: Detailed Results for USREF_SD_HS

Scenario: USREF_SD_HS								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,886	$17,878	$20,294	$22,893	$25,763
	Consumption		Billion 2010$	$12,413	$13,976	$15,973	$18,150	$20,518
	Investment		Billion 2010$	$2,469	$2,792	$3,158	$3,515	$3,975
Natural Gas	Wellhead Price		2010$ per Mcf	$4.40	$5.30	$6.52	$6.92	$7.40
	Production		Tcf	22.56	24.30	26.03	27.55	29.13
	Exports		Tcf	0.37	2.19	3.93	4.38	4.38
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	24.80	23.95	23.15	23.93	24.93
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.15	0.15	0.15
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.28	3.11	2.95	2.86	2.83
		ELE	Tcf	6.88	6.44	6.08	6.69	7.30
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.17	0.16	0.16	0.17
		MAN	Tcf	4.18	4.04	3.94	4.01	4.19
		OIL	Tcf	1.30	1.32	1.24	1.28	1.28
		SRV	Tcf	2.42	2.43	2.43	2.51	2.64
		TRK	Tcf	0.47	0.47	0.47	0.50	0.53
		TRN	Tcf	0.22	0.22	0.22	0.23	0.25
		C	Tcf	4.78	4.68	4.59	4.58	4.59
		G	Tcf	0.92	0.92	0.92	0.95	1.00
	Export Revenues [1]		Billion 2010$	$1.51	$10.76	$23.75	$28.08	$30.03
Percentage Change								
Macro	Gross Domestic Product		%	0.02	0.09	0.08	0.06	0.03
	Gross Capital Income		%	(0.02)	(0.16)	(0.24)	(0.24)	(0.20)
	Gross Labor Income		%	(0.02)	(0.12)	(0.19)	(0.19)	(0.16)
	Gross Resource Income		%	4.89	21.45	24.76	21.89	16.93
	Consumption		%	0.07	0.05	0.00	(0.02)	(0.01)
	Investment		%	0.11	0.03	(0.11)	(0.05)	(0.05)
Natural Gas	Wellhead Price		%	2.42	14.04	18.65	17.49	13.75
	Production		%	0.65	3.67	8.28	9.30	9.59
	Pipeline Imports		%					
	Total Demand		%	(0.90)	(5.26)	(7.73)	(7.84)	(6.84)
	Sectoral Demand	AGR	%	(1.41)	(7.17)	(9.83)	(9.58)	(8.08)
		COL	%					
		CRU	%					
		EIS	%	(1.39)	(7.08)	(9.73)	(9.52)	(8.05)
		ELE	%	(0.89)	(5.66)	(8.61)	(8.97)	(7.97)
		GAS	%					
		M_V	%	(0.89)	(5.17)	(7.76)	(7.94)	(6.95)
		MAN	%	(1.22)	(6.52)	(9.09)	(8.95)	(7.60)
		OIL	%	(1.21)	(6.64)	(9.17)	(8.97)	(7.56)
		SRV	%	(0.58)	(3.75)	(5.91)	(6.09)	(5.38)
		TRK	%	(0.36)	(2.42)	(4.26)	(4.61)	(4.25)
		TRN	%	(0.40)	(2.50)	(4.37)	(4.72)	(4.36)
		C	%	(0.45)	(3.21)	(5.18)	(5.36)	(4.76)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 153: Detailed Results for USREF_SD_HR

Scenario: USREF_SD_HR								
	Description		Units	2015	2020	2025	2030	2035
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,891	$17,882	$20,292	$22,893	$25,762
	Consumption		Billion 2010$	$12,415	$13,974	$15,972	$18,151	$20,519
	Investment		Billion 2010$	$2,467	$2,789	$3,160	$3,516	$3,975
Natural Gas	Wellhead Price		2010$ per Mcf	$4.62	$5.57	$6.52	$6.91	$7.40
	Production		Tcf	22.83	24.55	26.03	27.55	29.13
	Exports		Tcf	1.10	2.92	3.93	4.38	4.38
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	24.35	23.48	23.15	23.93	24.93
	Sectoral Demand	AGR	Tcf	0.15	0.14	0.15	0.15	0.15
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.19	3.03	2.95	2.86	2.83
		ELE	Tcf	6.75	6.30	6.08	6.69	7.30
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.17	0.16	0.16	0.17
		MAN	Tcf	4.08	3.94	3.94	4.01	4.19
		OIL	Tcf	1.27	1.29	1.24	1.28	1.28
		SRV	Tcf	2.39	2.40	2.43	2.51	2.64
		TRK	Tcf	0.46	0.46	0.47	0.50	0.53
		TRN	Tcf	0.22	0.22	0.22	0.23	0.25
		C	Tcf	4.73	4.63	4.59	4.58	4.59
		G	Tcf	0.91	0.91	0.92	0.95	1.00
	Export Revenues [1]		Billion 2010$	$4.71	$15.07	$23.75	$28.08	$30.03
Percentage Change								
Macro	Gross Domestic Product		%	0.05	0.11	0.07	0.05	0.03
	Gross Capital Income		%	(0.09)	(0.24)	(0.25)	(0.24)	(0.20)
	Gross Labor Income		%	(0.07)	(0.19)	(0.20)	(0.19)	(0.16)
	Gross Resource Income		%	15.86	30.34	24.68	21.87	16.92
	Consumption		%	0.09	0.03	0.00	(0.01)	(0.01)
	Investment		%	0.01	(0.07)	(0.06)	(0.04)	(0.04)
Natural Gas	Wellhead Price		%	7.71	19.75	18.64	17.48	13.75
	Production		%	1.86	4.75	8.28	9.29	9.59
	Pipeline Imports		%					
	Total Demand		%	(2.73)	(7.15)	(7.73)	(7.84)	(6.84)
	Sectoral Demand	AGR	%	(4.09)	(9.69)	(9.85)	(9.59)	(8.09)
		COL	%					
		CRU	%					
		EIS	%	(3.99)	(9.55)	(9.76)	(9.53)	(8.06)
		ELE	%	(2.76)	(7.69)	(8.61)	(8.97)	(7.97)
		GAS	%					
		M_V	%	(2.60)	(7.00)	(7.76)	(7.95)	(6.95)
		MAN	%	(3.61)	(8.81)	(9.09)	(8.95)	(7.60)
		OIL	%	(3.69)	(8.99)	(9.18)	(8.97)	(7.56)
		SRV	%	(1.82)	(5.15)	(5.91)	(6.09)	(5.38)
		TRK	%	(1.08)	(3.34)	(4.27)	(4.61)	(4.26)
		TRN	%	(1.13)	(3.44)	(4.39)	(4.73)	(4.37)
		C	%	(1.52)	(4.43)	(5.18)	(5.35)	(4.76)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 154: Detailed Results for USREF_SD_NC

Scenario: USREF_SD_NC								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,900	$17,880	$20,292	$22,896	$25,773
	Consumption		Billion 2010$	$12,415	$13,973	$15,973	$18,153	$20,520
	Investment		Billion 2010$	$2,461	$2,791	$3,161	$3,520	$3,980
Natural Gas	Wellhead Price		2010$ per Mcf	$5.01	$5.57	$6.52	$6.96	$7.73
	Production		Tcf	23.19	24.55	26.03	27.63	29.90
	Exports		Tcf	2.17	2.92	3.93	4.54	5.75
	Pipeline Imports		Tcf	2.61	1.84	1.05	0.76	0.17
	Total Demand		Tcf	23.64	23.47	23.15	23.85	24.33
	Sectoral Demand	AGR	Tcf	0.14	0.14	0.15	0.15	0.15
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.06	3.03	2.95	2.85	2.75
		ELE	Tcf	6.55	6.30	6.08	6.67	7.09
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.17	0.16	0.16	0.17
		MAN	Tcf	3.93	3.94	3.94	4.00	4.08
		OIL	Tcf	1.22	1.29	1.24	1.27	1.25
		SRV	Tcf	2.34	2.40	2.43	2.50	2.59
		TRK	Tcf	0.46	0.46	0.47	0.50	0.53
		TRN	Tcf	0.21	0.22	0.22	0.23	0.24
		C	Tcf	4.64	4.63	4.59	4.57	4.51
		G	Tcf	0.89	0.91	0.92	0.95	0.98
	Export Revenues [1]		Billion 2010$	$10.08	$15.06	$23.75	$29.29	$41.23
Percentage Change								
Macro	Gross Domestic Product		%	0.11	0.10	0.07	0.07	0.07
	Gross Capital Income		%	(0.20)	(0.25)	(0.25)	(0.24)	(0.24)
	Gross Labor Income		%	(0.17)	(0.19)	(0.20)	(0.19)	(0.20)
	Gross Resource Income		%	34.72	30.19	24.65	22.89	23.81
	Consumption		%	0.09	0.03	0.01	0.00	(0.00)
	Investment		%	(0.21)	0.02	(0.01)	0.10	0.09
Natural Gas	Wellhead Price		%	16.69	19.72	18.63	18.26	18.97
	Production		%	3.46	4.74	8.27	9.62	12.48
	Pipeline Imports		%					
	Total Demand		%	0.00	0.00	0.00	(0.00)	0.00
	Sectoral Demand	AGR	%	(5.57)	(7.15)	(7.74)	(8.14)	(9.09)
		COL	%	(8.17)	(9.71)	(9.86)	(9.96)	(10.69)
		CRU	%					
		EIS	%					
		ELE	%	(7.97)	(9.59)	(9.78)	(9.91)	(10.65)
		GAS	%	(5.64)	(7.69)	(8.61)	(9.31)	(10.56)
		M_V	%					
		MAN	%	(5.24)	(7.00)	(7.76)	(8.24)	(9.19)
		OIL	%	(7.25)	(8.81)	(9.09)	(9.29)	(10.06)
		SRV	%	(7.48)	(8.99)	(9.18)	(9.31)	(10.04)
		TRK	%	(3.78)	(5.15)	(5.91)	(6.33)	(7.19)
		TRN	%	(2.22)	(3.35)	(4.27)	(4.79)	(5.69)
		C	%	(2.28)	(3.47)	(4.40)	(4.92)	(5.83)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 155: Detailed Results for HEUR_D_NC

