Economic Analysis of Kenai LNG Export

Prepared by

Marvin Feldman, PhD
Resource Decisions, San Francisco

Prepared for

ConocoPhillips Natural Gas Corp.
& Marathon Oil Company

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ADNR	Alaska Department of Natural Resources
ANS	Alaska North Slope
Bcf	Billion cubic feet
CEA	Chugach Electric Association
ConocoPhillips	ConocoPhillips Alaska Natural Gas Corp.
DOE	Department of Energy
ISER	Institute for Social and Economic Research
LNG	liquefied natural gas
Marathon	Marathon Oil Company
MMS	Minerals Management Service
NSAI	Netherland, Sewell & Associates, Inc.
PGC	Potential Gas Committee
RCA	Regulatory Commission of Alaska
R/P ratio	reserve to production ratio
SGDA	Stranded Gas Development Act
Tcf	Trillion cubic feet

0 EXECUTIVE SUMMARY

This report presents the findings of an economic analysis commissioned by ConocoPhillips Alaska Natural Gas Corporation (ConocoPhillips) and Marathon Oil Company (Marathon) in connection with their evaluation of continued export of liquefied natural gas (LNG) from Kenai, Alaska to Japan or other Pacific Rim countries. The focus of this report is on the relationship between the available supply and the effective demand for Cook Inlet natural gas during the two-year study period (*i.e.*, Q2 of 2009 through Q1 of 2011). The conclusion reached in this report is that Cook Inlet natural gas supplies are more than adequate to meet both domestic and export demand for the study period.

Regional demand for Cook Inlet natural gas attributable to the major Southcentral Alaska utilities is largely contracted for through 2011. These major Southcentral Alaska utilities provide natural gas and generate electricity for all of the domestic use in the Cook Inlet. These utilities have no apparent need for the natural gas volumes proposed for export during the study period, even if only limited new reserves are discovered, and stress (high) demand assumptions are made.

Two sets of demand assumptions were used to project Southcentral Alaska energy and natural gas demand. The Stress Demand Case is weighted in the direction of increased natural gas demand. The Stress Demand Case is contrasted with the Expected Demand Case, which represents the most likely demand scenario. Two sets of supply assumptions were used to project Cook Inlet natural gas supply. The Stress Supply Case is based on existing reserves plus undiscovered potential natural gas resources that have a very high probability of being exceeded. The Expected Supply Case is based on existing reserves plus a less conservative estimate of undiscovered potential resources.

Under the combined Expected Supply and Expected Demand Cases, approximately 1.8 Trillion cubic feet (Tcf) of Cook Inlet natural gas would be available at the end of the study period. This volume provides a sufficient margin to allow for more natural gas to be found or, in the unlikely event supplies cannot be identified and developed, an orderly transition to other fuel supplies. Even under the combined Stress (low) Supply and Stress (high) Demand Cases, a highly unlikely scenario, Cook Inlet natural gas supplies remain adequate through 2011 and beyond. The adequacy of natural gas to satisfy domestic needs is further confirmed by the finding that contracts are currently in place to supply approximately 95% of domestic uses through the end of the requested export period. In addition, contracts have been offered but subsequently rejected by the Regulatory Commission of Alaska (RCA) that would have insured that 100% of domestic requirements would have been met through the export extension period. In essence, local supply is not a matter of resource availability.

Natural gas supply is a function of **geology**, **market demand and availability**, and **price**. In regard to **geology**, both the Alaska Department of Natural Resources (ADNR) and Netherland, Sewell & Associates, Inc. (NSAI) reports estimate that there were approximately 1,700 Billion cubic feet (Bcf) of proven and probable natural gas reserves already discovered in the Cook Inlet as of January 1, 2006. In addition, the Colorado School of Mines' Potential Gas Committee (PGC) estimates that there is a high degree of probability that between 600 Bcf and 1,050 Bcf of natural gas remains to be discovered in the Cook Inlet. The PGC report also estimates that there is considerable upside possible, with a range of 1,650 Bcf to 6,600 Bcf of probable and possible natural gas resources remaining to be discovered in the Cook Inlet, excluding speculative resources of 7,200 Bcf. The U.S. Department of Energy's (DOE) 2004 report on Southcentral Alaska estimates potential resources in the Cook Inlet at 13 to 17 Tcf, much higher than the PGC study. The DOE report states that the Cook Inlet is a highly prospective natural gas basin. However, in order to err on the side of conservatism, this report has only used the high-probability estimates of 600 Bcf to 1,050 Bcf of additional resources in the PGC report.

In regard to **market demand and availability**, the exploration and production of natural gas in the Cook Inlet region has historically been inhibited by low demand and an over supply of gas. The Cook Inlet region has only recently declined into the range of reserve to production (R/P) ratios experienced by the Lower 48 States for approximately the last thirty years. At an R/P ratio of about 10, the exploration and development of natural gas reserves keeps pace with the natural gas demand in the Lower 48 States. Before reserves dip much below this band in the Cook Inlet region, it is highly likely that effective demand will drive intensified natural gas exploration and development efforts. In fact, this phenomenon has been observed in the Cook Inlet region in the last several years. It is also important to note that there must be available (un-contracted) market demand in order for effective demand to provide the proper incentives for increased exploration and development activities. As noted earlier, approximately 95% of the natural gas market has already been contracted for the next five years. Therefore, any new natural gas exploration and development efforts must wait until there are either new natural gas markets available before they start production, or they must displace existing natural gas production.

Price, the third determinant of natural gas supply, has followed a similar trend to that of market demand. Historically low natural gas prices have risen considerably in the past several years. Thus, based on supply function consideration, Cook Inlet natural gas supplies are poised for expansion.

Beyond the term of the study period, effective demand may also drive the development of energy resource alternatives available in the areas served by the major Southcentral Alaska utilities. These areas are rich in energy resources with 1,726 Bcf of natural gas reserves in discovered reservoirs, 1.6 billion tons of proven coal reserves (the energy equivalent of 35 Tcf of natural gas), and numerous undeveloped hydroelectric sites. Alaska North Slope (ANS) natural gas and LNG imports through the terminal currently used for exports are also options to meet regional energy needs further out into the future.

The LNG plant also serves an important role in the supply and demand balance in the areas served by the major Southcentral Alaska utilities. The domestic natural gas market in the Cook Inlet has limited storage for serving the extreme peak demands that occur under exceptional circumstances, such as extremely cold weather. The natural gas production associated with LNG exports has been diverted as required for heating and electricity generation. An extension of LNG exports will insure that this backup supply of gas for Cook Inlet utilities remains available for at least several more years. If by contrast, an LNG extension were not to be granted, a significant portion of Cook Inlet production would likely need to be shut-in due to low market demand. Because of the maturity of the reservoirs, shutting in production will almost certainly result in lost reserves and deliverability.

In addition, the LNG plant may serve to spur additional exploration and development by third parties. The LNG plant has the capacity to liquefy more natural gas than is currently planned should additional supply become available. Given that the local utility market is satisfied, the only significant economic market outlet in the post 2009 time frame is the LNG plant. As such, the plant could serve as the economic engine for additional exploration.

An LNG export extension would also provide the means of preserving the LNG infrastructure for potential future service for either an LNG import terminal or, should circumstances change, the continuation of LNG manufacturing. The LNG plant is ideally positioned to serve as an LNG import terminal should such an option be required to bridge the gap between a possible supply shortfall in Cook Inlet and the large volumes a spur line from the proposed Alaska North Slope Gas Pipeline Project will require to be economic.

National demand for Cook Inlet natural gas has not been considered in connection with past DOE decisions to authorize LNG exports from Kenai. For the study period, the Jones Act, among other things, renders any plan to ship Kenai LNG to the Lower 48 States impractical. Benefits to the United States of continued LNG exports have been considered in past DOE decisions, and those benefits continue to be relevant and significant. Continued exports would directly improve the overall foreign trade balance between the United States and the buyer country or countries by more than several hundred million dollars during the study period. Continued LNG exports to Japan and/or other Pacific Rim countries will also strengthen the United States' diplomatic and economic ties in that region.

The tangible benefits to the Alaskan economy of continued LNG exports are also relevant and significant. These benefits include employment, personal income, and tax revenues. LNG production provides a stable source of income and employment in an area noted for seasonal unemployment and a marked cyclic response to world oil price changes. Direct, indirect, and induced employment in the Kenai Peninsula Borough due to LNG plant operations currently accounts for 186 jobs and $15.9 million in personal income per year.

In addition to the LNG manufacturing and shipping impacts, benefits accrue to the local economy as a result of the production of natural gas as a feedstock used in LNG manufacturing. The benefits of production of natural gas for the LNG plant include employment, royalties, severance tax, and other local and state taxes, and their associated indirect and induced benefits. Royalties, severance and state income taxes associated with LNG feedstock production contributed $47.7 million to state revenues in 2005. Although the employment and other state and local tax benefits due to feedstock production were not quantified in this analysis, they provide significant additional economic benefits to the state and local economy.

1 INTRODUCTION

ConocoPhillips and Marathon (collectively "Applicants") operate a LNG production facility near Kenai, Alaska and two LNG tankers. Since 1969, the Kenai facility has used Cook Inlet natural gas to produce LNG for export to Japan. The Applicants' current export authorization for the LNG facility expires March 31, 2009. In order to continue the LNG export operation beyond that date, the Applicants must obtain authorization from DOE.

The Applicants commissioned Resource Decisions to perform an economic study of the continued export of LNG from Kenai. This report documents the methods and results of that study. The period of analysis extends from 2006 through 2011. This time frame covers the Applicants' current export authorization period plus the two-year period for which export authorization is sought in the current application (*i.e.*, April 1, 2009 through March 31, 2011).

The economic analysis of the Kenai LNG export encompasses several issues. Foremost among them is the effect of continued gas export on regional supplies. A map of the Cook Inlet region showing natural gas fields is presented in Figure 1.1. The "regional" market for Cook Inlet region natural gas includes all of Southcentral Alaska and parts of Interior Alaska extending from Homer in the south to Fairbanks in the north.[1] Southcentral Alaska defines the likely service area which is or could conceivably be served with Cook Inlet region natural gas.[2] Within this area, it is important to determine the present and projected future demand for natural gas and to evaluate the adequacy of known reserves and potential resources in meeting this demand.

A second consideration raised by continued LNG export is the prospect for and effect of shipping Kenai LNG to the Lower 48 States rather than to Japan and/or other countries in the Pacific market. The question is whether an economically viable market for Kenai LNG exists in the Lower 48 States, and, if so, whether or not national economic interests would be affected. A third economic consideration is the effect which cessation of LNG production would have on the Southcentral Alaska economy. This report addresses all of these considerations.

[1] Fairbanks and Homer receive some gas-fired electrical energy from the Anchorage area. Homer is not directly served by natural gas. Fairbanks' space heating needs are met in part by LNG trucked from the Cook Inlet region.

[2] Fairbanks is part of an area known as the Interior rather than Southcentral Alaska; however, for purposes of this report, natural gas consumption in Fairbanks is included in Southcentral Alaska numbers.

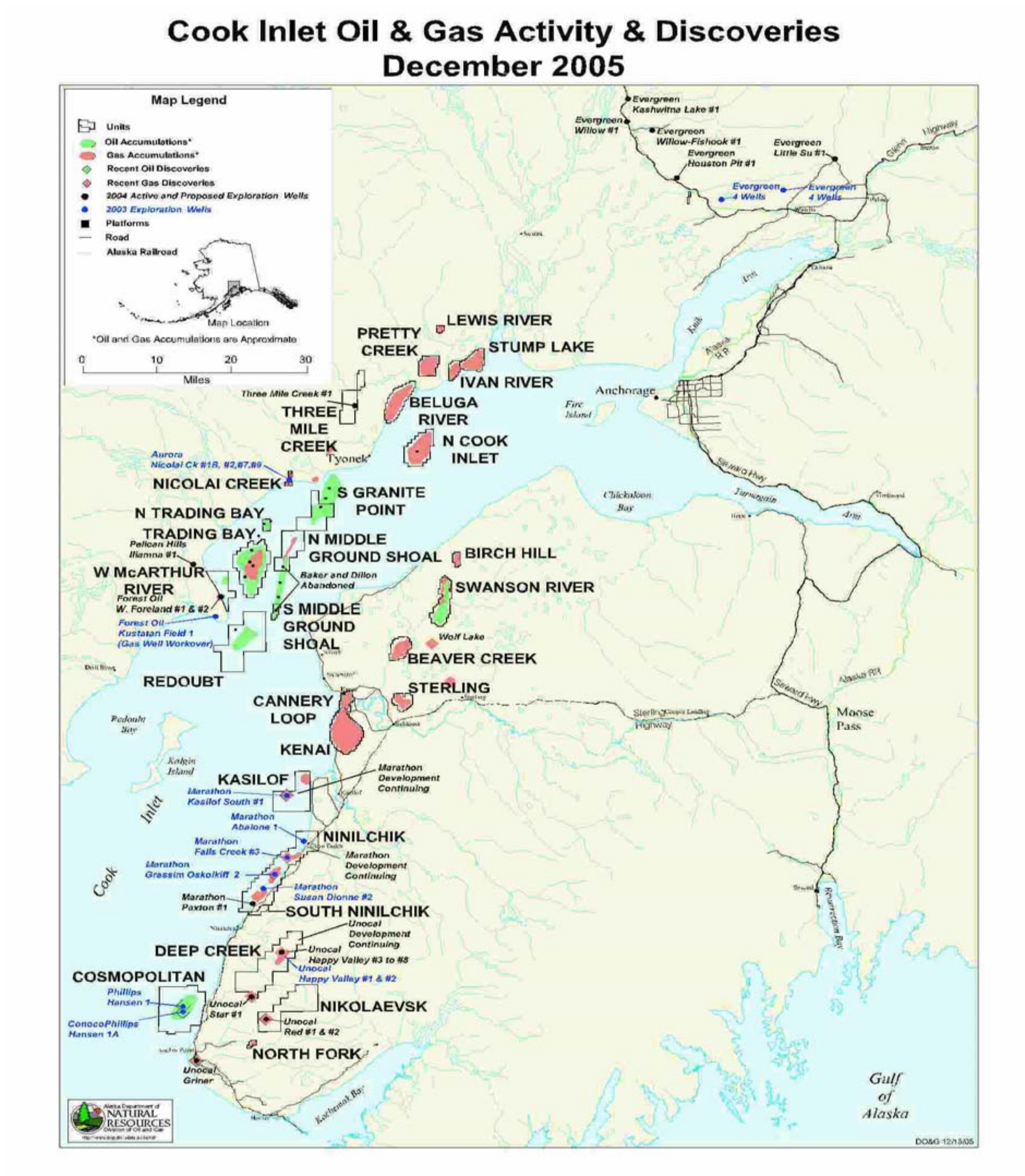

Figure 1.1

Source: ADNR, 2006
http://www.dog.dnr.state.ak.us/oil/products/maps/cookinlet/images/cook_inlet_activity_map_2005-12-15.pdf