Scenario: HEUR_D_NC								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$16,000	$18,002	$20,442	$23,023	$25,929
	Consumption		Billion 2010$	$12,441	$14,000	$16,012	$18,184	$20,565
	Investment		Billion 2010$	$2,475	$2,812	$3,176	$3,537	$4,001
Natural Gas	Wellhead Price		2010$ per Mcf	$4.31	$4.46	$5.04	$5.25	$5.82
	Production		Tcf	25.66	27.83	30.04	31.24	32.82
	Exports		Tcf	3.30	3.94	4.87	4.59	5.61
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	24.63	25.16	25.42	26.79	27.35
	Sectoral Demand	AGR	Tcf	0.14	0.14	0.15	0.15	0.15
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.04	3.13	3.14	3.18	3.05
		ELE	Tcf	7.54	7.54	7.50	8.17	8.74
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.18	0.17	0.18	0.18
		MAN	Tcf	3.93	4.10	4.23	4.47	4.53
		OIL	Tcf	1.16	1.23	1.22	1.32	1.27
		SRV	Tcf	2.39	2.48	2.57	2.70	2.78
		TRK	Tcf	0.47	0.49	0.52	0.57	0.62
		TRN	Tcf	0.22	0.23	0.24	0.27	0.29
		C	Tcf	4.65	4.70	4.71	4.77	4.68
		G	Tcf	0.90	0.94	0.97	1.02	1.05
	Export Revenues [1]		Billion 2010$	$13.18	$16.30	$22.77	$22.33	$30.25
Percentage Change								
Macro	Gross Domestic Product		%	0.25	0.21	0.15	0.09	0.10
	Gross Capital Income		%	(0.31)	(0.32)	(0.29)	(0.20)	(0.21)
	Gross Labor Income		%	(0.24)	(0.23)	(0.22)	(0.15)	(0.16)
	Gross Resource Income		%	63.40	45.34	33.90	21.40	24.37
	Consumption		%	0.10	0.01	(0.01)	0.00	0.00
	Investment		%	(0.31)	0.06	(0.03)	0.14	0.15
Natural Gas	Wellhead Price		%	28.73	27.46	23.37	15.80	18.15
	Production		%	3.93	5.19	8.38	8.85	10.41
	Pipeline Imports		%					
	Total Demand		%	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Sectoral Demand	AGR	%	(8.64)	(9.26)	(9.10)	(7.11)	(8.42)
		COL	%	(12.74)	(12.66)	(11.72)	(8.79)	(10.02)
		CRU	%					
		EIS	%					
		ELE	%	(12.44)	(12.52)	(11.63)	(8.77)	(9.99)
		GAS	%	(8.80)	(9.99)	(10.17)	(8.15)	(9.86)
		M_V	%					
		MAN	%	(8.20)	(9.14)	(9.19)	(7.25)	(8.53)
		OIL	%	(11.47)	(11.61)	(10.89)	(8.22)	(9.45)
		SRV	%	(11.88)	(11.91)	(11.04)	(8.26)	(9.48)
		TRK	%	(5.65)	(6.35)	(6.61)	(5.27)	(6.32)
		TRN	%	(3.18)	(3.96)	(4.57)	(3.88)	(4.78)
		C	%	(3.24)	(4.10)	(4.70)	(4.00)	(4.91)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 156: Detailed Results for HEUR_SD_LSS

Scenario: HEUR_SD_LSS								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,963	$17,974	$20,423	$23,011	$25,909
	Consumption		Billion 2010$	$12,433	$14,001	$16,013	$18,182	$20,563
	Investment		Billion 2010$	$2,484	$2,812	$3,176	$3,531	$3,995
Natural Gas	Wellhead Price		2010$ per Mcf	$3.39	$3.72	$4.43	$4.84	$5.23
	Production		Tcf	24.76	26.89	28.73	29.95	30.97
	Exports		Tcf	0.18	1.10	2.01	2.19	2.19
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.84	27.06	26.98	27.89	28.92
	Sectoral Demand	AGR	Tcf	0.16	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.45	3.46	3.39	3.34	3.26
		ELE	Tcf	8.23	8.16	8.02	8.56	9.33
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.21	0.19	0.18	0.18	0.19
		MAN	Tcf	4.41	4.49	4.55	4.68	4.83
		OIL	Tcf	1.31	1.36	1.31	1.38	1.35
		SRV	Tcf	2.53	2.61	2.68	2.78	2.90
		TRK	Tcf	0.48	0.51	0.54	0.59	0.64
		TRN	Tcf	0.22	0.24	0.25	0.27	0.30
		C	Tcf	4.88	4.90	4.89	4.89	4.85
		G	Tcf	0.96	0.99	1.02	1.06	1.10
	Export Revenues [1]		Billion 2010$	$0.57	$3.80	$8.25	$9.83	$10.62
Percentage Change								
Macro	Gross Domestic Product		%	0.02	0.06	0.06	0.04	0.03
	Gross Capital Income		%	(0.01)	(0.06)	(0.10)	(0.09)	(0.08)
	Gross Labor Income		%	(0.01)	(0.04)	(0.07)	(0.07)	(0.06)
	Gross Resource Income		%	2.58	10.21	11.75	9.10	8.13
	Consumption		%	0.03	0.02	(0.00)	(0.01)	(0.01)
	Investment		%	0.06	0.04	(0.02)	(0.01)	(0.01)
Natural Gas	Wellhead Price		%	1.20	6.29	8.29	6.87	6.27
	Production		%	0.26	1.64	3.66	4.33	4.18
	Pipeline Imports		%					
	Total Demand		%	(0.43)	(2.41)	(3.56)	(3.29)	(3.17)
	Sectoral Demand	AGR	%	(0.68)	(3.35)	(4.61)	(4.07)	(3.79)
		COL	%					
		CRU	%					
		EIS	%	(0.67)	(3.30)	(4.57)	(4.05)	(3.77)
		ELE	%	(0.43)	(2.61)	(4.00)	(3.78)	(3.73)
		GAS	%					
		M_V	%	(0.43)	(2.40)	(3.60)	(3.35)	(3.22)
		MAN	%	(0.60)	(3.07)	(4.29)	(3.81)	(3.57)
		OIL	%	(0.60)	(3.14)	(4.36)	(3.84)	(3.58)
		SRV	%	(0.26)	(1.59)	(2.53)	(2.41)	(2.34)
		TRK	%	(0.15)	(0.98)	(1.73)	(1.76)	(1.76)
		TRN	%	(0.17)	(1.01)	(1.77)	(1.80)	(1.80)
		C	%	(0.20)	(1.32)	(2.15)	(2.08)	(2.02)

1 Export revenues are based on LNG exports net of liquefaction loss.

Figure 157: Detailed Results for HEUR_SD_LS

Scenario: HEUR_SD_LS								
	Description		Units	2015	2020	2025	2030	2035
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,965	$17,984	$20,422	$23,011	$25,909
	Consumption		Billion 2010$	$12,435	$14,000	$16,012	$18,182	$20,564
	Investment		Billion 2010$	$2,485	$2,808	$3,177	$3,532	$3,996
Natural Gas	Wellhead Price		2010$ per Mcf	$3.43	$3.98	$4.46	$4.84	$5.23
	Production		Tcf	24.82	27.28	28.82	29.95	30.97
	Exports		Tcf	0.37	2.19	2.19	2.19	2.19
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.72	26.36	26.88	27.89	28.92
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.42	3.34	3.38	3.34	3.26
		ELE	Tcf	8.20	7.93	7.99	8.56	9.33
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.21	0.19	0.18	0.18	0.19
		MAN	Tcf	4.38	4.35	4.53	4.68	4.83
		OIL	Tcf	1.30	1.31	1.30	1.38	1.35
		SRV	Tcf	2.52	2.56	2.67	2.78	2.90
		TRK	Tcf	0.48	0.50	0.54	0.59	0.64
		TRN	Tcf	0.22	0.23	0.25	0.27	0.30
		C	Tcf	4.87	4.82	4.88	4.89	4.85
		G	Tcf	0.96	0.97	1.02	1.06	1.10
	Export Revenues [1]		Billion 2010$	$1.18	$8.07	$9.06	$9.83	$10.62
Percentage Change								
Macro	Gross Domestic Product		%	0.03	0.11	0.06	0.04	0.03
	Gross Capital Income		%	(0.02)	(0.15)	(0.12)	(0.09)	(0.08)
	Gross Labor Income		%	(0.01)	(0.11)	(0.09)	(0.07)	(0.06)
	Gross Resource Income		%	5.44	22.13	12.88	9.08	8.12
	Consumption		%	0.05	0.00	(0.01)	(0.01)	(0.01)
	Investment		%	0.10	(0.10)	0.01	0.01	0.01
Natural Gas	Wellhead Price		%	2.52	13.51	9.11	6.86	6.27
	Production		%	0.53	3.11	3.97	4.33	4.18
	Pipeline Imports		%					
	Total Demand		%	(0.89)	(4.93)	(3.89)	(3.29)	(3.17)
	Sectoral Demand	AGR	%	(1.38)	(6.79)	(5.05)	(4.08)	(3.79)
		COL	%					
		CRU	%					
		EIS	%	(1.35)	(6.70)	(5.02)	(4.06)	(3.78)
		ELE	%	(0.90)	(5.34)	(4.37)	(3.79)	(3.73)
		GAS	%					
		M_V	%	(0.88)	(4.88)	(3.94)	(3.35)	(3.22)
		MAN	%	(1.23)	(6.25)	(4.69)	(3.82)	(3.57)
		OIL	%	(1.24)	(6.41)	(4.77)	(3.84)	(3.58)
		SRV	%	(0.55)	(3.31)	(2.77)	(2.41)	(2.34)
		TRK	%	(0.32)	(2.05)	(1.90)	(1.76)	(1.76)
		TRN	%	(0.33)	(2.09)	(1.96)	(1.81)	(1.81)
		C	%	(0.43)	(2.78)	(2.37)	(2.08)	(2.02)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 158: Detailed Results for HEUR_SD_LR

Scenario: HEUR_SD_LR								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,972	$17,983	$20,422	$23,010	$25,909
	Consumption		Billion 2010$	$12,435	$13,999	$16,012	$18,182	$20,564
	Investment		Billion 2010$	$2,482	$2,809	$3,178	$3,532	$3,996
Natural Gas	Wellhead Price		2010$ per Mcf	$3.61	$3.97	$4.46	$4.84	$5.23
	Production		Tcf	25.06	27.28	28.82	29.94	30.97
	Exports		Tcf	1.10	2.19	2.19	2.19	2.19
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.23	26.36	26.88	27.89	28.92
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.33	3.34	3.37	3.34	3.26
		ELE	Tcf	8.04	7.93	7.99	8.56	9.33
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.19	0.18	0.18	0.19
		MAN	Tcf	4.27	4.35	4.53	4.68	4.83
		OIL	Tcf	1.27	1.31	1.30	1.38	1.35
		SRV	Tcf	2.49	2.56	2.67	2.78	2.90
		TRK	Tcf	0.48	0.50	0.54	0.59	0.64
		TRN	Tcf	0.22	0.23	0.25	0.27	0.30
		C	Tcf	4.82	4.82	4.88	4.89	4.85
		G	Tcf	0.95	0.97	1.02	1.06	1.10
	Export Revenues [1]		Billion 2010$	$3.69	$8.07	$9.06	$9.83	$10.62
Percentage Change								
Macro	Gross Domestic Product		%	0.07	0.11	0.06	0.03	0.03
	Gross Capital Income		%	(0.09)	(0.16)	(0.12)	(0.09)	(0.08)
	Gross Labor Income		%	(0.07)	(0.11)	(0.09)	(0.07)	(0.06)
	Gross Resource Income		%	17.33	22.05	12.86	9.07	8.11
	Consumption		%	0.05	(0.00)	(0.01)	(0.01)	(0.00)
	Investment		%	(0.02)	(0.05)	0.02	0.01	0.01
Natural Gas	Wellhead Price		%	7.97	13.49	9.11	6.86	6.27
	Production		%	1.49	3.10	3.97	4.32	4.18
	Pipeline Imports		%					
	Total Demand		%	(2.71)	(4.94)	(3.90)	(3.29)	(3.17)
	Sectoral Demand	AGR	%	(4.08)	(6.80)	(5.06)	(4.08)	(3.80)
		COL	%					
		CRU	%					
		EIS	%	(3.98)	(6.71)	(5.03)	(4.07)	(3.79)
		ELE	%	(2.76)	(5.35)	(4.37)	(3.78)	(3.73)
		GAS	%					
		M_V	%	(2.60)	(4.88)	(3.94)	(3.36)	(3.22)
		MAN	%	(3.67)	(6.25)	(4.69)	(3.82)	(3.58)
		OIL	%	(3.78)	(6.41)	(4.76)	(3.84)	(3.58)
		SRV	%	(1.71)	(3.32)	(2.78)	(2.41)	(2.34)
		TRK	%	(0.96)	(2.05)	(1.90)	(1.76)	(1.76)
		TRN	%	(0.98)	(2.11)	(1.96)	(1.81)	(1.81)
		C	%	(1.42)	(2.78)	(2.36)	(2.07)	(2.02)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 159: Detailed Results for HEUR_SD_HS