1.1 PURPOSE

The purpose of this report is to examine how each of the following would be impacted by continued export of Kenai LNG for the period of April 1, 2009 through March 31, 2011. Specifically, this report will address the following:

- Southcentral Alaska natural gas demand for all existing and prospective use categories;
- Natural gas supplies from the Cook Inlet region;
- Alternative natural gas and energy supplies in Southcentral Alaska;
- Impacts of LNG export on taxes, royalties, employment and economic development in the State of Alaska;
- The significant obstacles to diversion of Kenai LNG to the Lower 48 States; and
- The strategic importance of Kenai LNG exports to the U.S. trade balance.

1.2 BACKGROUND AND ISSUES

1.2.1 *Background of Natural Gas Uses in Southcentral Alaska*

Currently, the primary users of Cook Inlet natural gas resources are: (1) the Kenai LNG facility owned by the Applicants, (2) an ammonia-urea fertilizer plant owned by Agrium U.S. Inc. (Agrium) and (3) Southcentral Alaska's electrical and heating energy consumers. Figure 1.2 illustrates the proportions of Cook Inlet natural gas which each use consumed in 2005.

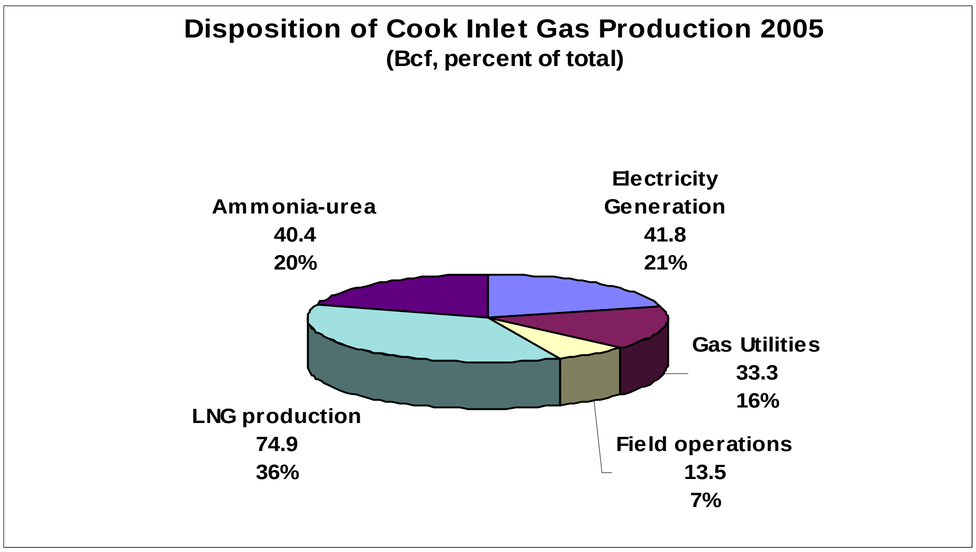

Figure 1.2

Source: ADNR, 2006 and Resource Decisions calculations.

Despite these competing uses, economically viable demand has typically been well below supply, as evidenced by historically low prices (relative to Lower 48 States prices) and the low level of natural gas drilling interest. Local demand for electricity and utility gas for space heating is expected to grow in step with expected population growth, but will be partially offset by planned efficiency improvements as the electrical utilities modernize their generation capacity. The production of natural gas for LNG feedstock is expected to decline as planned export volumes step down in Q1 of 2007, step down further in Q2 of 2009, and continue at a reduced level through the remainder of the planned export period. The use of natural gas for ammonia-urea production has continued to decrease over time as natural gas prices have increased and is anticipated to end by year-end 2007.

In reviewing the natural gas supply situation, it is important to consider substitute energy sources which can be used for space heating and electrical generation. These energy substitutes include coal gasification, coal-bed methane, wind and hydropower. Coal from both developed and undeveloped fields is plentiful in the region.

1.2.2 *Southcentral Alaska Natural Gas Supply and Demand Issues*

Study Area Definition: Southcentral Alaska, for purposes of this report, encompasses the Municipality of Anchorage, the Matanuska-Susitna Borough, the Kenai Peninsula Borough, and the Fairbanks North Star Borough. This is the logical demand area for Cook Inlet natural gas. The Cook Inlet region, as defined in the natural gas supply analysis, encompasses a more limited geographic region. Cook Inlet is the supply region designation for all significant Alaska natural gas resources discovered to-date outside of the North Slope.

In addition to the normal supply and demand forces influencing Cook Inlet natural gas, several other factors may have a bearing on the determination of the continued availability of natural gas for LNG export. These factors, described briefly below, will be addressed in depth in connection with the supply and demand analyses.

Electric Utility Demand: The "gas-by-wire" use of the Anchorage-Fairbanks inter-tie supplies natural gas-fired economy power to Fairbanks. Electricity supplies formerly self-generated at Fort Richardson Army Base and Elmendorf Air Force Base are now supplied by commercial utilities.

Demand Projection: More than 65% of Alaska’s population resides within a single electrical grid fueled predominantly by Cook Inlet natural gas. Potential future influences which might further increase natural gas usage by electric utilities include:

- Possible conversion of existing dual fuel capacity to natural gas only;
- Increases in Fairbanks electricity generation demand for natural gas; and
- Demographically driven increases in electricity usage.

Demographics: Alaska population and employment has been growing steadily since 1988. From 1991 to 2005, employment rose at an average annual rate of 1.8%. This rate slowed in 2003 and 2004 with job growth rates of 1.4% and 1.6%, respectively. But in 2005 the job growth rate increased to 2.1%, due primarily to strong growth in the mining, petroleum, and construction sections. Growth in the economy of Southcentral Alaska has paralleled the statewide trend.[3]

Natural Gas Pipelines: In 1985, Enstar Natural Gas Company (Enstar) constructed a natural gas pipeline from the Beluga natural gas field to Anchorage. Since then, Enstar has expanded its distribution lines in Wasilla, Palmer and on the Kenai Peninsula to enable residences and businesses to convert from fuel oil to gas for home heating. The distribution system increased regional demand for Cook Inlet natural gas. The natural gas distribution system was recently expanded via a retired military pipeline to provide natural gas service to Whittier.

Hydroelectric and Coal Energy Supplies: Southcentral Alaska and areas to the north along the railbelt to Fairbanks are amply endowed with coal and hydroelectric resources. The Bradley Lake hydroelectric project began operation in 1991. No further hydroelectric developments are presently planned. The Healy Clean Coal Project, which commenced trial operation in 1998, has not produced electricity since 1999.[4] However, the resource base to support new hydroelectric and coal developments still exists. Homer Electric Association recently announced that it reached an agreement to restart the Healy Clean Coal Project.[5] When developed, this project would reduce demand for Cook Inlet natural gas. However, it is not anticipated that power would be generated from this plant before the export period covered by the proposed application ends in 2011. Therefore, none of the cases analyzed in this report assumes further development of these natural gas substitutes, which provides a cushion or conservative bias to the analysis.[6]

North Slope Gas Pipeline: BP Exploration (Alaska) Inc., ConocoPhillips Company and ExxonMobil Corporation have pursued an Alaska North Slope Gas Pipeline Project under Alaska's Stranded Gas Development Act (SGDA). Other projects for natural gas pipelines from the Alaska North Slope have also been considered or promoted. Some of these concepts have included the potential for delivery of ANS natural gas to Cook Inlet. Although no option would be in place during the period of analysis (2006 to 2011), ANS natural gas could potentially provide a long term natural gas supply for Southcentral Alaska.

1.3 METHODOLOGY

There are several factors that may influence future supply and demand for natural gas resources. Because of uncertainty as to how each of these factors may play out, a scenario-based approach is used in this analysis. Expected Cases and Stress Cases are postulated for both supply and demand, creating an Expected Demand Case, an Expected Supply Case, a Stress Demand Case and a Stress Supply Case. In this context, "Stress" refers to conditions which increase regional

[3] Alaska Economic Trends, April 2006, page 51

[4] Alaska Energy Authority, 2005. http://www.aidea.org/PDF%20files/HCCPFactSheet.pdf.

[5] "State, Homer Electric reach deal on Healy," Petroleum News Bulletin, November 26, 2006. http://www.petroleumnews.com/pnads/401402946.shtml.

[6] Conservative biases tend to provide an additional cushion, providing greater assurance that remaining gas supplies will be at least as great as those estimated.

demand or decrease regional supplies of natural gas or substitute energy sources. In contrast to the Stress Demand Case, an Expected Demand Case utilizes the most likely estimates for Southcentral Alaska natural gas demand. In contrast to the Stress Supply Case, an Expected Supply Case utilizes the most likely estimates for Cook Inlet natural gas supply. The combination of the Expected Demand Case and Expected Supply Case reflects the most realistic appraisal of the relevant natural gas supply-demand balance.

The analysis reported in this study consists of the following elements:

- A demand model for the Southcentral Alaska region;[7]
- A supply analysis for Cook Inlet natural gas resources;
- A supply-demand balance for Southcentral Alaska; and
- Impact analyses of alternative supply-demand outcomes.

Each of these elements is briefly described below.

Demand: The demand model is based in part on a report by the Institute for Social and Economic Research (ISER) entitled "Economic Projections: Alaska and The Southern Railbelt 2005-2030."[8] ISER is a publicly-funded research center within the University of Alaska Anchorage. Its stated purpose is to "enhance the well-being of Alaskans and others, through non-partisan research that helps people understand social and economic systems and supports informed public and private decision-making."[9] As such, it is generally regarded as the definitive source for Alaska demographic analysis. The demographic projections used in ISER, 2005 were used by Chugach Electric Association (CEA) to assist in its long-term planning. These demographic projections were coupled with original estimates of per-capita and other energy use parameters to produce the natural gas demand forecasts used in this report.

In the analysis presented here, the Stress Demand Case assumes that all uncertain factors affecting demand will result in increased demand. This case includes high state oil revenue projections, aggressive petroleum development, and relatively rapid growth in all basic industry sectors. The Expected Demand Case assumes that oil revenues and other demand factors are at their mean or expected levels. The assumptions underlying these cases are discussed in more detail in Sections 2 and 3.

Supply: The supply analysis projects Cook Inlet natural gas production through Q1 of 2011 under Stress and Expected assumptions. The Stress Supply Case assumes that production is limited to proven natural gas reserves plus the potential resources which are present with a high degree of certainty. The Expected Supply Case is based on proven reserves plus mean estimates

[7] The demand for gas-fired electric generation for Fairbanks (via the Anchorage Fairbanks intertie) is included in the demand region, although Fairbanks itself does not directly utilize natural gas.

[8] Hereafter referenced as "ISER, 2005."

[9] ISER website: http://www.iser.uaa.alaska.edu/.

of potential resources. Possible and speculative resources are disregarded in both cases. The assumptions underlying these cases are discussed in more detail in Sections 2 and 4.

Supply-Demand Balance: Supply-demand balances are projected through 2011 based on the supply and demand cases discussed above utilizing the four possible combinations of the Expected Demand Case, the Expected Supply Case, the Stress Demand Case and the Stress Supply Case. The supply-demand balance is discussed later in Section 5.

Impact Analysis: The impact analysis analyzes the regional and national economic effects of the three possible outcomes of the DOE decision. These outcomes are:

- Continued export of Kenai LNG to Japan and/or one or more Pacific Rim countries;
- Export of Kenai LNG to the Lower 48 States; or
- Closure of the Kenai LNG facility.

1.4 SUPPLY AND DEMAND ASSUMPTIONS

A series of assumptions is used to define the Southcentral Alaska natural gas supply and demand situation under the Stress Demand and Supply Cases and Expected Demand and Supply Cases. These assumptions are summarized in Table 1-2 and are described more fully in Section 2.

Table 1-2: Summary of Economic Assumptions

	Expected Case	Stress Case
Demand Assumptions:		
Demographics	Uses ISER, 2005 Base Case.	Uses ISER, 2005 Base Case plus high Demand Case increases.
Field Operations	Project in proportion to 2005 natural gas production.	Project in proportion to Stress Demand Case production.
Electricity Generation	Use 2005 demand as a base. Project based on percentage increase forecast in utility projections.	Use 2005 demand as a base. Increase based on assumption of no modernization of generation facilities through 2011.
Utility Gas	Use 2005 demand as a base. Increase in proportion to ISER, 2005 base case demographic projections.	Use 2005 demand as a base. Increase in proportion to ISER, 2005 base case plus high Stress Demand Case increases.
Ammonia Manufacture	Use current demand through end of 2007, and then cease production.	Continue current demand through the study period.
LNG Manufacture	LNG deliveries reduced from 34 cargos per year to 28 cargos per year starting in 2007, further reduced to 26 cargos per year starting in Q2 2009.	LNG deliveries reduced from 34 cargos per year to 28 cargos per year starting in 2007, further reduced to 26 cargos per year starting in Q2 2009.
Supply Assumptions:		
Cook Inlet Reserves	Use Netherland, Sewell & Associates Inc.'s Jan. 1, 2006 proven reserves of 1,212 Bcf plus 514 Bcf probable reserves.	Use Netherland, Sewell & Associates Inc.'s Jan. 1, 2006 proven reserves of 1,212 Bcf plus 514 Bcf probable reserves.
Cook Inlet Resources (undiscovered)	Based on Potential Gas Committee most likely estimate of Probable Cook Inlet region resources (onshore plus offshore) of 1,050 Bcf.	Based on Potential Gas Committee minimum estimate of Probable Cook Inlet region resources (onshore plus offshore) of 600 Bcf.

1.5 SUMMARY OF RESULTS AND CONCLUSIONS

The analyses conducted in this study demonstrate that continued export of Kenai LNG would not threaten the availability of natural gas to meet regional demand. Indeed, it is difficult to postulate plausible future conditions which do not support this conclusion. Below is a brief summary of this study's findings.

Regional Demand: Southcentral Alaska annual domestic natural gas demand (excluding exports) has grown from 69 Bcf in 1980 to 88.6 Bcf in 2005.[10] By 2011, domestic natural gas demand is projected to decline slightly to 79.3 Bcf under the Expected Demand Case due primarily to efficiency gains in power generation. Under the Stress Demand Case, regional domestic demand is expected to rise about 12% to 100.3 Bcf in 2011.

Total annualized demand (including exports) is projected to fall from 203.9 Bcf in 2005[11] to 79.3 Bcf in 2011 after LNG exports cease under the Expected Demand Case. This fall in demand is based on the assumption that both fertilizer manufacturing and LNG exports will stop by March of 2011. Under the Stress Demand Case, which assumes higher population growth and continuation of fertilizer manufacturing, total annualized demand is expected to fall to 120.3 Bcf in 2011 after LNG exports cease.

Regional Supply: Cook Inlet natural gas supply has historically exceeded demand. Note that:

- Most current supplies of natural gas were developed only incidentally to the exploration and development of oil;
- Most of the current reserves were developed from fields which were discovered during the 1950s and 1960s;
- Proved reserves to production ratios during the 1980 to 2005 time frame have averaged 20, far in excess of the 8-10 R/P ratios typically observed in the Lower 48 States;[12]
- Total proven and probable reserves are 1,726 Bcf as of January 1, 2006 (NSAI estimates);
- There is a 50% probability that undiscovered resources of at least 1,050 Bcf remain to be discovered in the Cook Inlet region in the "probable resource" category; and
- There is a high degree of certainty that at least 600 Bcf of undeveloped probable resources remain to be discovered in the Cook Inlet region.

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[10] ADNR 2006, page 3-27

[11] Ibid.

[12] "Cook Inlet Gas Supply Outlook," Presentation of J. Scott Jepsen of ConocoPhillips to Southcentral Alaska Energy Forum, September 20, 2006.

Regional Supply-Demand Balance: Under the Expected Supply Case and Expected Demand Case, approximately 1,800 Bcf of natural gas would remain available in the Cook Inlet region after the requested export authorization period. Under the Expected Supply Case and Stress Demand Case, approximately 1,700 Bcf will remain available at the end of the export authorization period. This is almost exactly equal to current proven reserves.

Even if Stress (low) supply conditions are coupled with Stress demand conditions, 1,300 Bcf would still be available at the termination of the authorization period.

Supply to the Lower 48 States: Prospects for shipping Kenai LNG to the Lower 48 States during the export authorization period are remote from an economic standpoint. Section 27 of the Merchant Marine Act of 1920, commonly known as the Jones Act, prohibits transportation of merchandise from one United States port to another United States port in a vessel that is not built in the United States, documented under the laws of the United States and owned and operated by United States citizens or corporations. In light of these restrictions, shipping LNG from Kenai to another United States port would not be economically viable for several reasons. The Applicants would be required to purchase ships built in the United States; however, no such ships are currently available and none has been built in the United States in decades. It is estimated that the construction of such ships would cost in excess of $200 million per ship. Next, no LNG regasification terminals currently exist on the West Coast of the United States and the transportation distance to the existing LNG terminals on the Gulf Coast or East Coast would be economically prohibitive. Although the Energía Costa Azul regasification terminal in Baja California, Mexico may be completed prior to the proposed LNG export period (2009-2011), it is highly unlikely that there would be uncontracted capacity for LNG from Alaska.

Impacts of Discontinuing LNG Export: If the Applicants' proposed LNG export authorization were denied, the Kenai facility would shut down. Cessation of LNG production and export would result in a significant loss of jobs and revenue in Alaska and a negative impact on the United States balance of trade. In addition, according to the Applicants, cessation of LNG production would likely have a negative effect on the total recovery of reserves for the fields supplying natural gas to the LNG plant. Most of the natural gas fields are mature fields that have been producing natural gas for the last 20 to 40 years. If the LNG export application is denied, it is likely that wells associated with the fields that feed the plant would be shut-in because there would no longer be a readily available market for the gas. Ultimate reserves recovery would be reduced because of cross-flow from sands with different water saturations and pressures.

1.6 REPORT ORGANIZATION

This analysis is divided into seven sections. Section 2 describes the analytic framework and the inter-fuel substitution possibilities for natural gas. An analysis of the demand for natural gas in Southcentral Alaska is presented in Section 3. Section 4 analyzes the supply of natural gas and other substitute fuels in Southcentral Alaska. Section 5, the supply-demand balance, compares the results from the two previous sections. Section 6 discusses the regional and national economic effects of continued LNG export and alternatives. Finally, references are provided in Section 7.

2 ANALYTIC FRAMEWORK FOR SOUTHCENTRAL ALASKA SUPPLY/ DEMAND ANALYSIS

2.1 INTRODUCTION

The analysis of the Southcentral Alaska energy system and the projection of the possible impacts of continued export of LNG presented in this study rely on a simple and straightforward analytic framework. Two cases are postulated for both supply and demand: Expected Cases and Stress Cases. The Expected Cases use the best estimates (50% probability or most-likely estimates) for demand and supply assumptions. The Stress Cases use demand assumptions that are higher than expected and supply assumptions that have a very high probability of being exceeded. When combined, the Stress Demand Case and Stress Supply Case impart a doubly conservative bias to the analysis. The analysis demonstrates that, even with high demand and low supply assumptions, Southcentral Alaska natural gas supplies are adequate to support both regional demand and the continued export of LNG.

2.2 ANALYTIC FRAMEWORK

The economic analysis conducted for this study evaluates the following components:

- competing regional demand for natural gas;
- available regional supplies of natural gas or substitute fuels;
- regional economic impacts which would result from cessation of LNG production;
- Lower 48 States demand for natural gas; and
- strategic economic considerations for United States-international trade relations.

The first two items, regional supply and regional demand, constitute the potentially most important issues. Due to their importance, the analysis in this study focuses mainly on examination of regional supply-demand issues. A framework for analyzing regional supply-demand projections is presented below. The remaining three items are discussed in Section 6.

The relevant boundary for analyzing regional energy supply and demand is the area defined as Southcentral Alaska. The portion of electricity demand in Fairbanks which is supplied by Cook Inlet natural gas is also included in the demand region. A comprehensive network of natural gas pipelines and electrical inter-ties serves Southcentral Alaska, making the area a unified supply-demand region.

2.2.1 *Regional Supply-Demand Cases*

There are uncertainties that surround several supply and demand issues central to a forecast of the energy situation in Southcentral Alaska. To surmount these uncertainties, the analysis reported here relies on a scenario approach under which two cases are postulated for both supply and demand.

The Expected Supply and Demand Cases are based on the supply and demand scenarios that are most likely to occur. These cases utilize the most likely outcome of events which can be specified statistically (*i.e.*, oil price and potential undiscovered resources) and the best professional judgment for other uncertain events.

The Stress Supply and Demand Cases are based on supply and demand scenarios that are biased against adequacy of natural gas supply surplus for LNG export. Supply is thus biased toward the low side in the Stress Supply Case while demand is biased toward the high side in the Stress Demand Case. For proposed projects affecting energy supplies, assumptions made in each case would maximize demand and minimize supply.

By combining these unlikely supply and demand conditions, an extremely biased stress case scenario is created. The joint probability of all these unfavorable situations actually occurring is very low. It is much more likely that the future would be more favorable for the natural gas supply-demand balance.

The Southcentral Alaska energy demand projections are presented in detail in Section 3. In the Expected Demand Case, oil and natural gas revenues, demographic projections and availability of proposed substitute fuel sources are based on the ISER Base Case projections (ISER, 2005). Demographic demand assumptions for the Stress Demand Case are consistent with the high oil prices associated with ISER's High Case revenue projection as well as the development of large prospective projects which would increase natural gas demand. All prospective projects which would tend to provide substitute fuels are assumed not to be developed, further exaggerating the Stress bias.

The Southcentral Alaska supply assumptions are developed in detail in Section 4. Supplies in the Expected Supply Case are limited to total proven plus probable reserves, plus the most likely estimate of probable Cook Inlet natural gas resources. The Stress Supply Case assumes a more conservative estimate based on total proven plus probable reserves, plus the high probability estimates for probable undiscovered resources.

2.2.2 *Energy-Related Projects in Southcentral Alaska: Supply Issue Status and Assumptions*

Alaska North Slope Natural Gas

As noted above, a number of concepts for delivering ANS natural gas to Southcentral Alaska have been identified, but none would be in place during the period of analysis (2006 to 2011). If a pipeline to Southcentral Alaska is built, a large supply of natural gas would be available to Southcentral Alaska. However, timing and price are indeterminate at this time. Although ANS natural gas will not be available to Southcentral Alaska during the period studied in this report, an ANS natural gas pipeline project would place additional demand pressure on existing Cook Inlet supplies in response to the demographic effects. ISER estimates that construction of the ANS natural gas pipeline could begin as early as 2010 and then ramp up through 2014. No ANS natural gas is expected to become available during the period studied in this report (2006 through Q1 of 2011). However, the Stress Demand Case does reflect the increased demand due to construction of an Alaska North Slope Gas Pipeline Project (see Section 2.2.3).

Coalbed Methane

Alaska's extensive coal beds (see Section 4.3.4) could contain vast amounts (up to 1,000 Tcf)[13] of methane which might provide an essentially unlimited source of natural gas. No supply or demand impacts from coalbed methane are included in this report.

Kenai Coal Gasification

Agrium (owner and operator of the Kenai fertilizer plant) announced plans for the Blue Sky Project in November 2005.[14] The project will use coal gasification as an alternative to natural gas to feed its fertilizer plant at Nikiski on the Kenai Peninsula. The initial phase of the feasibility study looked at developing a coal gasification plant at Nikiski using two potential sources of coal. The coal could come from the Usibelli coal mine in Healy, or from the huge Beluga coal field located on the west side of the Cook Inlet. The Beluga coalfield is currently undeveloped, but has proven reserves of more than 2 billion tons of low sulfur coal. The proposed project would provide synthetic gas for the continued operation of the fertilizer plant with additional gas and waste heat available for electrical generation. In August 2006, Agrium announced that it was proceeding to the second phase of the project, namely, a detailed feasibility study. If all goes according to plan, construction of the plant might be completed as early as 2011.[15] In parallel with the Agrium feasibility study, Science International Applications Corp. (SAIC), under contract to DOE, has investigated the potential for an integrated gasification

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[13] ADNR 2006. http://www.dog.dnr.state.ak.us/oil/products/publications/healy/pbif/xgcbm.pdf.