Scenario: HEUR_SD_HS								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,965	$17,986	$20,439	$23,022	$25,918
	Consumption		Billion 2010$	$12,437	$14,004	$16,013	$18,180	$20,561
	Investment		Billion 2010$	$2,486	$2,813	$3,175	$3,531	$3,994
Natural Gas	Wellhead Price		2010$ per Mcf	$3.43	$3.98	$4.84	$5.21	$5.59
	Production		Tcf	24.82	27.28	29.67	31.13	32.17
	Exports		Tcf	0.37	2.19	4.02	4.38	4.38
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.72	26.36	25.90	26.89	27.92
	Sectoral Demand	AGR	Tcf	0.15	0.15	0.15	0.15	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.42	3.34	3.22	3.20	3.13
		ELE	Tcf	8.20	7.93	7.66	8.21	8.95
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.21	0.19	0.17	0.18	0.18
		MAN	Tcf	4.38	4.35	4.33	4.49	4.64
		OIL	Tcf	1.30	1.31	1.24	1.32	1.30
		SRV	Tcf	2.52	2.56	2.60	2.70	2.82
		TRK	Tcf	0.48	0.50	0.53	0.58	0.63
		TRN	Tcf	0.22	0.23	0.25	0.27	0.29
		C	Tcf	4.87	4.82	4.77	4.78	4.75
		G	Tcf	0.96	0.97	0.99	1.03	1.07
	Export Revenues [1]		Billion 2010$	$1.18	$8.07	$18.05	$21.15	$22.70
Percentage Change								
Macro	Gross Domestic Product		%	0.03	0.12	0.14	0.09	0.06
	Gross Capital Income		%	(0.02)	(0.14)	(0.21)	(0.19)	(0.17)
	Gross Labor Income		%	(0.01)	(0.10)	(0.16)	(0.14)	(0.13)
	Gross Resource Income		%	5.38	22.12	26.64	20.29	17.95
	Consumption		%	0.06	0.04	(0.01)	(0.02)	(0.02)
	Investment		%	0.12	0.08	(0.05)	(0.02)	(0.02)
Natural Gas	Wellhead Price		%	2.51	13.51	18.45	14.96	13.55
	Production		%	0.52	3.11	7.05	8.47	8.21
	Pipeline Imports		%					
	Total Demand		%	(0.89)	(4.93)	(7.39)	(6.76)	(6.50)
	Sectoral Demand	AGR	%	(1.40)	(6.82)	(9.52)	(8.33)	(7.73)
		COL	%					
		CRU	%					
		EIS	%	(1.38)	(6.74)	(9.44)	(8.29)	(7.70)
		ELE	%	(0.89)	(5.33)	(8.28)	(7.76)	(7.62)
		GAS	%					
		M_V	%	(0.88)	(4.90)	(7.47)	(6.88)	(6.60)
		MAN	%	(1.24)	(6.26)	(8.87)	(7.82)	(7.31)
		OIL	%	(1.24)	(6.41)	(9.00)	(7.86)	(7.32)
		SRV	%	(0.55)	(3.30)	(5.33)	(5.01)	(4.85)
		TRK	%	(0.32)	(2.04)	(3.66)	(3.68)	(3.66)
		TRN	%	(0.35)	(2.11)	(3.75)	(3.77)	(3.75)
		C	%	(0.41)	(2.75)	(4.55)	(4.34)	(4.20)

[1] Export revenues are based on LNG exports net of liquefaction loss.

Figure 160: Detailed Results for HEUR_SD_HR

Scenario: HEUR_SD_HR								
	Description		Units	2015	2020	2025	2030	2035
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,973	$18,012	$20,438	$23,021	$25,918
	Consumption		Billion 2010$	$12,442	$14,000	$16,010	$18,181	$20,564
	Investment		Billion 2010$	$2,486	$2,805	$3,178	$3,532	$3,996
Natural Gas	Wellhead Price		2010$ per Mcf	$3.61	$4.61	$4.93	$5.21	$5.59
	Production		Tcf	25.06	27.96	29.83	31.13	32.17
	Exports		Tcf	1.10	4.38	4.38	4.38	4.38
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.23	24.85	25.70	26.89	27.92
	Sectoral Demand	AGR	Tcf	0.15	0.14	0.15	0.15	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.33	3.08	3.18	3.19	3.13
		ELE	Tcf	8.04	7.44	7.59	8.21	8.95
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.18	0.17	0.18	0.18
		MAN	Tcf	4.27	4.03	4.29	4.49	4.64
		OIL	Tcf	1.27	1.21	1.23	1.32	1.30
		SRV	Tcf	2.49	2.46	2.59	2.70	2.82
		TRK	Tcf	0.48	0.49	0.53	0.57	0.63
		TRN	Tcf	0.22	0.23	0.24	0.27	0.29
		C	Tcf	4.82	4.66	4.74	4.78	4.75
		G	Tcf	0.95	0.93	0.98	1.03	1.07
	Export Revenues [1]		Billion 2010$	$3.69	$18.71	$20.00	$21.15	$22.70
Percentage Change								
Macro	Gross Domestic Product		%	0.08	0.27	0.13	0.08	0.06
	Gross Capital Income		%	(0.07)	(0.34)	(0.26)	(0.20)	(0.17)
	Gross Labor Income		%	(0.06)	(0.25)	(0.19)	(0.15)	(0.13)
	Gross Resource Income		%	17.27	52.53	29.53	20.22	17.92
	Consumption		%	0.10	0.01	(0.02)	(0.01)	(0.01)
	Investment		%	0.11	(0.22)	0.03	0.02	0.03
Natural Gas	Wellhead Price		%	7.96	31.57	20.46	14.95	13.54
	Production		%	1.49	5.68	7.61	8.46	8.20
	Pipeline Imports		%					
	Total Demand		%	(2.71)	(10.38)	(8.12)	(6.77)	(6.50)
	Sectoral Demand	AGR	%	(4.14)	(14.12)	(10.46)	(8.36)	(7.75)
		COL	%					
		CRU	%					
		EIS	%	(4.05)	(13.92)	(10.39)	(8.32)	(7.73)
		ELE	%	(2.75)	(11.20)	(9.08)	(7.76)	(7.62)
		GAS	%					
		M_V	%	(2.64)	(10.24)	(8.20)	(6.90)	(6.60)
		MAN	%	(3.71)	(13.02)	(9.71)	(7.83)	(7.31)
		OIL	%	(3.77)	(13.34)	(9.87)	(7.86)	(7.32)
		SRV	%	(1.70)	(7.15)	(5.87)	(5.01)	(4.85)
		TRK	%	(0.97)	(4.47)	(4.05)	(3.69)	(3.66)
		TRN	%	(1.01)	(4.57)	(4.18)	(3.79)	(3.76)
		C	%	(1.36)	(6.06)	(5.03)	(4.33)	(4.19)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 161: Detailed Results for HEUR_SD_NC

Scenario: HEUR_SD_NC								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$16,017	$18,025	$20,462	$23,039	$25,948
	Consumption		Billion 2010$	$12,447	$14,002	$16,012	$18,184	$20,565
	Investment		Billion 2010$	$2,473	$2,812	$3,177	$3,538	$4,002
Natural Gas	Wellhead Price		2010$ per Mcf	$4.68	$4.98	$5.55	$5.71	$6.41
	Production		Tcf	25.87	28.24	30.81	32.43	34.24
	Exports		Tcf	4.23	5.44	6.72	6.89	8.39
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	23.91	24.07	24.34	25.67	25.99
	Sectoral Demand	AGR	Tcf	0.13	0.13	0.14	0.14	0.14
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	2.91	2.95	2.97	3.02	2.87
		ELE	Tcf	7.32	7.19	7.15	7.78	8.23
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.17	0.16	0.17	0.17
		MAN	Tcf	3.77	3.88	4.02	4.25	4.28
		OIL	Tcf	1.11	1.17	1.15	1.25	1.20
		SRV	Tcf	2.34	2.41	2.49	2.61	2.67
		TRK	Tcf	0.46	0.48	0.51	0.56	0.60
		TRN	Tcf	0.22	0.22	0.24	0.26	0.28
		C	Tcf	4.58	4.57	4.59	4.64	4.53
		G	Tcf	0.88	0.90	0.94	0.99	1.01
	Export Revenues [1]		Billion 2010$	$18.35	$25.13	$34.58	$36.49	$49.83
Percentage Change								
Macro	Gross Domestic Product		%	0.35	0.34	0.25	0.16	0.18
	Gross Capital Income		%	(0.42)	(0.47)	(0.42)	(0.32)	(0.33)
	Gross Labor Income		%	(0.33)	(0.34)	(0.32)	(0.25)	(0.26)
	Gross Resource Income		%	88.35	70.57	52.78	36.18	41.62
	Consumption		%	0.14	0.02	(0.01)	0.00	0.00
	Investment		%	(0.41)	0.04	0.01	0.18	0.18
Natural Gas	Wellhead Price		%	39.81	42.27	35.75	26.06	30.14
	Production		%	4.78	6.75	11.16	12.97	15.18
	Pipeline Imports		%					
	Total Demand		%	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Sectoral Demand	AGR	%	(11.32)	(13.18)	(12.97)	(10.98)	(12.98)
		COL	%	(16.58)	(17.87)	(16.58)	(13.50)	(15.34)
		CRU	%					
		EIS	%					
		ELE	%	(16.19)	(17.66)	(16.46)	(13.45)	(15.30)
		GAS	%	(11.50)	(14.17)	(14.43)	(12.54)	(15.11)
		M_V	%					
		MAN	%	(10.73)	(13.00)	(13.07)	(11.18)	(13.14)
		OIL	%	(14.93)	(16.41)	(15.42)	(12.64)	(14.50)
		SRV	%	(15.45)	(16.82)	(15.63)	(12.69)	(14.54)
		TRK	%	(7.51)	(9.21)	(9.55)	(8.24)	(9.89)
		TRN	%	(4.25)	(5.81)	(6.66)	(6.10)	(7.55)
		C	%	(4.35)	(6.01)	(6.86)	(6.29)	(7.74)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 162: Detailed Results for LEUR_SD_LSS