[14] "Step closer to coal, By 2010 Agrium, Usibelli expect to replace gas with coals as feedstock for Nikiski plant," Petroleum News Bulletin, November 20, 2005. http://www.petroleumnews.com/pnads/455052233.shtml.

[15] "Agrium moves forward on Blue Sky coal gasification project to feed Nikiski fertilizer plant," Petroleum News Bulletin, September 10, 2006. http://www.petroleumnews.com/pnads/69122499.shtml.

combined cycle plant in conjunction with the Beluga coal field.[16] The potential effects of the project are not included in the Expected Cases or Stress Cases because such effects would not occur within the time-frame of this analysis. Fertilizer production is discussed in Section 2.2.3.

Kenai LNG Regasification Terminal

The Kenai LNG plant has the potential for being converted into an LNG import and regasification facility. The large LNG storage tanks and pipeline infrastructure represent significant investments that could be used to provide another option for natural gas supplies. An extension of the LNG export license will help preserve this infrastructure, should it be required in the future.

2.2.3 *Energy-Related Projects in Southcentral Alaska: Demand Issue Status and Assumptions*

Natural Gas Storage

Gas buyers in Southcentral Alaska have historically relied on their suppliers not only to provide natural gas, but to accommodate wide daily shifts in the quantity supplied. Thus far, producers have been able to provide this accommodation, allowing gas buyers until recently to operate without the need for significant natural gas storage.[17] However, as Cook Inlet natural gas supplies decline, it may be necessary for gas buyers to invest and develop new facilities, such as storage, in order to more economically meet their supply needs. To date, all gas buyers have elected to continue to rely on producers to supply load management. Natural gas storage projects have been developed by the producers in the Swanson River, Pretty Creek, and Kenai fields.

Alaska North Slope Gas Pipeline Project-Induced Demand

As noted in Section 2.2.2, demand effects from a construction boom could occur as a result of the development of the proposed Alaska North Slope Gas Pipeline Project. The population and employment growth induced by the proposed project were estimated as part of ISER's natural gas demand study[18] and are included in the Stress Demand Case estimate. ISER estimates that these potential effects could begin as early as 2010 and continue well beyond the timeframe of this analysis.

Electricity Generation

Electricity generation in Southcentral Alaska is almost entirely fueled by natural gas. In the past decade, natural gas consumption for electrical generation has been highly correlated with

[16] "Coal gasification options in Alaska, DOE/SAIC studying coal gasification at Nikiski and coal to liquids at Healy; Nikiski plant looks marginally economic," Petroleum News Bulletin, October 29, 2006. http://www.petroleumnews.com/pnads/613003680.shtml.

[17] Storage caverns, LNG storage/peak shaving units, and other storage facilities are commonly used throughout the Lower 48 States to supply natural gas for peak shaving and swing purposes.

[18] ISER 2004: Economic Projections for Alaska and the Southern Railbelt 2004-2030, page 91. Hereafter referenced as "ISER, 2004."

population. Both of the major electricity companies in Southcentral Alaska, CEA and Anchorage Municipal Light and Power (ML&P), plan to upgrade their generation capacity to use more efficient generators (ML&P in 2009, CEA in 2011). If this occurs as planned, the natural gas usage for electrical generation per capita would be reduced. This planned increased efficiency is reflected in the Expected Demand Case. The Stress Demand Case continues to project demand as a function of population, assuming the 2005 per capita natural gas usage for electrical generation and no change in end-user efficiency or conversion efficiencies.[19]

LNG Production

Kenai LNG production will require natural gas feedstock of 76.8 Bcf per year to support 34 export cargos in 2006, declining to 28 cargos (62.2 Bcf per year) for the remainder of the current export period and then 26 cargos (57.7 Bcf per year) for the two-year export authorization sought by the Applicants. This amount is included in both the Expected Demand Case and the Stress Demand Case.

Fertilizer Manufacturing

Agrium, a manufacturer of fertilizer, shut down its operations at the end of October 2006 and announced plans to start back up in the spring of 2007.[20] As a result, Agrium's current demand for natural gas feedstock is projected to continue until year-end 2007 in the Expected Demand Case. The Stress Demand Case assumes that Agrium will continue its present level of operations through the study period. To date, however, Agrium has not been able to secure a long-term natural gas supply. If the Agrium Blue Sky coal gasification plan proves feasible, the Agrium plant could continue operations, but it would not place demand on Cook Inlet natural gas supplies as the feedstock would be coal.

Natural Gas Distribution System Expansion

Pipelines were built from the Kenai area to Anchorage soon after development of Kenai natural gas reserves. Alaska Pipeline Company, an affiliate of Enstar, completed a natural gas pipeline from the Beluga gas field on the west side of Cook Inlet to Anchorage in 1985. In order to provide natural gas to the Matanuska-Susitna Borough, the pipeline was routed around Cook Inlet and Knik Arm rather than a more direct route by underwater pipeline. Subsequently, Enstar has expanded distribution lines in the regional communities of Wasilla and Palmer to enable residences and businesses to convert from diesel fuel to natural gas for space heating. The distribution system has resulted in substantial increases in Enstar's natural gas sales. These increases are reflected in both the Expected Demand Case and Stress Demand Case estimates. A pipeline to Homer is under consideration by Enstar. If built, it would supply approximately

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[19] The proposed Agrium Blue Sky coal gasification project would potentially provide additional electricity to the grid that serves Southcentral Alaska. Because electricity from this project would come on line after the LNG export application period, it was not considered in the Supply Cases or Demand Cases.

[20] Anchorage Daily News, October 21, 2006. http://www.adn.com; Agrium News Release, August 23, 2006. http://www.agrium.com/5784_6899.jsp.

1,000 customers as early as 2008. This additional demand is included in the Stress Demand Case estimate.

Military bases in Southcentral Alaska are currently supplied under a contract that expires at the end of September 2010, unless extended by mutual agreement for one year. The total demand for natural gas for the military bases has decreased in recent years as they no longer use their out-dated inefficient power plants for combined heat and power. Enstar has indicated that conservation is decreasing per-capita demand while additional customers are being served by natural gas. Enstar suggests that the 2004 demand is a good basis for projection, with future demand growth linked to forecasted population growth.

3 SOUTHCENTRAL ALASKA NATURAL GAS DEMAND ANALYSIS

This section discusses the demand for natural gas in Southcentral Alaska. Section 3.1 describes the demand modeling approach used in this analysis. Section 3.2 presents the economic and demographic assumptions specific to the demand analysis. The components of natural gas demand are then discussed in Section 3.3. Section 3.4 then summarizes projected natural gas use from 2006 to March 31, 2011, the end of the period for which the export authorization is sought.

3.1 DEMAND MODELING

Natural gas from the Cook Inlet region is distributed throughout Southcentral Alaska to meet industrial, space heating, and electric generation needs. The space heating and electrical demand projections presented in this report are based upon historic usage trends and an economic-demographic model of Southcentral Alaska. Demand projections for the two industrial uses, LNG and fertilizer manufacturing, are estimated separately based on plans released by the industrial users.

Two projections of future natural gas demand are estimated in this report: an Expected Demand Case and a Stress Demand Case. The Expected Demand Case is based on the most likely estimate of population growth and economic conditions (for electricity and utility natural gas demand) and the announced intentions of the industrial users. The Stress Demand Case is based on economic and demographic factors that tend to drive up demand for electricity and utility natural gas as well as less likely, but possible increased industrial use assumptions. In addition to different assumptions regarding the level of population and employment growth in Southcentral Alaska, the Expected Demand Case and Stress Demand Case projections also differ with regard to the volume of natural gas required for field operations in Cook Inlet.

3.2 ECONOMIC AND DEMOGRAPHIC ASSUMPTIONS

3.2.1 *Historic Demographic Baseline of Southcentral Alaska*

Historically, economic and demographic growth has tended to concentrate in the Southcentral Alaska region of the state, particularly in the Greater Anchorage area including the Matanuska-Susitna Borough (Table 3-1). The share of state population in Southcentral Alaska has increased from 43% in 1960 to 61% in 2003. In contrast, state and local government employment and basic sector growth have been more evenly distributed throughout the state with the exception of petroleum industry employment growth, half of which has taken place at regional headquarters in Anchorage.

Table 3-1: Historic Southcentral Alaska Demographic and Economic Distribution

	Anchorage		Matanuska-Susitna Borough		Kenai Peninsula Borough		Southcentral Alaska	
Year	**Pop.**	**Employ.**	**Pop.**	**Employ.**	**Pop.**	**Employ.**	**Pop.**	**Employ.**
1980	182,504	78,174	18,637	3,264	26,424	8,397	227,565	89,835
1981	188,527	86,162	19,908	3,700	27,599	9,115	236,034	98,977
1982	201,299	98,081	23,083	4,382	31,051	9,853	255,433	112,316
1983	216,164	102,703	27,971	5,354	35,148	10,399	279,283	118,456
1984	226,195	108,386	33,552	6,542	38,275	11,402	298,022	126,330
1985	233,870	110,888	37,670	6,996	40,645	12,213	312,185	130,097
1986	235,133	105,602	39,974	6,699	41,653	11,435	316,760	123,736
1987	227,974	99,553	39,050	6,193	40,871	10,804	307,895	116,550
1988	222,950	99,062	37,985	6,095	39,949	11,089	300,884	116,246
1989	221,884	103,440	38,953	6,510	40,117	13,067	300,954	123,017
1990	226,338	109,962	39,683	7,077	40,802	13,891	306,823	130,930
1991	235,626	112,979	41,819	7,878	42,132	14,376	319,577	135,233
1992	244,111	114,138	44,370	8,253	43,459	14,474	331,940	136,865
1993	249,440	116,603	46,659	8,667	43,814	15,451	339,913	140,721
1994	253,503	119,100	47,636	9,575	45,059	15,816	346,198	144,491
1995	252,729	119,499	48,906	10,080	45,906	16,107	347,541	145,686
1996	253,234	119,948	50,367	10,075	46,654	16,110	350,255	146,133
1997	254,752	122,987	52,125	10,685	47,695	16,328	354,572	150,000
1998	257,260	126,776	54,153	11,367	48,532	16,586	359,945	154,729
1999	259,391	128,295	55,694	11,735	48,952	16,342	364,037	156,372
2000	260,283	130,892	59,322	12,361	49,691	17,317	369,296	160,570
2001	264,052	134,930	61,772	12,873	50,051	17,367	375,875	165,170
2002	268,738	137,917	64,293	13,904	50,486	17,628	383,517	169,449
2003	273,600	140,700	67,500	15,000	51,400	17,700	392,500	173,400
2004	277,900	145,000	70,300	15,800	50,900	17,900	399,100	178,700
2005	285,700	148,400	72,700	16,500	50,800	17,600	409,200	182,500
Av.Ann. Growth Rate 1980-2005	1.7%	2.5%	5.4%	6.4%	2.5%	2.9%	2.3%	2.8%

Source: ISER, 2005, pages 108-112.

Another important way in which Southcentral Alaska differs from the rest of the state is that the level of population is largely determined by the health of the economy. A large proportion of the population is employed and changes in employment opportunities lead to commensurate changes in population. Elsewhere in Alaska, population change is not as sensitive to changing employment opportunities, as demonstrated during the statewide economic recession which began in late 1985. The recession largely affected jobs in the service and infrastructure sectors, and significant out migration from Southcentral Alaska occurred in response to declining job opportunities.

3.2.2 *Economic and Demographic Assumptions - Expected Demand Case*

The assumptions regarding future economic and demographic trends presented in the following sections are from ISER, 2005. The demographic projections presented in ISER's report were prepared for CEA to assist in their long-term planning. The Expected Demand Case presented in this analysis uses ISER's base case demographic and economic assumptions and projections from that report, and the Stress Demand Case uses ISER's high case demographic and economic assumptions. The following description of ISER's Base Case conditions is quoted verbatim from ISER 2005, page 1:

> For the state as a whole, the most likely (BASE CASE) rate of wage and salary employment growth, the best measure of the size of the economy, is projected to gradually rise, resulting in a 30-year average (2000 to 2030) of .94 percent (Table 1A). This is based on the assumptions of continued competitiveness of Alaska's export industries and successful downsizing of state and local government in response to reduced petroleum revenues. The drag this transition places on the economy is gradually overcome. Growth in real personal income will also be below the historical rate because of slower growth in the number of jobs, the continuing shift toward lower wage industries, and slower growth in government payments to individuals. Population will grow at a faster rate than employment because of the continuing trends of aging of the population and the replacement of nonresidents in the work force with Alaskan residents. The average household size will continue its historical decline so growth in the number of households will exceed that of population.
>
> Economic and population growth will be concentrated in South Central Alaska (The Southern Railbelt). In the BASE CASE, the 30 year average wage and salary employment growth rate is .83 percent for Anchorage, 4.51 percent for the Matanuska-Susitna Borough, and .42 percent for the Kenai Peninsula Borough. The rate for the rest of the state is .47 percent. Anchorage and the Matanuska-Susitna Borough will continue to become more integrated economically, and an increasing share of the growth in 'Greater Anchorage' will gravitate to the Matanuska- Susitna Borough. Strength in this region comes from its economic diversity. Anchorage serves as the trade, service, and headquarters center for the state. The Kenai Peninsula Borough is also relatively diversified with oil, fishing, timber, tourism, and government.