Scenario: LEUR_SD_LSS								
	Description		Units	2015	2020	2025	2030	2035
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,791	$17,719	$20,060	$22,691	$25,568
	Consumption		Billion 2010$	$12,382	$13,920	$15,861	$18,093	$20,477
	Investment		Billion 2010$	$2,443	$2,757	$3,135	$3,495	$3,956
Natural Gas	Wellhead Price		2010$ per Mcf	$5.73	$6.82	$8.04	$8.33	$9.00
	Production		Tcf	19.60	20.15	20.58	21.13	21.83
	Exports		Tcf	-	0.78	0.86	-	0.19
	Pipeline Imports		Tcf	3.00	2.61	2.37	2.01	1.75
	Total Demand		Tcf	22.60	21.98	22.09	23.14	23.39
	Sectoral Demand	AGR	Tcf	0.16	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.18	3.05	2.96	2.86	2.75
		ELE	Tcf	5.23	4.88	5.08	5.91	6.10
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.19	0.16	0.15	0.16	0.16
		MAN	Tcf	3.99	3.88	3.86	3.95	3.99
		OIL	Tcf	1.32	1.37	1.37	1.36	1.38
		SRV	Tcf	2.32	2.33	2.35	2.45	2.54
		TRK	Tcf	0.45	0.45	0.47	0.49	0.51
		TRN	Tcf	0.21	0.21	0.22	0.23	0.24
		C	Tcf	4.68	4.61	4.59	4.63	4.58
		G	Tcf	0.88	0.89	0.90	0.94	0.97
	Export Revenues [1]		Billion 2010$	$0.00	$4.93	$6.41	$0.00	$1.58
Percentage Change								
Macro	Gross Domestic Product		%	0.00	0.01	(0.01)	(0.01)	0.01
	Gross Capital Income		%	0.00	(0.08)	(0.06)	(0.01)	(0.00)
	Gross Labor Income		%	0.00	(0.06)	(0.05)	(0.00)	(0.00)
	Gross Resource Income		%	(0.02)	7.82	3.12	(0.06)	0.43
	Consumption		%	0.02	0.00	(0.01)	0.00	0.00
	Investment		%	0.04	(0.07)	(0.08)	0.08	0.08
Natural Gas	Wellhead Price		%	(0.00)	5.78	2.75	(0.00)	0.42
	Production		%	(0.00)	1.35	2.70	(0.01)	0.60
	Pipeline Imports		%					
	Total Demand		%	(0.00)	(2.28)	(1.42)	(0.01)	(0.25)
	Sectoral Demand	AGR	%	(0.02)	(3.06)	(1.78)	(0.03)	(0.30)
		COL	%					
		CRU	%					
		EIS	%	(0.02)	(3.01)	(1.76)	(0.04)	(0.31)
		ELE	%	0.01	(2.46)	(1.56)	(0.00)	(0.29)
		GAS	%					
		M_V	%	(0.00)	(2.19)	(1.44)	(0.01)	(0.25)
		MAN	%	(0.02)	(2.76)	(1.64)	(0.00)	(0.27)
		OIL	%	0.00	(2.81)	(1.62)	(0.00)	(0.28)
		SRV	%	0.00	(1.70)	(1.14)	(0.01)	(0.21)
		TRK	%	(0.00)	(1.11)	(0.89)	(0.01)	(0.17)
		TRN	%	(0.01)	(1.14)	(0.91)	(0.02)	(0.19)
		C	%	0.02	(1.50)	(1.04)	0.00	(0.19)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 163: Detailed Results for HEUR_SD_LSS_QR

Scenario: HEUR_SD_LSS_QR								
	Description		Units	2015	2020	2025	2030	2035
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,963	$17,976	$20,428	$23,016	$25,915
	Consumption		Billion 2010$	$12,434	$14,003	$16,015	$18,184	$20,566
	Investment		Billion 2010$	$2,484	$2,812	$3,176	$3,531	$3,995
Natural Gas	Wellhead Price		2010$ per Mcf	$3.39	$3.72	$4.43	$4.84	$5.23
	Production		Tcf	24.76	26.89	28.73	29.94	30.97
	Exports		Tcf	0.18	1.10	2.01	2.19	2.19
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.84	27.06	26.97	27.89	28.92
	Sectoral Demand	AGR	Tcf	0.16	0.15	0.16	0.16	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.45	3.46	3.39	3.34	3.26
		ELE	Tcf	8.23	8.16	8.02	8.56	9.33
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.21	0.19	0.18	0.18	0.19
		MAN	Tcf	4.41	4.49	4.55	4.68	4.83
		OIL	Tcf	1.31	1.36	1.31	1.38	1.35
		SRV	Tcf	2.53	2.61	2.68	2.78	2.90
		TRK	Tcf	0.48	0.51	0.54	0.59	0.64
		TRN	Tcf	0.22	0.24	0.25	0.27	0.30
		C	Tcf	4.88	4.90	4.89	4.89	4.85
		G	Tcf	0.96	0.99	1.02	1.06	1.10
	Export Revenues [1]		Billion 2010$	$0.57	$3.80	$8.25	$9.83	$10.62
Percentage Change								
Macro	Gross Domestic Product		%	0.02	0.07	0.08	0.06	0.05
	Gross Capital Income		%	(0.01)	(0.07)	(0.10)	(0.09)	(0.08)
	Gross Labor Income		%	(0.01)	(0.05)	(0.07)	(0.07)	(0.07)
	Gross Resource Income		%	2.51	10.16	11.70	9.06	8.09
	Consumption		%	0.04	0.03	0.01	0.00	0.00
	Investment		%	0.06	0.04	(0.02)	(0.01)	(0.01)
Natural Gas	Wellhead Price		%	1.19	6.27	8.28	6.86	6.26
	Production		%	0.26	1.63	3.66	4.32	4.18
	Pipeline Imports		%					
	Total Demand		%	(0.43)	(2.41)	(3.56)	(3.29)	(3.17)
	Sectoral Demand	AGR	%	(0.70)	(3.37)	(4.64)	(4.09)	(3.82)
		COL	%					
		CRU	%					
		EIS	%	(0.70)	(3.34)	(4.61)	(4.08)	(3.81)
		ELE	%	(0.43)	(2.60)	(3.99)	(3.78)	(3.73)
		GAS	%					
		M_V	%	(0.45)	(2.42)	(3.63)	(3.38)	(3.25)
		MAN	%	(0.61)	(3.09)	(4.31)	(3.83)	(3.59)
		OIL	%	(0.60)	(3.14)	(4.36)	(3.84)	(3.58)
		SRV	%	(0.26)	(1.59)	(2.53)	(2.41)	(2.34)
		TRK	%	(0.16)	(0.99)	(1.74)	(1.77)	(1.77)
		TRN	%	(0.19)	(1.03)	(1.79)	(1.82)	(1.82)
		C	%	(0.19)	(1.31)	(2.14)	(2.06)	(2.01)
1	Export revenues are based on LNG exports net of liquefaction loss.							

Figure 164: Detailed Results for HEUR_SD_HR_QR

Scenario: HEUR_SD_HR_QR								
	Description		Units	**2015**	**2020**	**2025**	**2030**	**2035**
Level Values								
Macro	Gross Domestic Product		Billion 2010$	$15,974	$18,013	$20,443	$23,027	$25,927
	Consumption		Billion 2010$	$12,444	$14,003	$16,013	$18,184	$20,567
	Investment		Billion 2010$	$2,486	$2,804	$3,178	$3,532	$3,996
Natural Gas	Wellhead Price		2010$ per Mcf	$3.61	$4.61	$4.93	$5.21	$5.59
	Production		Tcf	25.06	27.96	29.83	31.13	32.17
	Exports		Tcf	1.10	4.38	4.38	4.38	4.38
	Pipeline Imports		Tcf	2.26	1.27	0.25	0.14	0.14
	Total Demand		Tcf	26.22	24.85	25.70	26.89	27.92
	Sectoral Demand	AGR	Tcf	0.15	0.14	0.15	0.15	0.16
		COL	Tcf	-	-	-	-	-
		CRU	Tcf	-	-	-	-	-
		EIS	Tcf	3.33	3.08	3.18	3.19	3.13
		ELE	Tcf	8.04	7.44	7.59	8.21	8.95
		GAS	Tcf	-	-	-	-	-
		M_V	Tcf	0.20	0.18	0.17	0.18	0.18
		MAN	Tcf	4.27	4.03	4.29	4.48	4.64
		OIL	Tcf	1.27	1.21	1.23	1.32	1.30
		SRV	Tcf	2.49	2.46	2.59	2.70	2.82
		TRK	Tcf	0.48	0.49	0.53	0.57	0.63
		TRN	Tcf	0.22	0.23	0.24	0.27	0.29
		C	Tcf	4.82	4.66	4.75	4.78	4.75
		G	Tcf	0.95	0.93	0.98	1.03	1.07
	Export Revenues [1]		Billion 2010$	$3.68	$18.70	$20.00	$21.15	$22.70
Percentage Change								
Macro	Gross Domestic Product		%	0.09	0.28	0.16	0.11	0.10
	Gross Capital Income		%	(0.07)	(0.34)	(0.26)	(0.20)	(0.18)
	Gross Labor Income		%	(0.06)	(0.25)	(0.19)	(0.15)	(0.14)
	Gross Resource Income		%	17.17	52.44	29.47	20.17	17.87
	Consumption		%	0.12	0.03	(0.00)	0.00	0.01
	Investment		%	0.11	(0.22)	0.02	0.01	0.02
Natural Gas	Wellhead Price		%	7.94	31.55	20.45	14.94	13.53
	Production		%	1.49	5.68	7.61	8.45	8.20
	Pipeline Imports		%					
	Total Demand		%	(2.72)	(10.38)	(8.12)	(6.77)	(6.50)
	Sectoral Demand	AGR	%	(4.17)	(14.15)	(10.50)	(8.40)	(7.79)
		COL	%					
		CRU	%					
		EIS	%	(4.09)	(13.96)	(10.43)	(8.37)	(7.77)
		ELE	%	(2.74)	(11.19)	(9.08)	(7.76)	(7.61)
		GAS	%					
		M_V	%	(2.68)	(10.27)	(8.23)	(6.94)	(6.64)
		MAN	%	(3.73)	(13.03)	(9.73)	(7.85)	(7.33)
		OIL	%	(3.77)	(13.33)	(9.87)	(7.86)	(7.32)
		SRV	%	(1.69)	(7.15)	(5.87)	(5.01)	(4.85)
		TRK	%	(0.98)	(4.48)	(4.06)	(3.70)	(3.68)
		TRN	%	(1.04)	(4.59)	(4.19)	(3.81)	(3.78)
		C	%	(1.34)	(6.04)	(5.01)	(4.31)	(4.17)

[1] Export revenues are based on LNG exports net of liquefaction loss.

APPENDIX D - COMPARISON WITH EIA STUDY

NERA's modeling of shifts in natural gas price, production, and demand are built off an attempt to replicate EIA's price path. This was an important step to ensure that the NERA model output was consistent with the EIA's model. Of particular importance was the ability to replicate EIA's natural gas prices as closely as possible since it is a key driver of macroeconomic impacts. In this process, we ran the exact export scenarios reflected in the EIA Study. We ran Low/Slow, Low/High, High/Slow, and High/Rapid export expansion scenarios for the Reference, High Shale, and Low Shale outlooks. In total we ran 16 EIA consistent scenarios to compare model results. NERA Reference shale gas case scenarios are referenced as NERA_REF_LS, NERA_REF_LR, NERA_REF_HS, and NERA_REF_HR. Similarly, the High Shale and Low Shale case outlook for the NERA Study is referenced as NERA_HEUR_LS, NERA_HEUR_LR, NERA_HEUR_HS, NERA_HEUR_HR, NERA_LEUR_LS, NERA_LEUR_LR, NERA_LEUR_HS, NERA_LEUR_HR, respectively. The corresponding EIA scenarios are referenced as EIA_REF_LS, EIA_REF_LR, EIA_REF_HS, EIA_REF_HR, EIA_HEUR_LS, EIA_HEUR_LR, EIA_HEUR_HS, EIA_HEUR_HR, EIA_LEUR_LS, EIA_LEUR_LR, NERA_LEUR_HS, and NERA_LEUR_HR.

The natural gas supply curve in the NERA model was calibrated to EIA's natural gas supply curve in order to produce a response similar to the EIA High/Rapid scenario for the respective baselines. While the results of this price calibration scenario were nearly duplicated, other macroeconomic scenarios exhibited some differences between the NERA and EIA model runs. These variances are due primarily to differences in the model structure and modeling characteristics such as sectoral price elasticity of demand, supply elasticity, and other behavioral model parameters.

For changes in natural gas prices, the most apparent difference between the EIA and NERA model runs is seen in the High/Slow scenario. This is true for the Reference, High EUR and Low EUR baselines as seen in Figure 165, Figure 166, and Figure 167.These differences arise because we first estimate the implied price elasticity of natural gas supply to replicate the High/Rapid case and then adopt that elasticity for the other scenario runs.

Figure 165: Reference Case Natural Gas Price Percentage Changes

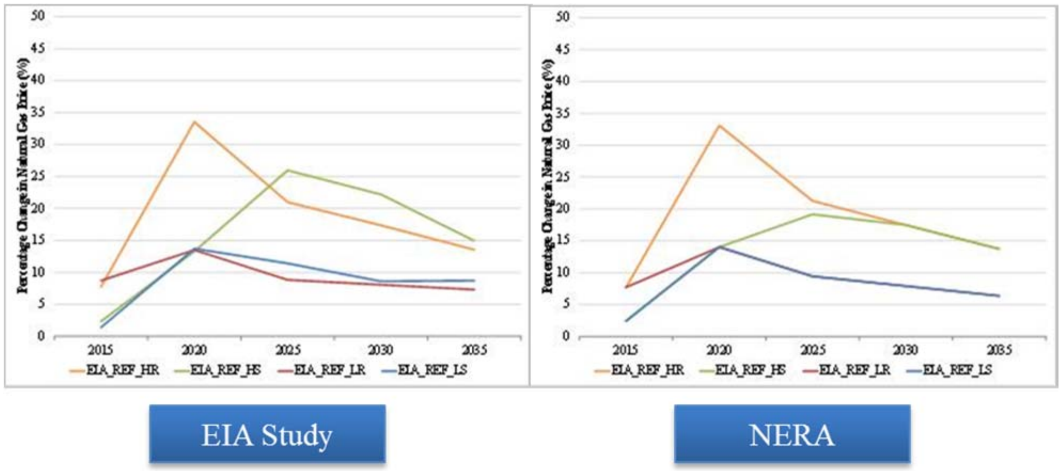


Figure 166: High EUR Natural Gas Price Percentage Changes

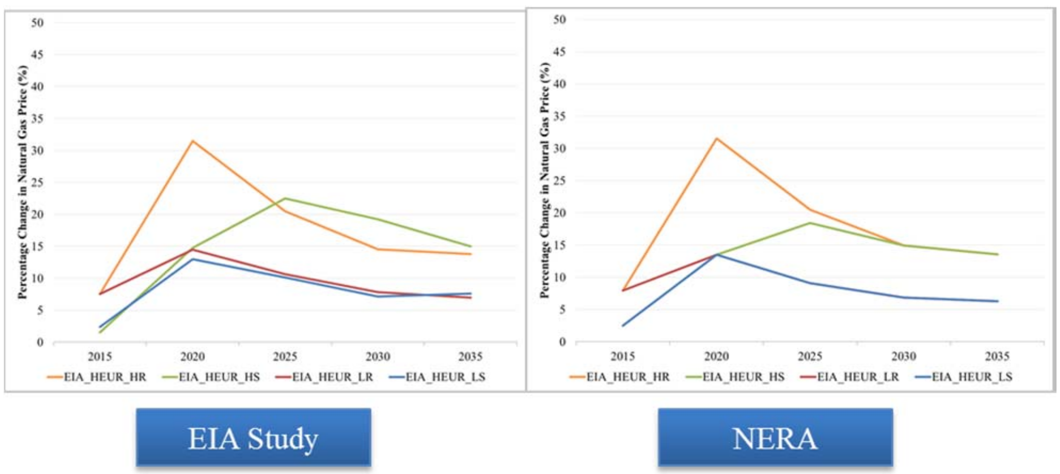
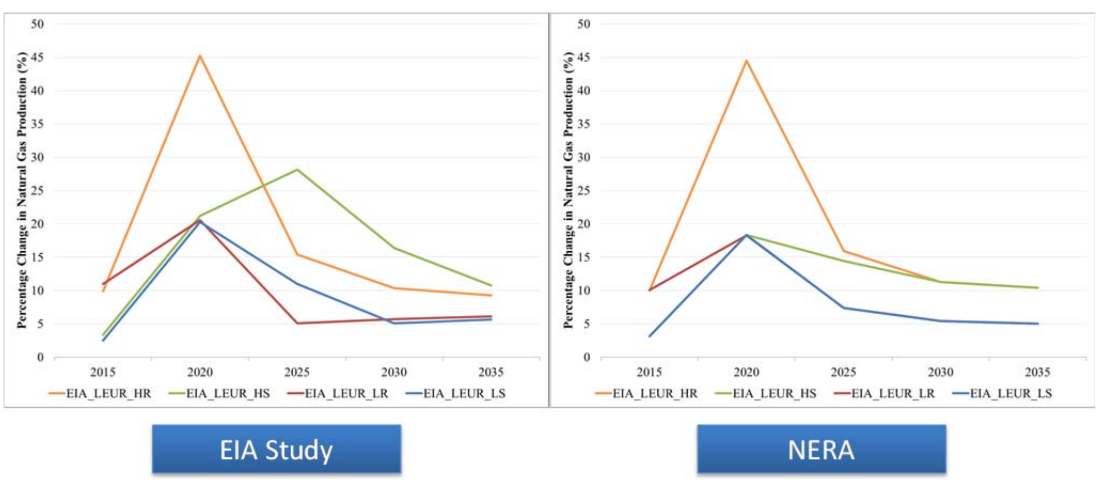


Figure 167: Low EUR Natural Gas Price Percentage Changes



The prices seen in the EIA High/Slow scenario in each baseline case deviate primarily in 2025, but also in 2030, in the range of 5% to 10% higher than the price change seen in the NERA High/Slow scenario. The low/slow scenario also shows small, but noticeable, differentials between the EIA and NERA model runs, particularly with the Reference and Low EUR baselines in 2025. Other than these differences, the general paths of price development in the NERA model runs tend to closely follow those estimated in the EIA study.

Changes in levels of natural gas demand and production show greater differences between the EIA and NERA runs than those seen in price. As briefly mentioned above, and elaborated on to a greater extent below, much of these variances result from the different elasticities used in the models and the overall model structures. The similar paths, but different magnitudes, of demand and production changes compared to the closely matched price changes reveal implied elasticities as a major source of variance. Figure 169 shows the implied supply elasticities for each case in 2015, 2025, and 2035.

The EIA Study assumed four different export scenarios for three different natural gas resources estimates (Reference, High Shale EUR, and Low Shale EUR). The scenarios for each baseline provide sufficient information about natural gas prices and supply quantities to be able to examine the natural gas supply curves. The supply curves are characterized by prices, quantities and the curvature. The current study makes all effort to simulate the EIA's supply curves despite the differences in the model construct. Figure 168 shows the EIA Study and NERA study supply curves for years 2020 and 2035 for the three natural gas resource outlooks.

Examining the curves suggests that the short-run supply curves (2020) are more inelastic than the long-run (2035) supply curves in both studies. The flattening of the supply curves is due to the fact that production and resource constraints are less binding over time. Under the High EUR case, 30 to 34 Tcf of natural gas can be supplied within a price range of $5 to $6/Mcf in the long run. However, under the Low EUR case, less natural gas can be supplied at a much higher price.

The EIA Study supply curves are shown as solid lines and the NERA supply curves are shown as dotted lines. Although the long-run supply curves are fairly close to one another, the short-run NERA supply curves are more inelastic. Given the supply curves, for a given change in quantity supplied, natural gas production in NERA model is relatively more price responsive in 2020 than in the EIA Study. The differences in the underlying assumption of the implied supply elasticities in 2020 drive this shape of the supply curve.

Figure 168: Natural Gas Supply Curves

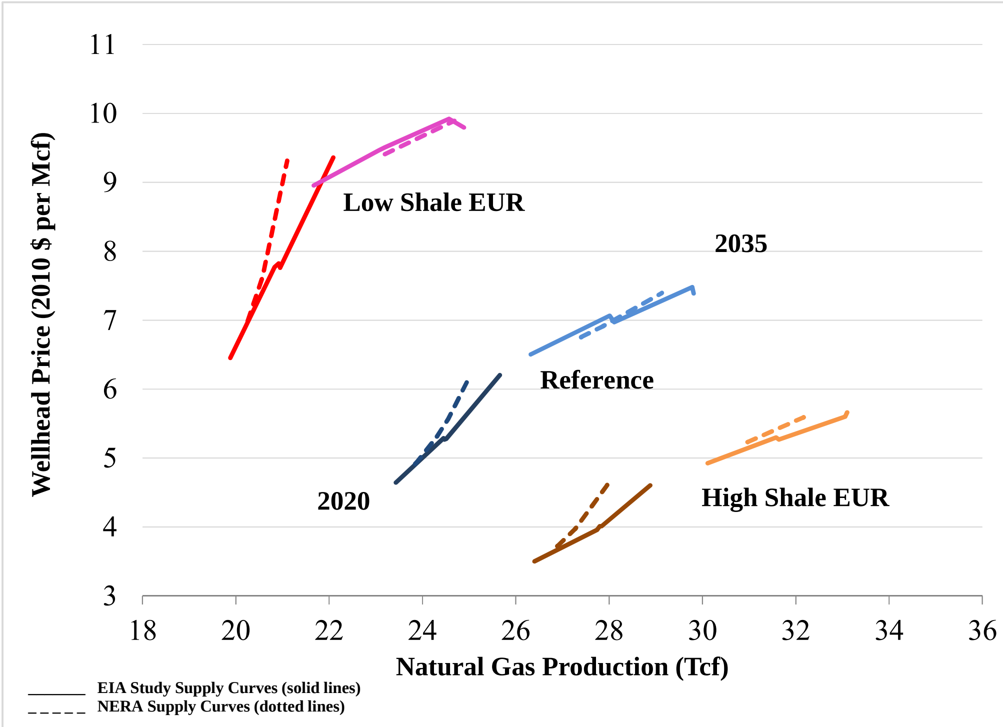
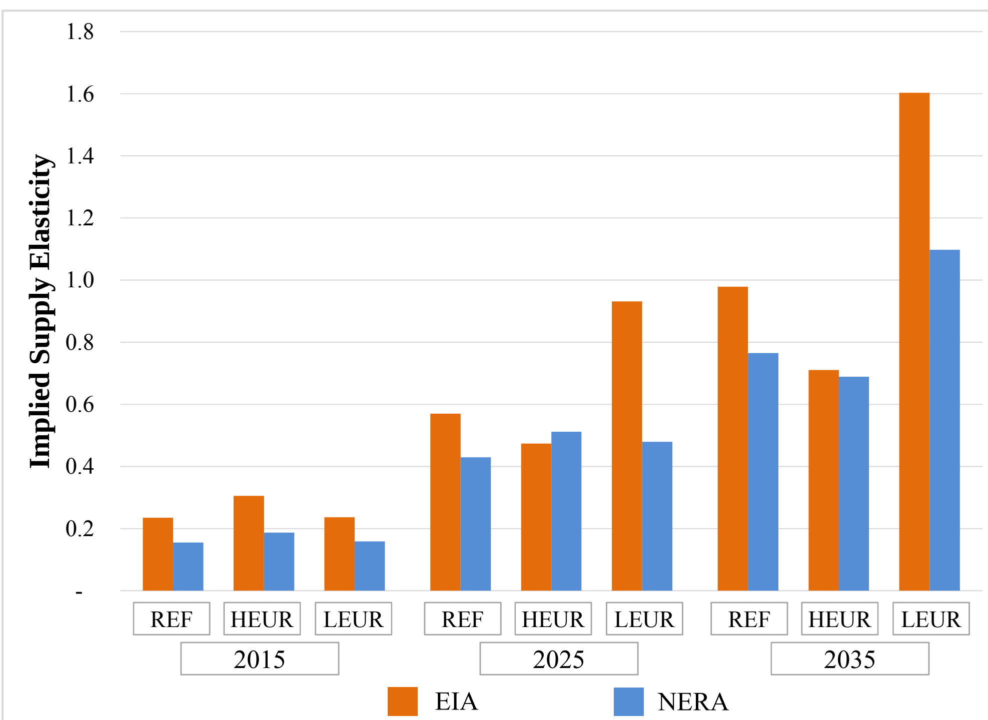


Figure 169: Implied Elasticities of Supply for Cases



Overall, the changes in natural gas demand are dampened in the EIA Study relative to the changes seen in the NERA model results, as seen in Figure 170, Figure 171, and Figure 172. The biggest differences appear to be found in the two rapid scenarios, High/Rapid and Low/Rapid. For each of the baseline cases, the rapid scenarios in the EIA Study show a significantly smaller magnitude of change in demand than they do in the comparable NERA model runs. Similar to the changes in price seen earlier, these differences are most pronounced in 2025 and 2030.