Table 3-2: Base Case Demographic Projections for Southcentral Alaska

	Anchorage		Matanuska-Susitna Borough		Kenai Peninsula Borough		Southcentral Alaska	
Year	**Pop.**	**Employ.**	**Pop.**	**Employ.**	**Pop.**	**Employ.**	**Pop.**	**Employ.**
2006	288,500	151,100	74,800	17,100	50,400	17,400	413,700	185,600
2007	290,900	152,200	77,800	17,800	50,400	17,200	419,100	187,200
2008	293,200	152,100	81,900	19,000	50,800	17,200	425,900	188,300
2009	292,800	151,200	86,200	20,400	50,800	17,000	429,800	188,600
2010	292,500	150,500	90,600	22,000	50,900	16,900	434,000	189,400
2011	293,300	150,800	94,500	23,300	51,200	17,000	439,000	191,100
Av. Ann. Growth 2006-2011	0.3%	-0.03%	4.0%	5.3%	0.3%	-0.4%	**1.0%**	**0.5%**

Source: Compiled by Resource Decisions from ISER, 2005, pages 53-55.

Southcentral Alaska population growth is expected to average about 1% annually over the 2006 through 2011 time frame while employment is expected to grow by 0.5% annually.

3.2.3 *Economic and Demographic Assumptions - Stress Demand Case*

The Stress Demand Case assumes developments that would tend to contribute to rapid rates of employment and population growth for Southcentral Alaska. ISER created a High Demand Sensitivity Case for forecasting demand for electric utilities in Southcentral Alaska and Fairbanks.[21] Although the ISER High Demand Sensitivity Case is used in this report to underpin the Stress Demand Case, it is already apparent that some of the time frame assumptions that underpin ISER's High Demand Sensitivity Case may have been overly optimistic. For example, ISER assumes that construction of the Alaska North Slope Gas Pipeline Project begins in 2010. ISER's High Demand Sensitivity Case assumes the following conditions:

- **Oil price:** Price falls to $50 per barrel in 2008 and then increases with inflation. North Slope petroleum related employment increases marginally in response to higher oil price.
- **ANWR Development:** Development begins in 2010. Production begins in 2014, gradually increasing to 400 thousand barrels per day by 2020. Royalties shared 50/50 with federal government.
- **Military Demand:** Eielson Air Force Base in Fairbanks remains open.
- **Federal Spending:** Construction spending continues to generate 1,500 construction jobs. Grants to non-profits continue to grow at historical rate. Transfers to State government continue to grow at combined rate of population growth and inflation.
- **Basic Sector Job Shift to Matsu from Anchorage:** Higher employment and population increases the shift in basic sector employment to Matsu from Anchorage to three times the ISER Base Case.

[21] ISER 2005, page 118.

- **Permanent Fund Dividend:** Permanent Fund Dividend continues according to current formula.
- In addition to the Base Case growth, the Stress Demand Case growth rates include growth due to several situations which are assumed to occur during 2006 to 2011. These include:
  - Rapid tourism expansion;
  - High oil revenues;
  - Rapid mining sector growth;
  - Construction of the Alaska North Slope Gas Pipeline Project; and
  - Construction of the proposed Knik Arm Crossing.

To create an even higher demand scenario, the Stress Demand Case assumptions included in the current analysis assume that the Alaska North Slope Gas Pipeline Project construction begins in 2006.[22] With each of these situations having considerable uncertainty, the combined probability of all of these high growth (and thus high natural gas demand) situations occurring is extremely unlikely. Thus, these demographic factors combine to form a very pessimistic (conservative) Stress Demand Case.

Under the Stress Demand Case, Southcentral Alaska employment is projected to grow at the rate of 1.9% annually while population grows 2.3% during the 2006-2011 timeframe. The population growth rate is thus almost double that of the Base Case projection while the employment growth rate is almost five times higher than that of the Base Case.

Table 3-3: Stress Demand Case Demographic Projections for Southcentral Alaska

	Anchorage		Matanuska-Susitna Borough		Kenai Peninsula Borough		Southcentral Alaska	
Year	**Pop.**	**Employ.**	**Pop.**	**Employ.**	**Pop.**	**Employ.**	**Pop.**	**Employ.**
2006	288,789	151,402	74,875	17,151	50,501	17,435	414,164	185,988
2007	292,936	154,635	78,189	18,120	50,803	17,441	421,929	190,196
2008	299,650	156,663	83,620	19,893	52,070	17,699	435,340	194,255
2009	303,048	158,155	89,476	22,012	52,832	17,782	445,356	197,949
2010	309,173	160,734	96,308	24,574	54,361	18,134	459,842	203,442
2011	316,764	163,316	103,100	26,725	56,218	18,632	476,081	208,674
Av. Ann. Growth 2006-2011	1.6%	1.3%	5.5%	7.7%	1.8%	1.1%	2.3%	1.9%

Source: Compiled by Resource Decisions from ISER, 2005, pages 87-89 and 118-121.

[22] Events since the ISER projection make a 2006 startup of the Alaska North Slope Gas Pipeline Project gas line inconceivable. However, this assumption was retained as it was included by ISER and would be impossible for the author of this report to revise. This assumption imparts a slight upward bias to the Stress Demand Case projections.

3.3 NATURAL GAS DEMAND

Since the commencement of natural gas consumption from Cook Inlet in 1965, natural gas use has grown to average about 200 Bcf annually distributed among five major uses: electricity generation, natural gas delivered by utilities, field operations, ammonia-urea production, and LNG production.[23] Each of these uses is discussed below.

3.3.1 *Electricity Generation*

Historical Patterns: Over 80% of the electricity generated by the electric utilities in Southcentral Alaska is supplied by natural gas produced in Cook Inlet. Generation from three hydroelectric facilities provides almost all of the remaining 20%. In the Fairbanks area, coal-fired plants and combustion turbines burning #2 fuel oil generate most of the electricity. However, some natural gas-fired generation is delivered to the Fairbanks area via the Anchorage-Fairbanks Intertie. This power, often referred to as "gas-by-wire," is included in the electrical generation natural gas demand estimates for Southcentral Alaska. A small amount of LNG is also trucked from the Cook Inlet region to Fairbanks to supply a small natural gas utility with commercial and residential customers. This natural gas demand is included in the Southcentral Alaska gas utilities demand estimates.

Natural gas has dominated electrical generation because of its relatively inexpensive price, the relatively low capital cost of capacity additions, and the short time necessary to bring new units on line. These factors are expected to continue to influence the selection of future generation modes and make natural gas an attractive method of producing electricity compared to coal, hydropower, or fuel oil. The dominance of natural gas-fired electrical generation is not expected to change in the foreseeable future.

Historically, the consumption of electricity in Southcentral Alaska has grown very rapidly, primarily due to rapid economic growth, increased market penetration, and appliance saturation. Population growth, reduction of average household size, and extension of distribution systems (particularly in the time shortly after statehood) have contributed to rapid growth in the number of customers. Per capita electrical consumption has also grown as a function of strong growth in real per capita income, the relatively low price of electricity (compared to prices elsewhere in the U.S.), and the maturation of the commercial sector of the economy. Electricity used for space heating has been significant in the Fairbanks area and Matanuska-Susitna Borough, but has declined in recent years due to the relatively high cost of space heating by coal- and fuel oil-fired electricity in Fairbanks and the extension of utility gas distribution lines to the Matanuska-Susitna Borough with natural gas supplanting electrical heating.

As seen in Figure 3.1, recent per capita electricity usage shows a distinctly downward trend. This trend was verified in discussions with the major electricity utilities in Southcentral Alaska (CEA and ML&P). These declines reflect efficiency improvements in both generation and consumption of electricity.

[23] Military natural gas use is included under the electricity and utility gas categories.

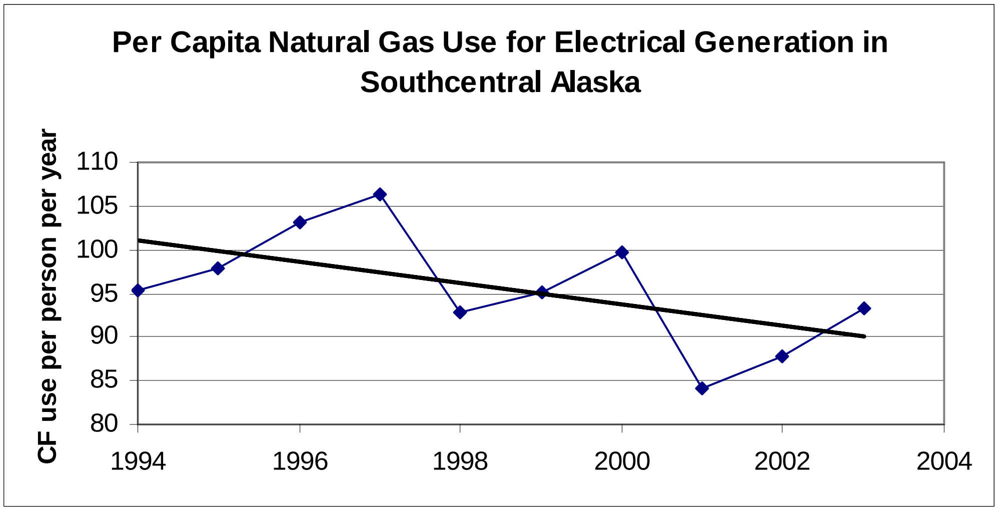

Figure 3.1

Source: Resource Decisions calculations.

The generation efficiency of both the CEA and ML&P systems is expected to increase due to the planned replacement of older generation facilities. The net effect of the combination of decreasing per-capita use, population growth, and generation efficiency improvements, is expected to decrease total electricity demand for natural gas. Table 3-4 shows the electric utilities' projections of demand for natural gas.

Table 3-4: Electric Utility Projections of Natural Gas Demand, 2006-2011 (Bcf)

	ML&P	CEA	Total
2006	10.5	28.0	38.5
2007	10.5	26.1	36.6
2008	10.5	26.1	36.6
2009	10.5	24.6	35.1
2010	9.5	24.9	34.4
2011	9.5	22.1	31.6
Avg.Ann.Growth Rate 2006-2011	-2.0%	-4.9%	-4.0%

Source: Based on the 2006 Load Forecast and CEA's Integrated Resource Plan and personal communication with ML&P.

Electricity Generation - Expected Demand Case: The Expected Demand Case electricity demand is based on the combined demand forecasts of ML&P and CEA. This demand reflects ML&P's planned generation upgrade which is projected to reduce their yearly natural gas demand by 1.0 Bcf starting in 2010. The net result is that natural gas usage for electricity generation is projected to decline by 4% during the 2006 to 2011 period under the Expected Demand Case.

Electricity Generation - Stress Demand Case: In the Stress Demand Case, projected natural gas demand for electricity generation is increased from the utilities' projections in proportion to the Stress Demand Case population increases. In addition, efficiency gains from ML&P's planned 2009 upgrade are not assumed to occur. Under the Stress Demand Case, annual demand for natural gas for electrical generation increases by 1.2% despite other efficiency gains (38.6 Bcf in 2006 to 41.0 Bcf in 2011).

3.3.2 *Utility Gas*

Historical Patterns: Natural gas distributed by utilities and third-party wholesalers for space heating, water heating, cooking, and other miscellaneous purposes is the second largest current domestic use of Cook Inlet natural gas. Like the natural gas used for electricity generation, the ultimate end-users of most of this utility natural gas are residences and commercial customers. There is very little manufacturing in Southcentral Alaska with the exception of petroleum products (included under the Field Use category) and a very small demand associated with fish processing (included in Utility Gas).

Utility gas is currently available to most of the potential customers in Southcentral Alaska and a small portion of the Fairbanks area market.[24] Homer and Seward are the only communities of significant size in Southcentral Alaska not currently served by natural gas. Outlying and sparsely populated areas in other parts of Southcentral Alaska are also unserved.

When natural gas became available in Southcentral Alaska, it quickly penetrated existing markets and consumption grew rapidly. Natural gas is now the most important source of energy for space heating in Anchorage and parts of the Kenai Peninsula and Matanuska-Susitna Borough. Utility natural gas distribution infrastructure is expanding in the Matanuska-Susitna valley area due to the development of new areas and the gradual in-fill of developed areas. This is the result of the low relative cost and convenience of natural gas.

The price of utility natural gas in Southcentral Alaska has increased during the past five years. Figure 3.2 shows the relationship between Cook Inlet and Henry Hub natural gas prices. Although Cook Inlet prices have begun to increase, they are still considerably lower and less than prices in the Lower 48 States.

[24] Although not part of Southcentral Alaska, this Fairbanks demand is included in the Southcentral region demand analysis as it is supplied from the Cook Inlet region and thus affects the Southcentral Alaska supply-demand balance.