Figure 170: Reference Case Natural Gas Demand Percentage Changes

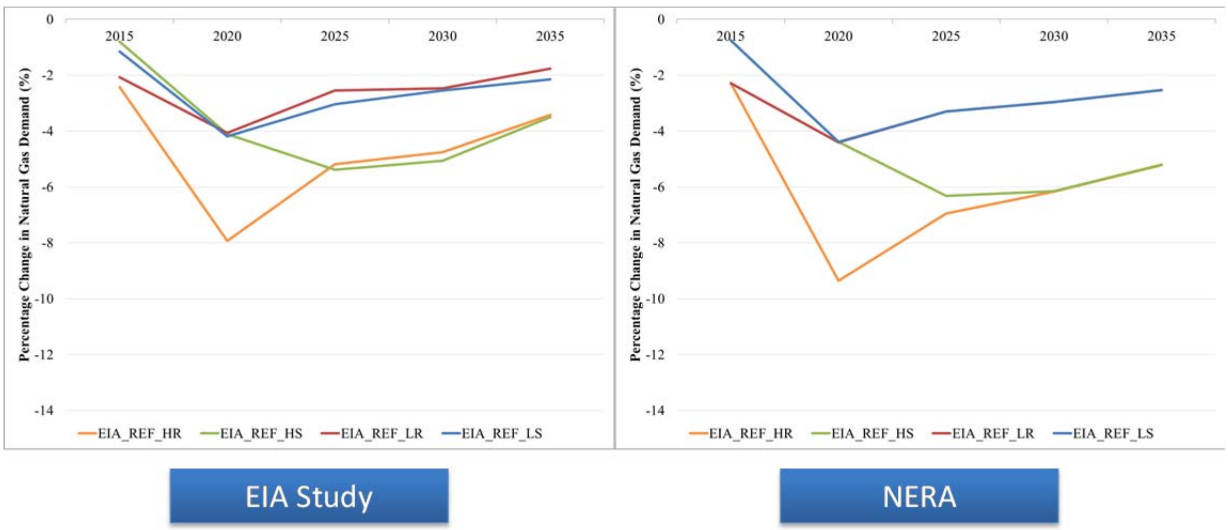


Figure 171: High EUR Natural Gas Demand Percentage Changes

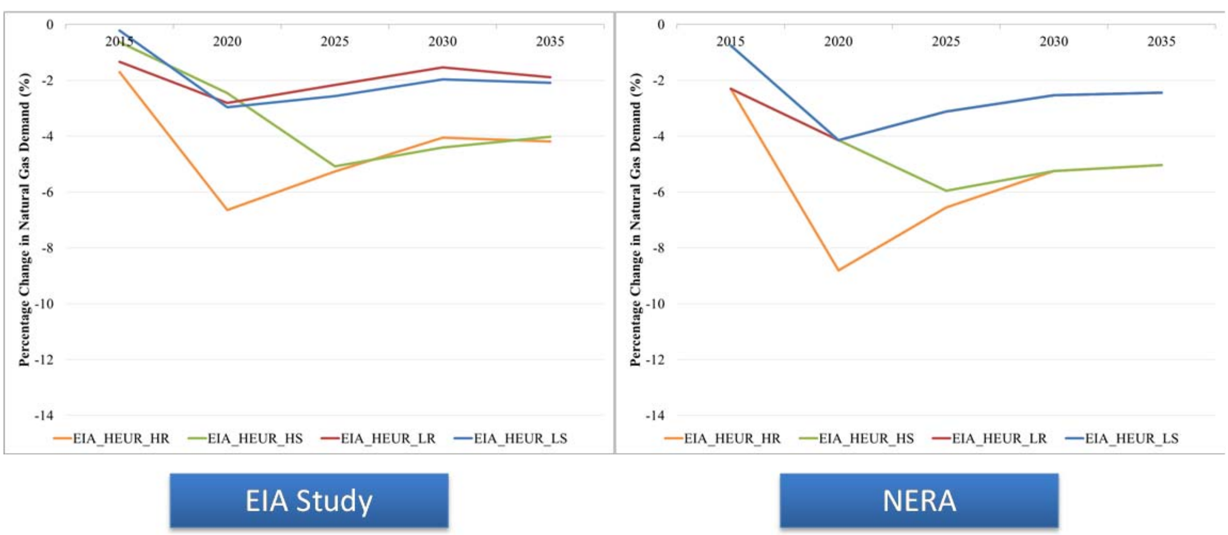
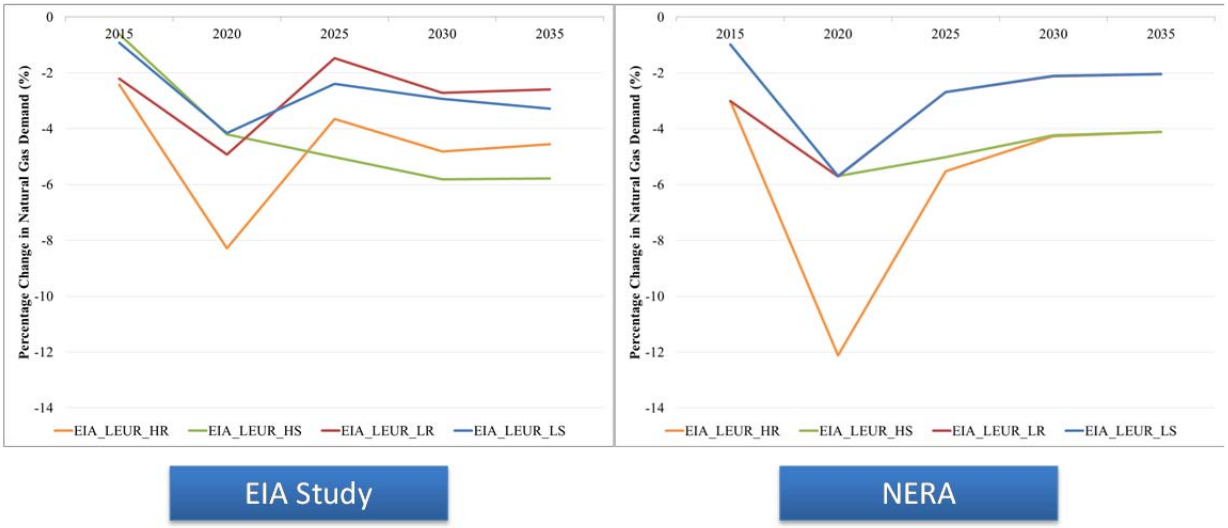


Figure 172: Low EUR Natural Gas Demand Percentage Changes



The results of the Low EUR baseline seen in Figure 172 show the most variance between the EIA and NERA results. In addition to the previously mentioned observation of overall lower magnitude changes in the EIA numbers relative to the NERA numbers and the largest differences being seen in 2025 and 2030, the paths of demand change in the two slow scenarios (High/Slow and Low/Slow) vary in later model years. In the EIA Study the changes in the High/Slow and Low/Slow scenarios get larger from 2025 to 2035 while in the NERA model the changes get smaller towards the end of the model horizon.

Differences between the changes in natural gas production seen in the EIA Study and the NERA modeling results are similar to those seen in demand changes, but in the opposite direction. In this metric, the EIA results show greater magnitudes of change than the NERA results, as can be seen in Figure 173, Figure 174, and Figure 175. This difference can be as large as 3% to 4%, as seen in the 2030 and 2035 years of the Reference Case high scenarios (High/Rapid and High/Slow).