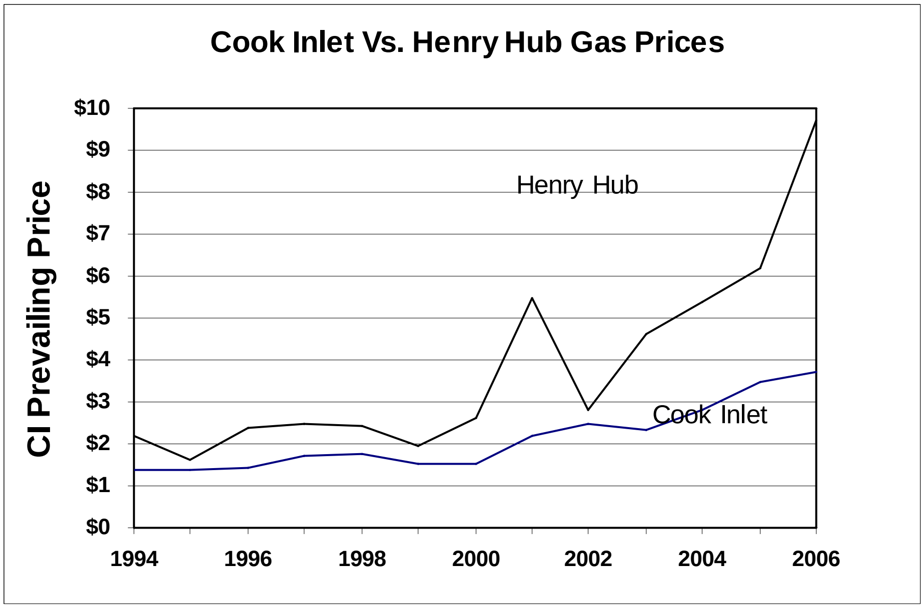

Figure 3.2: Cook Inlet vs. Henry Hub Natural Gas Prices

Source: Alaska Department of Revenue (ADOR)
Cook Inlet: http://www.tax.state.ak.us/programs/oil/prices/prevailingvalue/cookinlet.asp
Henry Hub: http://www.tax.state.ak.us/sourcesbook/Real$2006Oil&NatGasPrices.pdf

The higher prices faced by consumers have increased the incentive to use natural gas more efficiently. Thus, despite the increased penetration of utility gas to new customers, the per capita usage has decreased in recent years. Enstar reports lower energy usage per consumer due to energy efficiency retrofits for existing residential and commercial properties and more energy efficient new construction.[25] However, predicting future trends is difficult because per-customer use is declining at the same time that the number of customers is increasing.

Utility Gas - Expected Demand Case: The Expected Demand Case is based on the projected demand filed at the Regulatory Commission of Alaska (RCA) by Enstar.[26] As this demand is for Enstar's retail customers only, an additional allowance must be made for direct access customers. Enstar currently acts as a common carrier for about 9 Bcf of natural gas per year for direct access customers. The projected demand included in Enstar's RCA filing assumes that the proportion of direct access service will remain fairly constant.[27] Therefore, the Expected Demand Case consists of Enstar's projected demand plus the direct access natural gas, which is assumed to increase in proportion to Enstar's retail customer demand. As shown below in Table 3-5, demand is projected to rise from 35.7 Bcf in 2006 to 40.5 Bcf by 2011 in the Expected Demand Case.

25 Enstar, personal communication to M. Feldman of Resource Decisions, dated April 18, 2006.

26 Alaska Pipeline Company (Enstar) - Marathon Gas Sales Contract, dated October 15, 2005 at Exhibit A. http://www.enstarnaturalgas.com/CompanyInfo/Tariff%20Information/MarathonContractEff14Oct2005.pdf.

27 Enstar, personal communication to M. Feldman of Resource Decisions, dated April 18, 2006.

Utility Gas - Stress Demand Case: The Stress Demand Case assumes that the Expected Demand Case increases in proportion to the higher Stress Demand Case demographics. In addition, new customers are assumed to be added at a 2% greater rate than was assumed in Enstar's use projections. As a result, Stress Demand Case assumption for utility gas grows from 35.7 Bcf in 2005 to 43 Bcf per year in 2011, as reflected in Table 3-5 below.

Table 3-5: Expected Demand Case and Stress Demand Case for Utility Gas (Bcf)

			Total Utility Gas	
	Enstar Retail	Market-Out (Direct Access)	Expected	Stress
2006	26.7	9.0	35.7	35.7
2007	27.5	9.3	36.8	36.8
2008	28.3	9.5	37.8	37.8
2009	29.0	9.8	38.8	39.2
2010	29.7	10.0	39.7	41.3
2011	30.3	10.2	40.5	43.0
Total thru 1Q of 2011	148.8	50.1	199	202

Source: Resource Decisions calculations.

3.3.3 *Military Use*

Natural gas for the bases in Southcentral Alaska (Elmendorf Air Force Base and Fort Richardson Army Base) was formerly used for self-generation and district heating on the bases. The bases retired their natural gas-fired steam generating capacity because it was obsolete and inefficient. Fort Richardson shut down its generating facilities in 2004 and Elmendorf retired its generation equipment in 2005. The military now purchases electricity and natural gas for space heating from the civilian utilities. The net effect of this change is a slight increase in demand for utility gas and a reduction in natural gas for electricity generation. Overall, less natural gas is needed for military use because both the direct-fired heating and the electrical generation are more efficient. Military natural gas usage is no longer tracked separately by the ADNR. In this analysis, military natural gas use is included in the above market-out projections of natural gas for space heating and electricity.

3.3.4 *Natural Gas Use for Field Operations*

Historical Patterns: A significant amount of natural gas is consumed in the process of production of both oil and natural gas. This category of field operations consists of vented and flared gas, shrinkage (the volume reduction in natural gas that occurs when liquids are extracted from it, primarily from natural gas produced in conjunction with oil), as well as natural gas actually used on the lease to power pumps, generating equipment, and other machinery on the offshore platforms and onshore facilities. A small amount of Cook Inlet natural gas is also consumed at the Tesoro Corp. (Tesoro) refinery. This use is also included in the Field Operations category.

Figure 3.3 illustrates the relationship between Field Operations consumption and oil and natural gas production from 1994 to 2005. In the 1980s, annual field gas remained fairly constant in the 18-21 Bcf range. More recently, as oil production continues to decline, field use of natural gas has tapered off in proportion to oil production.

This variation seems to be fairly well explained by ordinary least squares (OLS) linear regression of annual field gas use as a function of annual oil and gas production. A regression relationship[28] provides a good fit[29] between actual field use (black solid line) and the backcast or predicted relationship (dashed line) as seen on Figure 3.3.

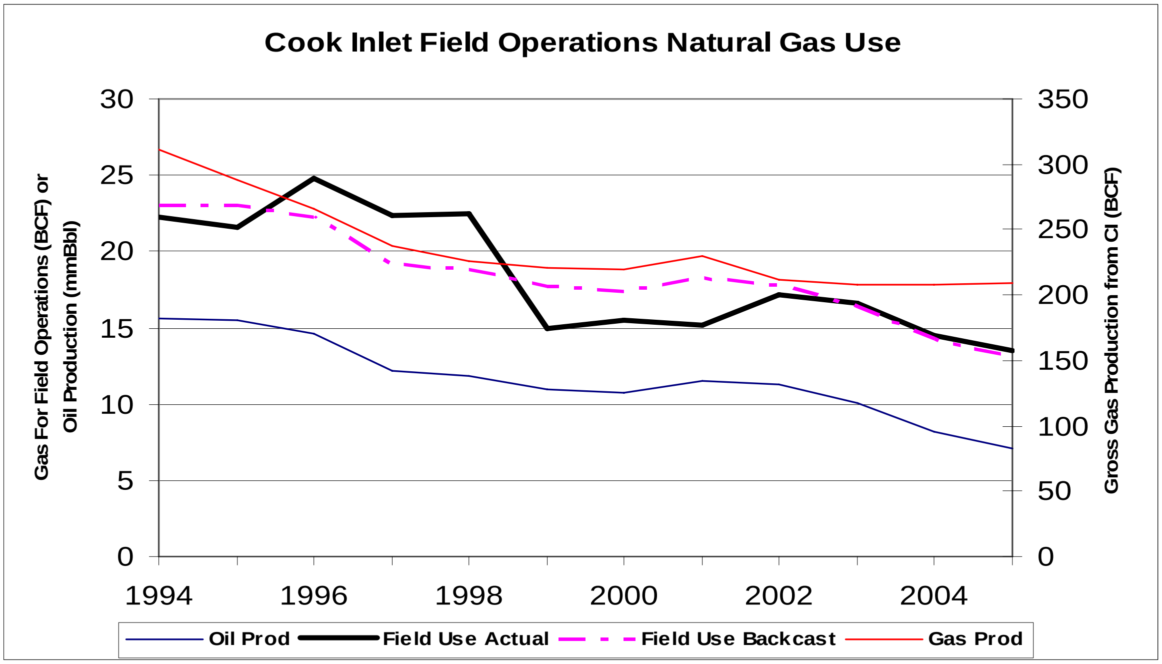

Figure 3.3

Source: ADNR 2006, Table III-10 and Resource Decisions calculations (backcast).

Natural Gas Use for Field Operations - Expected Demand Case: The regression equation is applied to the ADNR projection of oil production plus the natural gas production as predicted by all other Expected Demand Case estimates. The natural gas for field use is projected as shown in Table 3-6.

[28] The regression equation is Field Use = 1.15 * mmBbl oil + 0.024 * Bcf gas.

[29] The adjusted R squared is 89%.

Table 3-6: Historic and Projected Cook Inlet Field Use Natural Gas—Expected Demand Case

	Oil (including NGL)	Net Produced Gas	Gas Use for Field Operations
Year	**(mmBbl)**	**Bcf**	**Bcf**
1994	16	214.0	22.3
1995	16	214.4	21.6
1996	15	225.3	24.8
1997	12	214.4	22.4
1998	12	215.0	22.5
1999	11	213.4	14.9
2000	10.7	208.9	15.5
2001	11.5	210.8	15.2
2002	11.3	202.2	17.2
2003	10.1	200.4	16.6
2004	8.2	200.3	14.5
2005	7.1	203.9	13.5
2006	6.5	182	11.9
2007	6.1	170	11.1
2008	5.6	148	10.0
2009	4.9	143	9.1
2010	4.4	141	8.5
2011	4.3	95	7.2

Sources: For historic data ADNR 2006, Tables II.6 and II.8. Projections—Resource Decisions calculations

Natural Gas Use for Field Operations - Stress Demand Case: The Stress Demand Case projection uses the same relationship between field use and net oil and natural gas production as is used in the Expected Demand Case. However, as the projected natural gas production is higher in the Stress Demand Case, field use is somewhat higher than the Expected Demand Case as shown in Table 3-7.

Table 3-7: Projected Cook Inlet Field Use Natural Gas—Stress Demand Case

	Oil (including NGL)	Net Produced Gas	Gas Use for Field Operations
Year	**(mmBbl)**	**Bcf**	**Bcf**
2006	6.5	182	11.9
2007	6.1	171	11.2
2008	5.6	172	10.6
2009	4.9	172	9.8
2010	4.4	176	9.3
2011	4.3	135	8.2

Sources: ADNR, 2006 data and Resource Decisions calculations.

3.3.5 *Ammonia-Urea Manufacturing*

Historical Patterns: Since 1969, Unocal Corp. and its successor Agrium have operated a plant on the Kenai Peninsula that uses natural gas in the production of ammonia-urea fertilizer for international export. The initial annual use rate was approximately 20 Bcf. The plant was expanded after ten years and natural gas use averaged about 54 Bcf annually through 2002, varying somewhat from year to year with activity of the world fertilizer market and plant maintenance activity. In 2003 and 2004, Agrium's production was reduced about 20%. In 2005, one of two production trains was shut down thereby reducing plant capacity to 50% of its original capacity. On October 23, 2006, Agrium shut-down its plant for the 2006-2007 winter season.[30]

Ammonia-Urea Manufacture - Expected Demand Case: The Expected Demand Case assumes that the Agrium plant continues operations at reduced output (20 Bcf/year input) through 2007 and then closes. The Expected Demand Case also assumes that if the Agrium plant reopens it would utilize synthetic gas from a proposed coal gasification plant and would not affect Cook Inlet natural gas demand.

Ammonia-Urea Manufacture - Stress Demand Case: Although no plans to this effect have been announced, the Stress Demand Case assumes that the plant will continue its current level of operation (20 Bcf/year) at least through 2011.

3.3.6 *Liquefied Natural Gas Production*

Historical Patterns: ConocoPhillips and Marathon are currently authorized to export 64.4 trillion Btus (TBtus) of LNG annually (on a delivered basis). Approximately 75.4 Bcf of natural gas from Cook Inlet fields is required to deliver the fully authorized annual quantity of LNG to Japan. The difference between the required feedstock volume and the volume of natural gas delivered as LNG is accounted for by natural gas used in LNG production, as well as boil-off during transport to Japan and LNG used to fuel the ships. The net efficiency of the process averages 85%. Natural gas consumption for LNG averaged 65 Bcf from 1981 through 1993. In 1994, consumption increased to about 75 Bcf as a result of increased LNG demand and an expansion of the LNG plant.

Liquefied Natural Gas Production - Expected Demand Case: Each LNG tanker cargo requires 2.22 Bcf of natural gas be produced and delivered to the LNG production plant. Under the Expected Demand Case, LNG production is assumed to continue at a level that will require the use of approximately 75 Bcf/yr of feedstock natural gas through the Q1 of 2007, stepping down to an average of 62 Bcf/yr through Q1 of 2009 and then 58 Bcf/yr through Q1 of 2011.