Figure 173: Reference Case Natural Gas Production Percentage Changes

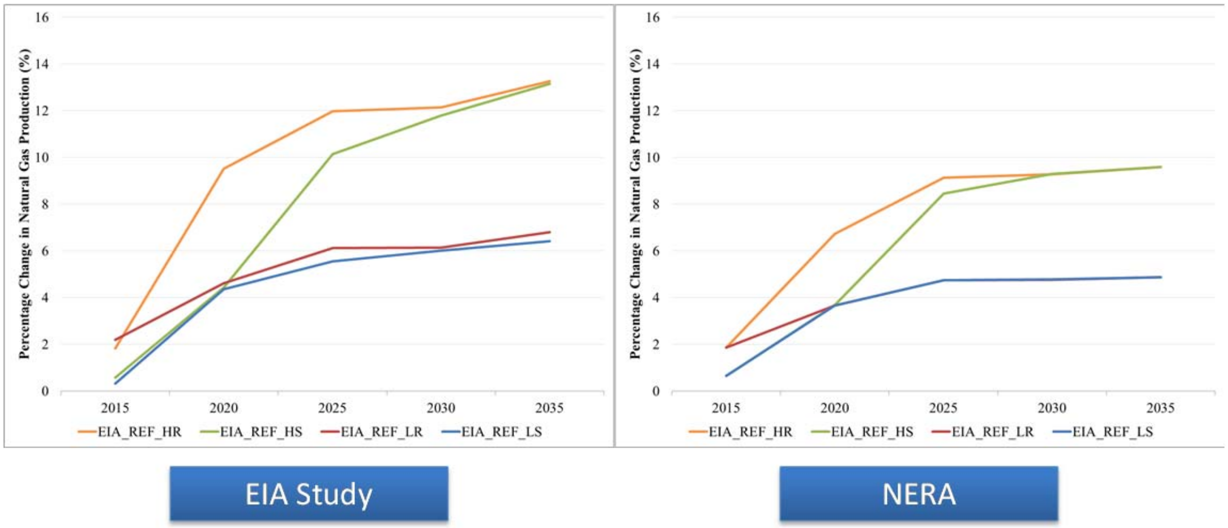


Figure 174: High EUR Natural Gas Production Percentage Changes

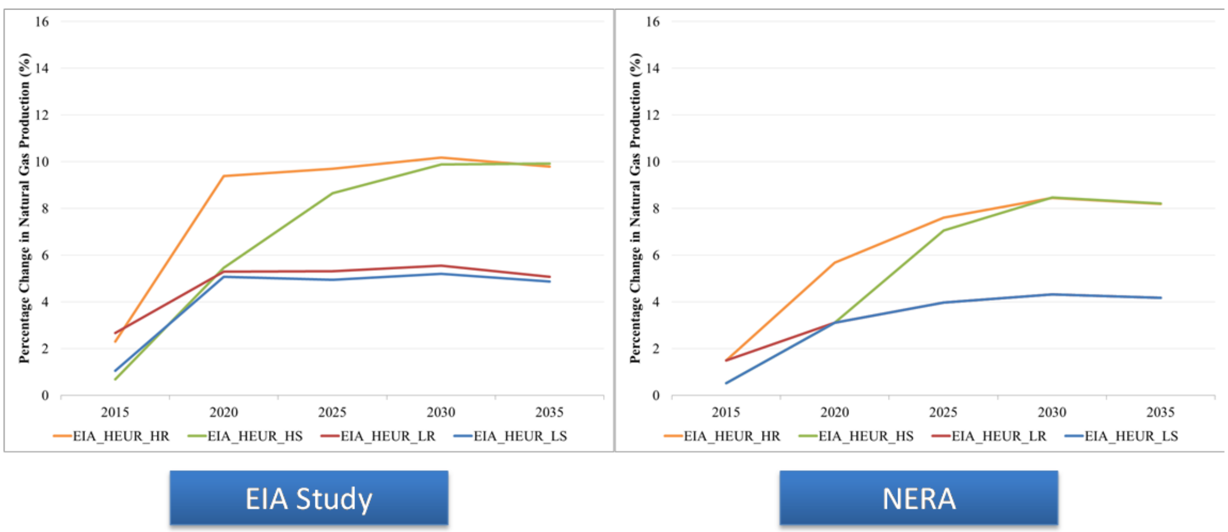
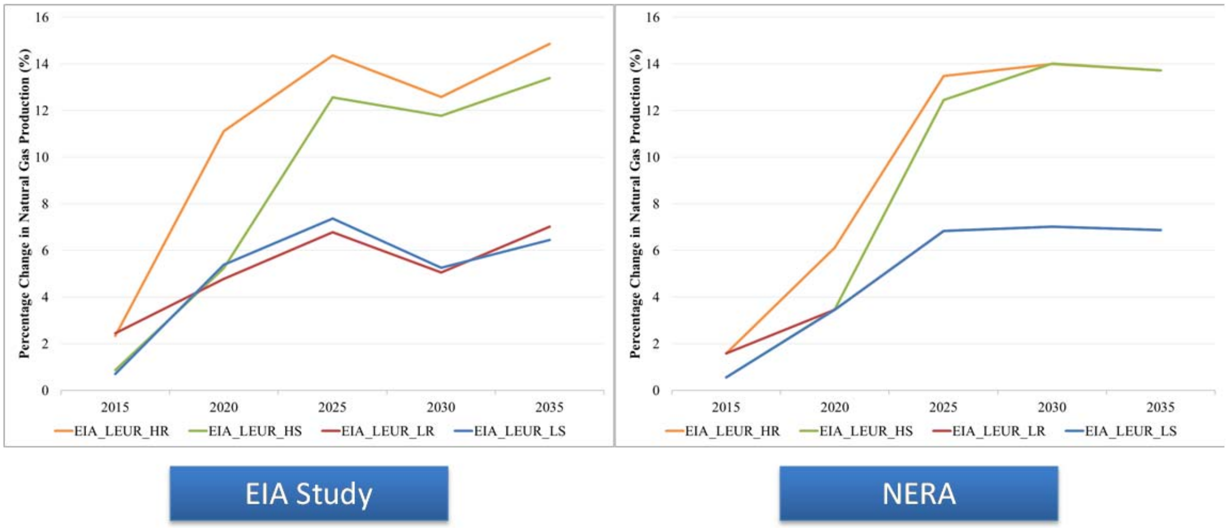


Figure 175: Low EUR Natural Gas Production Percentage Changes



Apart from the overall difference in levels of change seen between the two sets of model results, the general paths and patterns remain fairly similar because they are primarily driven by the level values and the pace of export expansion. The largest differences tend to occur in 2025 and 2030, similar to what is observed in the previous results, but the production changes also show some more variation in 2020.

Comparing changes in natural gas demand at a sectoral level reveal additional similarities and differences between the EIA Study model runs and the NERA model runs. As seen in Figure 176, Figure 177, and Figure 178, while overall levels of natural gas consumption are relatively consistent between the EIA Study and the NERA results, the sectoral components exhibit notable divergences. In particular, the NERA results show much greater demand response in the industrial sector while at the same time much less demand response in the electricity sector. These differences appear to be consistent across all baseline cases. The main reason for the variations in the electricity sector comes from the different way that the sector is modeled. EIA's NEMS model has a detailed bottom-up representation of the electricity sector, while the electricity sector in the NERA model is a nested CES function with limited technologies. This means that NEMS allows for switching from natural gas-based generation to other technology types easily, while the possibility of switching out of natural gas is more limited and controlled in the NERA model.

Figure 176: Reference Case Average Change in Natural Gas Consumed by Sector

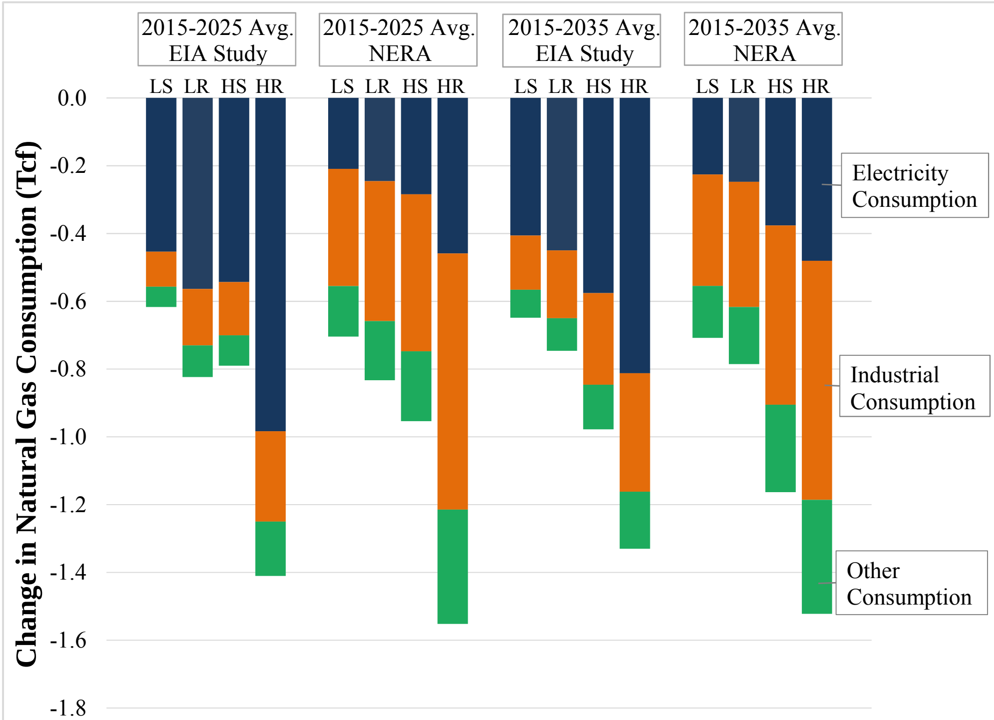


Figure 177: High EUR Average Change in Natural Gas Consumed by Sector

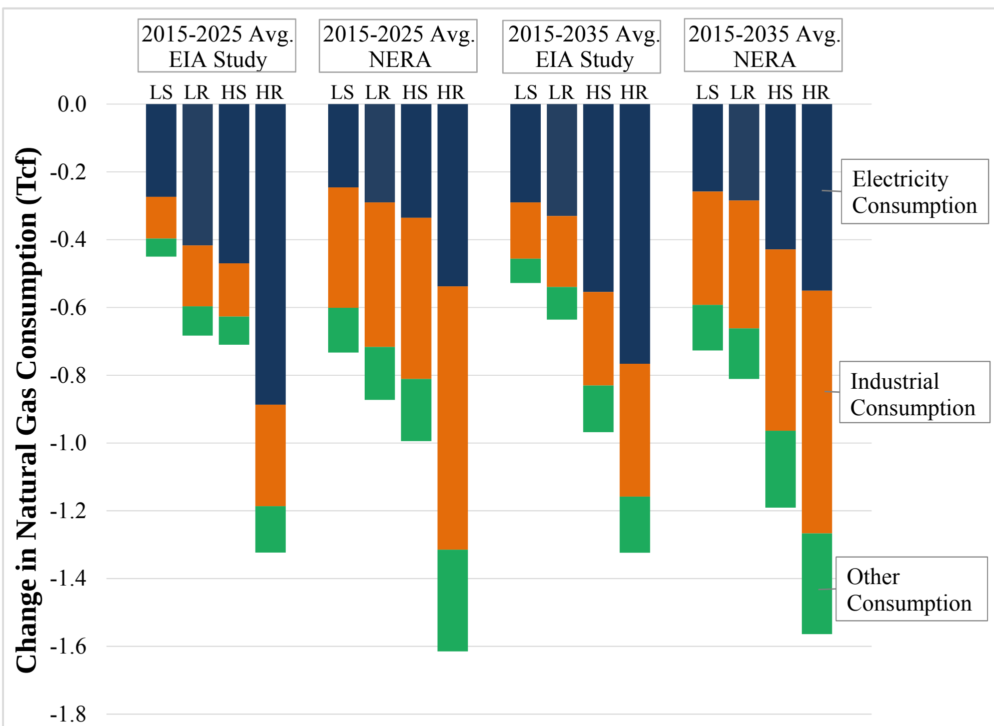
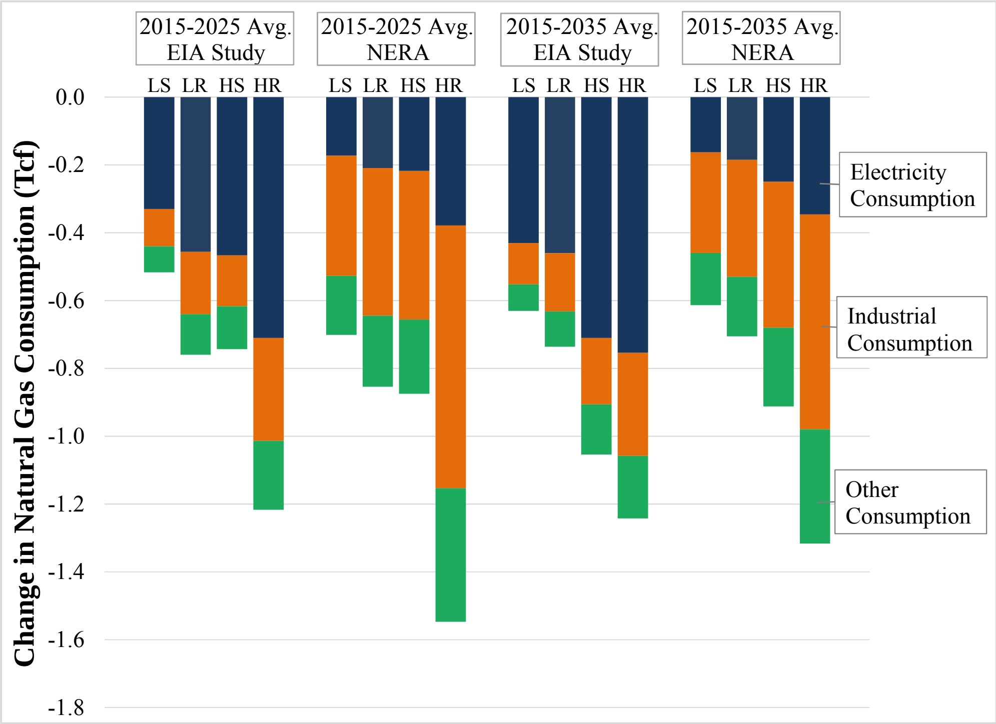


Figure 178: Low EUR Case Average Change in Natural Gas Consumed by Sector



APPENDIX E - FACTORS THAT WE DID NOT INCLUDE IN THE ANALYSIS

There are a number of issues that this study did not address directly. To avoid the misinterpretation of these results or the drawing of unwarranted implications, this section provides brief comments on each.

A. How Will Overbuilding of Export Capacity Affect the Market

This study assumes that the amount of capacity built will match market demand and that the pricing of liquefaction services will be based on long-run marginal costs. Should developers overbuild capacity, there could be pressure on take-or-pay contracts and potentially the margins earned for liquefaction services could be driven below the amount required to cover debt service and expected profits, just as has been the case with petroleum refining margins during periods of slack capacity.

B. Engineering or Infrastructure Limits on How Fast U.S. Liquefaction Capacity Could Be Built

Many of the scenarios investigated in this report assume rates of expansion of liquefaction facilities in the U.S. (and worldwide) that some industry sources believe will strain the capacity of engineering and construction providers. This could drive up the cost of building liquefaction facilities and constrain the rate of expansion to levels lower than those projected in the different scenarios investigated in this report, even if the U.S. resource and global market conditions were as assumed in those scenarios. This possibility requires analysis of the capabilities of the relevant global industries to support rapid construction that could be addressed in later studies.

C. Where Production or Export Terminals Will Be Located

There are proposals for export facilities in the Mid-Atlantic, Pacific Northwest and Canada, all of which could change basis differentials and potentially the location of additional natural gas production, with corresponding implications for regional impacts. To analyze alternative locations of export facilities it would be necessary to repeat both the EIA and the NERA analyses with additional scenarios incorporating demand for natural gas export in different regions.

D. Regional Economic Impacts

Since the EIA assumed that all of the demand for domestic production associated with LNG exports was located in the Gulf region, it was not possible in this study to examine regional impacts on either natural gas prices or economic activity. The Gulf Coast is not necessarily a representative choice given the range of locations now in different applications, so that any attempt to estimate regional impacts would be misleading without more regional specificity in the location of exports.

E. Effects on Different Socioeconomic Groups

Changes in energy prices are often divided into "effects on producers" and "effects on consumers." Although convenient to indicate that there are winners and losers from any market or policy change, this terminology gives limited insight into how the gains and losses are distributed in the economy. The ultimate incidence of all price changes is on individuals and households, for private businesses are all owned ultimately by people. Price changes affect not only the cost of goods and services purchased by households, but also their income from work and investments, transfers from government, and the taxes they pay. More relevant indicators of the distribution of gains and losses include real disposable income by income category, real consumption expenditures by income category, and possibly other measures of distribution by socioeconomic group or geography. This study addresses only the net economic effects of natural gas price changes and improved export revenues, not their distribution.

F. Implications of Foreign Direct Investment in Facilities or Gas Production

In this report it is assumed that all of the investment in liquefaction facilities and in increased natural gas drilling and extraction come from domestic sources. Macroeconomic effects could be different if these facilities and activities were financed by foreign direct investment ("FDI") that was additional to baseline capital flows into the U.S. FDI would largely affect the timing of macroeconomic effects, but quantifying these differences would require consideration of additional scenarios in which the business model was varied.

APPENDIX F – COMPLETE STATEMENT OF WORK

Task Title: Macroeconomic Analysis of LNG Exports

INTRODUCTION:

U.S. shale gas production has increased significantly due to novel hydraulic fracturing and horizontal drilling techniques that have reduced production costs. In the *Annual Energy Outlook 2011* prepared by the Department of Energy's Energy Information Administration, domestic natural gas production grows from 21.0 trillion cubic feet (Tcf) in 2009 to 26.3 Tcf in 2035, while shale gas production grows to 12.2 Tcf in 2035, when it is projected to make up 47 percent of total U.S. production. With this increased volume of domestic natural gas supply available, several companies have applied to the DOE/FE under section 3 of the Natural Gas Act ("NGA")[55] for authorization to export domestic natural gas as LNG to international markets where prices are currently higher. DOE/FE must determine whether applications to export domestically produced LNG to non-free trade agreement ("FTA") countries are consistent with the public interest[56].

To assist with the review of current and potential future applications to DOE/FE to export domestically produced LNG, DOE/FE has requested a natural gas export case study be performed by EIA. The EIA study will provide an independent case study analysis of the impact of increased domestic natural gas demand, as exports, under different incremental demand scenarios using the *AEO 2011* National Energy Modeling System ("NEMS") model. While useful to provide the range of marginal full-cost domestic natural gas production in different scenarios, the EIA NEMS case study will not address the macroeconomic impact of natural gas exports on the U.S. economy. A macroeconomic study that evaluates the impact of LNG exports is needed to more fully examine the impact of LNG exports on the U.S. economy.

PURPOSE:

The purpose of this task is to evaluate the macroeconomic impact of LNG exports using a general equilibrium macroeconomic model of the U.S. economy with an emphasis on the energy sector and natural gas in particular. The general equilibrium model should be developed to incorporate the EIA case study output from NEMS into the natural gas production module in order to calibrate supply cost curves in the macroeconomic model. A macroeconomic case study will be performed to evaluate the impact that LNG exports could have on multiple economic factors, but primarily on U.S. Gross Domestic Product, employment, and real income.

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[55] The authority to regulate the imports and exports of natural gas, including liquefied natural gas, under section 3 of the NGA (15 U.S.C. §717b) has been delegated to the Assistant Secretary for FE in Redelegation Order No. 00-002.04E issued on April 29, 2011.

[56] Under NGA section 3(c), the import and export of natural gas, including LNG, from and to a nation with which there is in effect a FTA requiring national treatment for trade in natural gas and the import of LNG from other international sources are deemed to be consistent with the public interest and must be granted without modification or delay. Exports of LNG to non FTA countries have not been deemed in the public interest and require a DOE/FE review.

The cases to be run will reflect LNG export volumes increasing by one billion cubic feet per day (Bcf/d) annually until reaching six Bcf/d from a reference case aligned with the *AEO 2011* reference case, a high natural gas resource case, and a low natural gas resource case. Additional cases will be run to evaluate the impact of LNG export volumes that increase much slower and much faster than in the reference case.

Some have commented that U.S. domestic natural gas prices could become disconnected with marginal domestic natural gas production cost and be influenced by higher international market prices. An analysis will be performed to assess whether there is an additional price increase, a "tipping point" price increase, above which exports of LNG have negative impacts on the U.S. economy for several of the cases. The "tipping point" price increase in this analysis could be above the marginal full production cost.

A qualitative report will be prepared that discusses how natural gas prices are formed in the United States and the potential impact that higher international prices could have on the U.S. market. This analysis will include an assessment of whether there are scenarios in which the domestic market could become unlinked to marginal production cost and instead become linked to higher international petroleum-based prices, and whether this could be a short-term or long-term impact, or both.

Initially, a preliminary assessment of the macroeconomic impact of the cases will be prepared and discussed with DOE. This will provide an opportunity for any adjustments to the ultimate cases that will be prepared. Finally, a report will be prepared that discusses the results of the macroeconomic study including topics identified in the Statement of Work.

STATEMENT OF WORK:

The types of analysis and discussions to be conducted include, but are not limited to:

1. U.S. Scenario Analysis (all 16 EIA cases) – Perform a case study on the impacts of a range of LNG export volumes on domestic full production costs under various export volume scenarios. A macroeconomic model will be aligned with the *AEO 2011 Reference Case* and other cases from the DOE/FE-requested EIA case study in different scenarios. Modify a general equilibrium model to calibrate supply cost curves in the macroeconomic model for consistency with EIA NEMS model. The following cases will be run with 5-year intervals through 2035:
    a. **Reference LNG Export Case** – using the macroeconomic model aligned with the *AEO 2011 Reference Case*, show export-related increases in LNG demand equal to the four export scenarios in the EIA study.
    b. Run sensitivity cases related to alternative shale gas resources and recovery economics. These include:
        i. **Low Shale Resource LNG Export Case** - align the macroeconomic model to the *AEO 2011 Low Shale EUR Case*, reflect LNG export volumes over time equal to the four export scenarios in the EIA study.

ii. **High Shale Resource LNG Export Case** – align the macroeconomic model to the *AEO 2011 High Shale EUR Case,* reflect LNG export volumes over time equal to the four export scenarios in the EIA study.

iii. **High Economic Growth LNG Export Case** - align the macroeconomic model to the *AEO 2011 High Economic Growth Case;* reflect LNG export volumes over time equal to the four export scenarios in the EIA study.

c. Run additional sensitivity cases – **Slow Increase in LNG Exports Case** - using the macroeconomic model aligned with the *AEO 2011 Reference Case,* increase LNG exports increase at a slower pace, growing at 0.5 Bcf/d beginning in 2015, until reaching 6 Bcf/d.

2. Preliminary Analysis – Prepare a preliminary analysis of the above cases and provide an initial summary of whether those cases have a positive or negative impact on GDP. After providing that information, discuss the results and determine whether the cases identified are still valid, if some cases should be eliminated, or others added.
3. Worldwide Scenario Analysis – Develop four global LNG market scenarios that define a range of international supply, demand, and market pricing into which U.S. LNG could be exported, as defined below. Using these scenarios, identify potential international demand for U.S. LNG exports, recognizing delivered LNG prices from the United States versus other global sources.
   a. Base case which is calibrated to EIA *International Energy Outlook 2011* for all natural gas
   b. Increased global LNG demand
   c. A restricted global LNG supply scenario in which only liquefaction facilities, of which there is already substantial construction, are completed
   d. Combination of higher international LNG demand and lower international LNG supply
4. Prepare a sensitivity analysis to examine how the ownership of the exported LNG and/or the liquefaction facility affects the U.S. economy.
5. Macroeconomic Report – Prepare a report that discusses the results of the different cases run with the key focus on the macroeconomic impacts of LNG exports. Combine global analysis and U.S. analysis to create new export scenarios that could be supported by the world market (as opposed to the EIA study in which LNG exports were exogenous to the model). Identify and quantify the benefits and drawbacks of LNG exports. Using a macroeconomic model, evaluate the comprehensive impact of all factors on:
   a. U.S. GDP
   b. Employment
   c. Household real income

   The Report will also include a discussion on:

   a. The observations on key cases run

b. Balance of trade impact
c. Expected impact on tax receipts from increased production of natural gas and exports
d. The impact of LNG exports on energy intensive sectors for the scenarios developed
e. Ownership sensitivity analysis
f. Benefits
    - Jobs creation for the nation, not just a region
    - Potential increases in Federal revenues
    - Export earnings and balance of trade
g. Drawbacks
    - Increased natural gas prices
    - Potential for, and impact of, loss of jobs in energy intensive industries
h. GDP Macroeconomic impact
    - Authoritative analysis on GDP of above factors
i. Other relevant analysis and information developed in consultation with DOE/FE

6. The price impacts of natural gas exports will be discussed in a qualitative report that includes how natural gas prices are formed in the United States and the potential impact that higher international prices could have on the U.S. market. This report could be stand-alone or part of the overall macroeconomic study. It will include, at a minimum, a discussion of:
    a. Current market mechanism that establishes U.S. domestic benchmark prices (e.g., Henry Hub)
    b. Potential market mechanism for linkage of domestic markets with higher international markets
    c. The potential linkage of natural gas with petroleum in international markets
7. Assess whether there is some volume of LNG exports, or price increase, above which the United States loses the opportunity for domestic value added industry development from use of low-cost domestic natural gas resources. The discussion will include:
    a. Identification of energy-intensive, trade-exposed industries potentially affected and characterization of their energy costs, employment and value added compared to all manufacturing
    b. Potential impacts on U.S. production of selected natural gas based bulk chemicals
8. After releasing the study results, at the request of DOE, prepare up to three responses to questions raised about the study in an LNG export proceeding or other public release of the study in which these questions or issues are raised

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