According to the Applicants, the reason for the reduction in LNG exports is due to the natural decline of their existing fields and other economic decisions.

[30] Anchorage Daily News, October 21, 2006. http:www.adn.com; Agrium News Release, August 23, 2006. http:www.agrium.com/5784_6899.jsp.

Liquefied Natural Gas Production - Stress Demand Case: The Stress Demand Case is identical to the Expected Demand Case.

3.4 SUMMARY OF NATURAL GAS DEMAND

The figures in this section illustrate the projected future demands for natural gas in Southcentral Alaska under the Expected Demand Case and the Stress Demand Case.

In the Expected Demand Case, as reflected in Figure 3.4, growth in domestic sales of natural gas will be modest. Cumulative domestic consumption for heating and electricity and field operations is expected to total 440 Bcf between January 1, 2006 and April 1, 2011. Industrial use (LNG and fertilizer) during that period is expected to total 373 Bcf. The fertilizer plant is expected to cease operation in 2007.

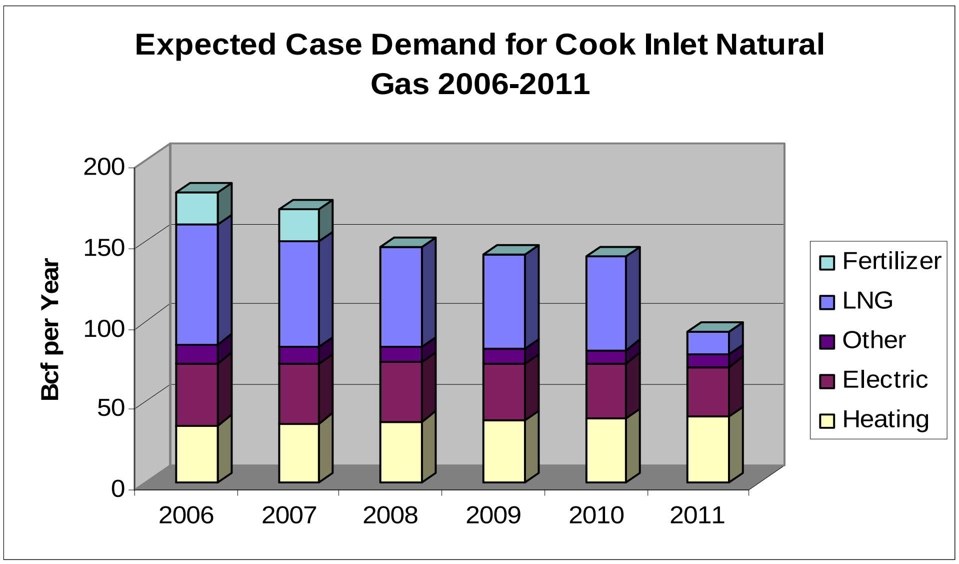

Figure 3.4

Source: Resource Decisions calculations.

Table 3-8 below summarizes the projected demand by use category for Cook Inlet natural gas from 2006 to the end of Q1 of 2011.

Table 3-8: Expected Demand for Cook Inlet Natural Gas by Major Use Category, 2006-2011 (Bcf)

Year	Electricity Generation	Gas Utilities	Field Operations	Subtotal Domestic Use	LNG Production	Ammonia-Urea	Subtotal Industrial Use	Total
2006	38.5	35.7	11.9	86.1	74.3	20.0	94.3	180.4
2007	36.6	36.8	11.1	84.5	65.2	20.0	85.2	169.7
2008	36.6	37.8	10.0	84.5	62.2	0.0	62.2	146.6
2009	35.1	38.8	9.1	83.0	58.8	0.0	58.8	141.8
2010	34.4	39.7	8.5	82.6	57.7	0.0	57.7	140.3
2011	31.6	40.5	7.2	79.3	14.4	0.0	14.4	93.7
Cum. Total*	**189**	**199**	**52**	**440**	**333**	**40**	**373**	**813**
Avg.Ann. Growth Rate **	-4.0%	2.5%	-10.4%	-1.6%	-6.5%	NA	NA	-6.5%

***** Cumulative Total from 2006 to Q1 2011
****** The average annual growth rate was calculated through 2010 rather than 2011 because only the first quarter of 2011 is included in the analysis.

Source: Resource Decisions estimate.

The projected cumulative quantities and proportion of natural gas use by category from 2006 through the end of the export authorization period under the Expected Demand Case is illustrated in Figure 3.5.

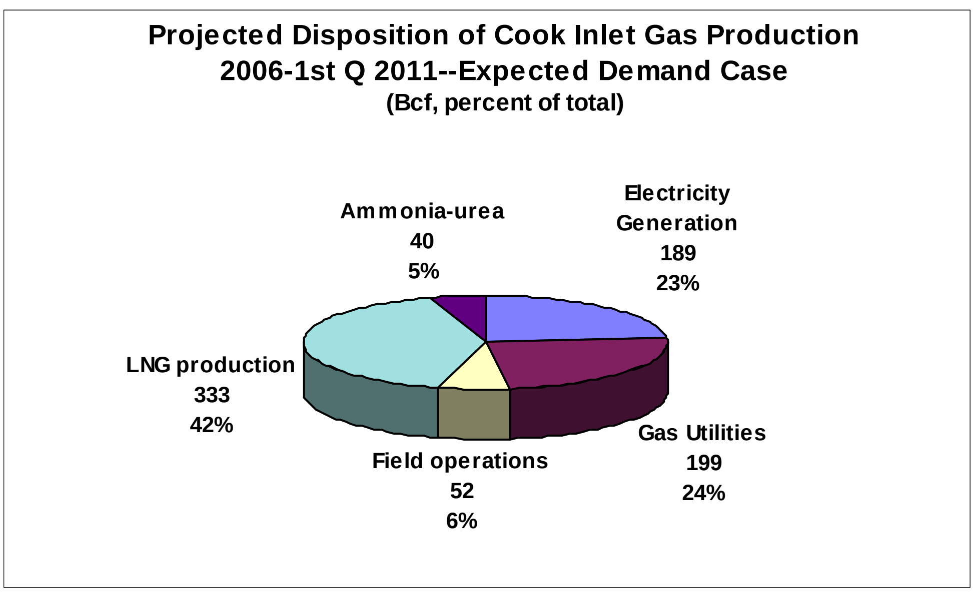

Figure 3.5

Source: Resource Decisions estimates

As reflected in Figure 3.6, in the Stress Demand Case, growth in demand for natural gas from Cook Inlet through 2011 will be largely driven by population increases and the consequent electrical and space heating needs. Industrial use of natural gas for LNG and fertilizer manufacture drops off by 2011, reducing demand from approximately 180 Bcf/yr to approximately 100 Bcf/yr for the local utilities.

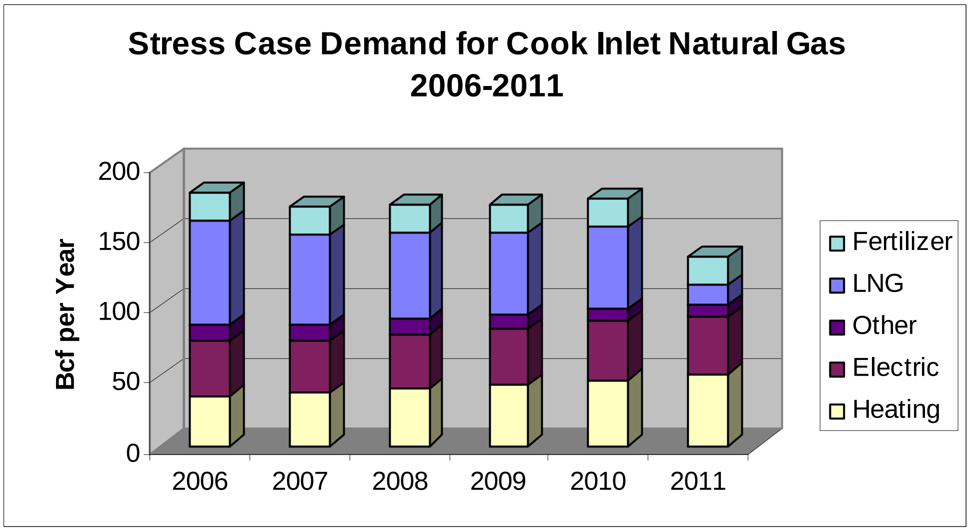

Figure 3.6

Source: Resource Decisions calculations.

Under the Stress Demand Case, higher growth rates and higher per-capita consumption are expected to increase cumulative domestic consumption (2006 through Q1 of 2011) to 479 Bcf. The Stress Demand Case industrial demand shows a more dramatic contrast with the Expected Demand Case due to the assumption of continued fertilizer production. Under the Stress Demand Case, industrial demand totals 438 Bcf or 65 Bcf higher than the Expected Demand Case. The projected demand for Cook Inlet natural gas from 2006 to the Q1 of 2011 under the Stress Demand Case is presented in Table 3-9 below.

Table 3-9: Stress Demand for Cook Inlet Natural Gas by Major Use Category, 2006-2011 (Bcf)

Year	Electricity Generation	Gas Utilities	Field Operations	Subtotal Domestic Use	LNG Production	Ammonia-Urea	Subtotal Industrial Use	Total
2006	38.6	35.8	11.9	86.4	74.3	20.0	94.3	180.7
2007	37.4	37.5	11.2	86.0	65.2	20.0	85.2	171.2
2008	39.1	40.4	10.6	90.2	62.2	20.0	82.2	172.3
2009	40.1	43.2	9.8	93.0	58.8	20.0	78.8	171.9
2010	41.9	47.2	9.3	98.4	57.7	20.0	77.7	176.1
2011	41.0	51.4	7.9	100.3	14.4	20.0	34.4	135.1
Cum. Total *	207	217	55	479	333	105	438	917
Avg.Ann. Growth Rate**	2.0%	6.6%	-6.2%	3.2%	-6.5%	NA	NA	-0.6%

***** Cumulative Total from 2006 to Q1 2011
****** The average annual growth rate was calculated through 2010 rather than 2011 because only the first quarter of 2011 is included in the analysis

Source: Resource Decisions estimates.

Finally, the projected quantity and proportion of natural gas use by category from 2006 through the end of the export authorization period (Q1 of 2011) under the Stress Demand Case is illustrated in Figure 3.7.

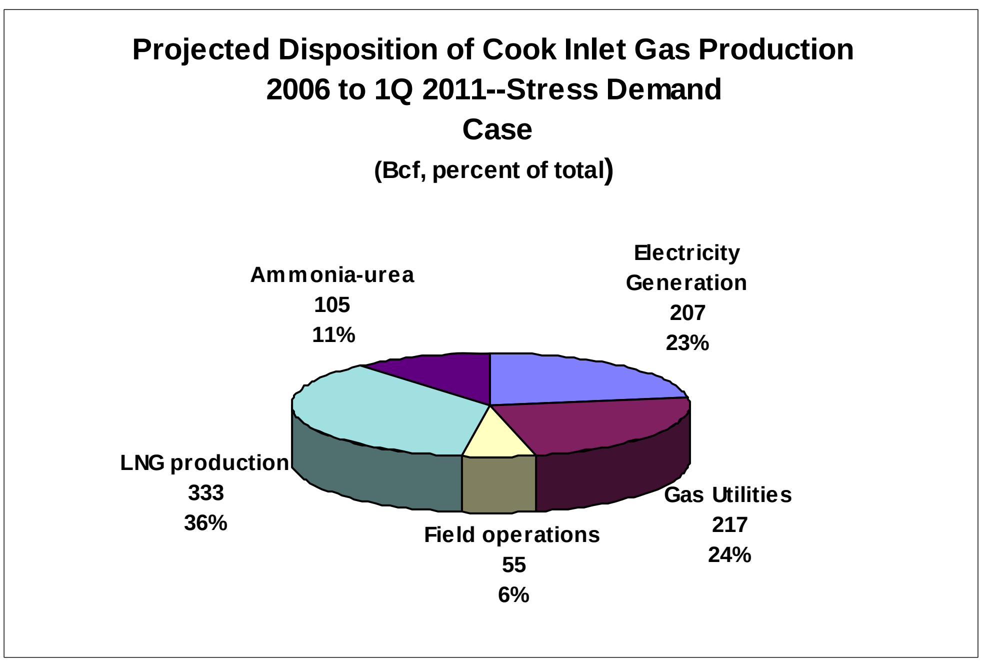

Figure 3.7

Source: Resource Decisions estimates.

4 SUPPLY ANALYSIS

4.1 INTRODUCTION

This section describes the natural gas supply situation in the Cook Inlet. Section 4.2 discusses the history of natural gas exploration and development in Cook Inlet. Section 4.3 describes the natural gas resources available. Finally, Section 4.4 presents the supply scenarios used in the supply-demand analysis.

4.2 NATURAL GAS EXPLORATION AND DEVELOPMENT IN THE COOK INLET

Several unique factors have influenced the development of natural gas resources in the Cook Inlet region. These factors include:

- The early discovery of large volumes of natural gas when exploring for oil;
- The consequent low natural gas prices due to market constraints; and
- The relatively high cost of drilling in Alaska.

Until very recently, these factors combined to limit exploration and development efforts for Cook Inlet natural gas. In the past decade, and especially during the past five years, the first two factors have reversed resulting in increased exploration and development efforts. In this section, the trends in Cook Inlet natural gas development are described and the reasons for their recent reversal are explained.

4.2.1 *Natural Gas Well Exploration and Development*

Natural gas was originally discovered in Cook Inlet in 1959 as a consequence of oil exploration. As seen on Table 4-1, which summarizes the oil and natural gas exploration history of Cook Inlet, by 1970, some 8 Tcf of recoverable reserves had already been discovered, accounting for all of the major gas fields in Cook Inlet.

Table 4-1: Summary of Cook Inlet Exploratory Gas Well Drilling and Discovery History

Time period	Number of gas exploratory wells drilled	Number of gas fields discovered	Success ratio (%)	Estimated ultimate recovery (Bcf)
1955-60	0	4	Infinite	2,569
1961-65	1	12	1200%	5,562
1966-70	4	3	75%	279
1971-75	4	2	50%	239
1976-80	8	3	38%	184
1981-85	2	0	0%	0
1986-90	3	0	0%	0
1991-95	1	1	100%	3
1996-00	3	3	100%	115
2001-05	22	5	23%	28
TOTAL	48	33	69%	8,979

Source: AOGCC data and Resource Decisions calculations.

Table 4-2 shows a more complete tally of the annual drilling effort in the Cook Inlet from 1959 through 2005, including the oil drilling efforts which resulted in the discovery of the vast majority of the known gas fields. The early emphasis on oil exploration can be seen in the totals box at the bottom of this table. In the 35 years from 1959 through 1994, only 22 natural gas exploration wells were drilled, as compared with more than ten times as many oil exploration wells. These 22 wells resulted in the discovery of the vast majority of the current natural gas reserves. The high reserves coupled with relative low prices stemming from an oversupplied market did not provide sufficient incentives to encourage exploration for new natural gas reserves until around 2000. In the past decade, natural gas exploration efforts have increased as the local market has slowly begun to require natural gas above and beyond the capacity of the existing natural gas developments. As a result, there has been a doubling of the number of pre-2000 natural gas exploration wells and development efforts of new and existing fields have increased significantly. Nonetheless, by all measures of total resource potential, Cook Inlet natural gas is still under explored.

Table 4-2: Cook Inlet Oil and Gas Exploration and Development History 1959-2005

	Exploration		Development		Total Wells Completed	
	Oil	Gas	Oil Dev	Gas Dev	Oil	Gas
1959	6	0	0	0	6	0
1960	5	0	0	2	5	2
1961	11	0	0	2	11	2
1962	14	0	0	1	14	1
1963	14	0	0	0	14	0
1964	6	1	0	0	6	1
1965	22	0	2	2	24	2
1966	37	2	2	2	39	4
1967	21	2	0	5	21	7
1968	19	0	1	0	20	0
1969	11	0	1	1	12	1
1970	7	0	0	0	7	0
1971	4	0	0	1	4	1
1972	4	0	1	0	5	0
1973	9	0	0	0	9	0
1974	3	0	0	0	3	0
1975	3	4	0	1	3	5
1976	4	1	1	2	5	3
1977	4	0	1	0	5	0
1978	3	2	0	3	3	5
1979	4	2	0	1	4	3
1980	1	3	0	1	1	4
1981	1	1	0	1	1	2
1982	3	1	0	0	3	1
1983	1	0	0	0	1	0
1984	4	0	0	0	4	0
1985	1	0	1	0	2	0
1986	0	1	0	1	0	2
1987	0	1	0	1	0	2
1988	1	0	0	0	1	0
1989	0	0	0	0	0	0
1990	2	1	1	0	3	1
1991	5	0	0	0	5	0
1992	1	0	0	1	1	1
1993	3	0	1	0	4	0
1994	0	0	0	0	0	0
1995	0	1	17	1	17	2
1996	0	1	4	1	4	2
1997	0	0	4	2	4	2
1998	0	2	1	0	1	2
1999	0	0	3	3	3	3
2000	0	0	6	2	6	2
2001	3	1	7	10	10	11
2002	1	4	5	7	6	11
2003	2	7	5	11	7	18

2004	0	6	0	19	0	25
2005	1	4	0	6	1	10
Total	**241**	**48**	**64**	**90**	**305**	**138**

Source: AOGCC data and Resource Decisions calculations.

Figure 4.1 below illustrates the Cook Inlet exploration history in terms of the number of exploration wells drilled, the ultimate recoverable reserves discovered, and the R/P ratios, which are a short hand method for approximating the number of years of remaining reserves.[31] As shown in Figure 4.1, when the R/P ratio approached 10 or less, there is an upswing in the number of exploration wells drilled looking for additional natural gas reserves. It is only since 2000 that the huge surplus of natural gas reserves have shrunk to the R/P levels typically seen in the Lower 48 States. Empirically, an R/P ratio of around 8 to 10 appears to coincide with sufficient tightening of supply and demand forces such that economic incentives are in place for natural gas exploration and development to be warranted.

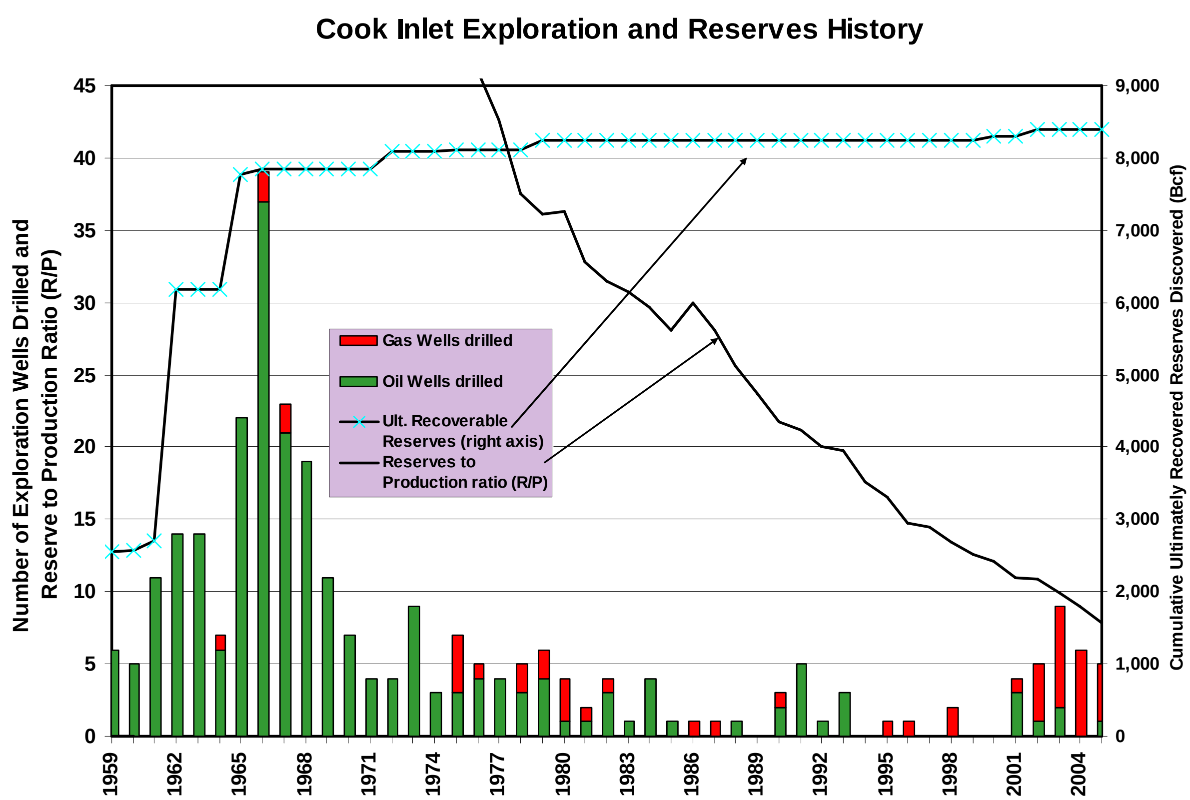

Figure 4.1

Sources: Wells: AOGCC well permit database (compiled by Resource Decisions); CI gas production: ADNR 2006, Table III.6; Reserves: ADNR, 2006.

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31 Note that reserve depletion is not linear. In reality, production will tail off such that natural gas production will be longer than the R/P ratio would suggest.

Figure 4.2 focuses on natural gas-specific exploration development efforts (omitting oil wells). It illustrates the historic relationships between the drilling of natural gas wells (both exploration and development) and price, and shows R/P ratio. It should be noted that prior to 2001, there was little or no demand for incremental natural gas production in Cook Inlet, as evidenced by the relatively low natural gas price. Figure 4.2 demonstrates the often overlooked development activities that are ongoing in the Cook Inlet as a result of the market demand for additional natural gas, demonstrated by the surge in natural gas development activities since 2001.

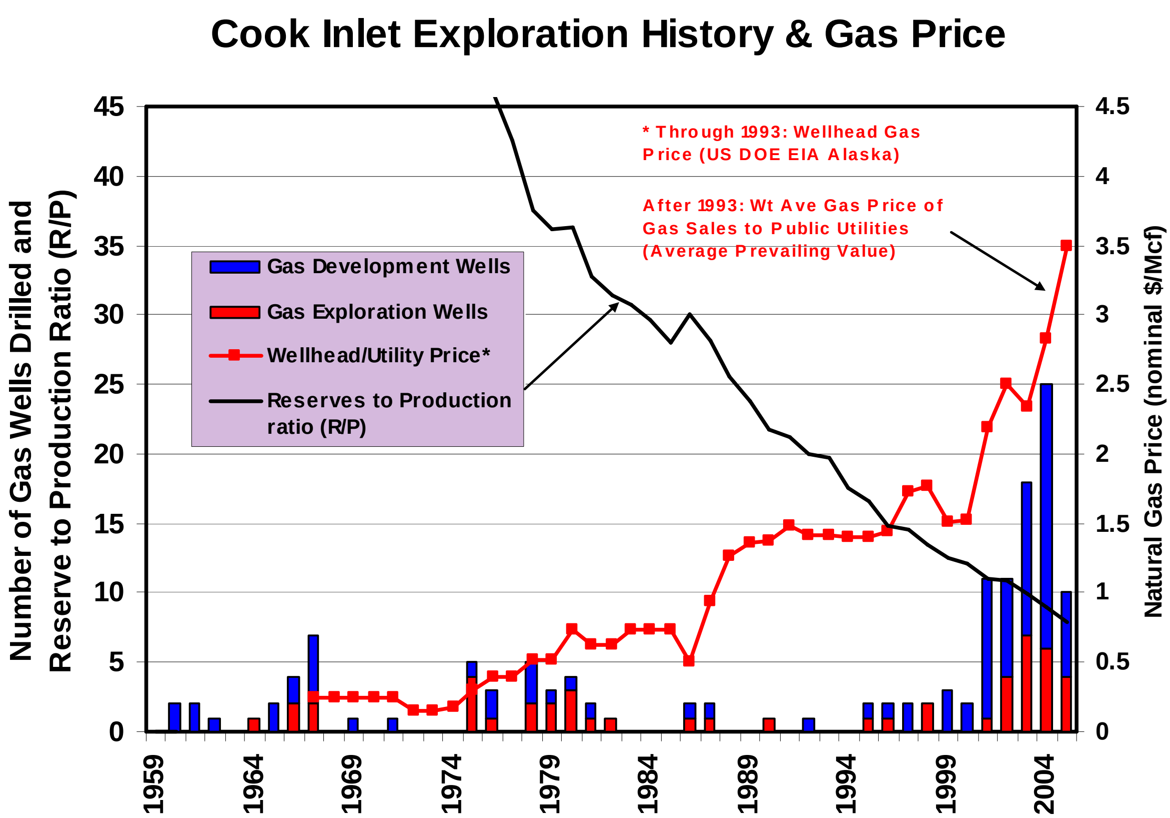

Figure 4.2

Sources: Wells: AOGCC well permit database (compiled by Resource Decisions); CI gas production: ADNR 2006, Table III.6; Reserves: ADNR, 2006.

Figure 4.3 focuses on the years from 1995 to 2005 during which time the local market began to require development of new reserves. Supply/demand dynamics resulted in increases in price, which attracted the capital necessary to develop new natural gas production and consequent increase in drilling activity. This figure shows that it is only since 2000 that the large surplus of natural gas disappeared and natural gas reserves began to approach the 8 to 10 R/P ratio typically seen in the Lower 48 States.

Natural gas exploration efforts can be understood as a function of geology, market and price. All three elements must be present for exploration to occur. Regional geology must indicate a reasonable expectation of exploration success. Market demand must indicate that the natural gas will be purchased. Prices must be sufficient to justify the cost of exploration and development efforts. Similarly, development of natural gas reserves is a function of these same variables. The existence of large quantities of overhanging reserves or low prices will prevent the creation of new reserves.

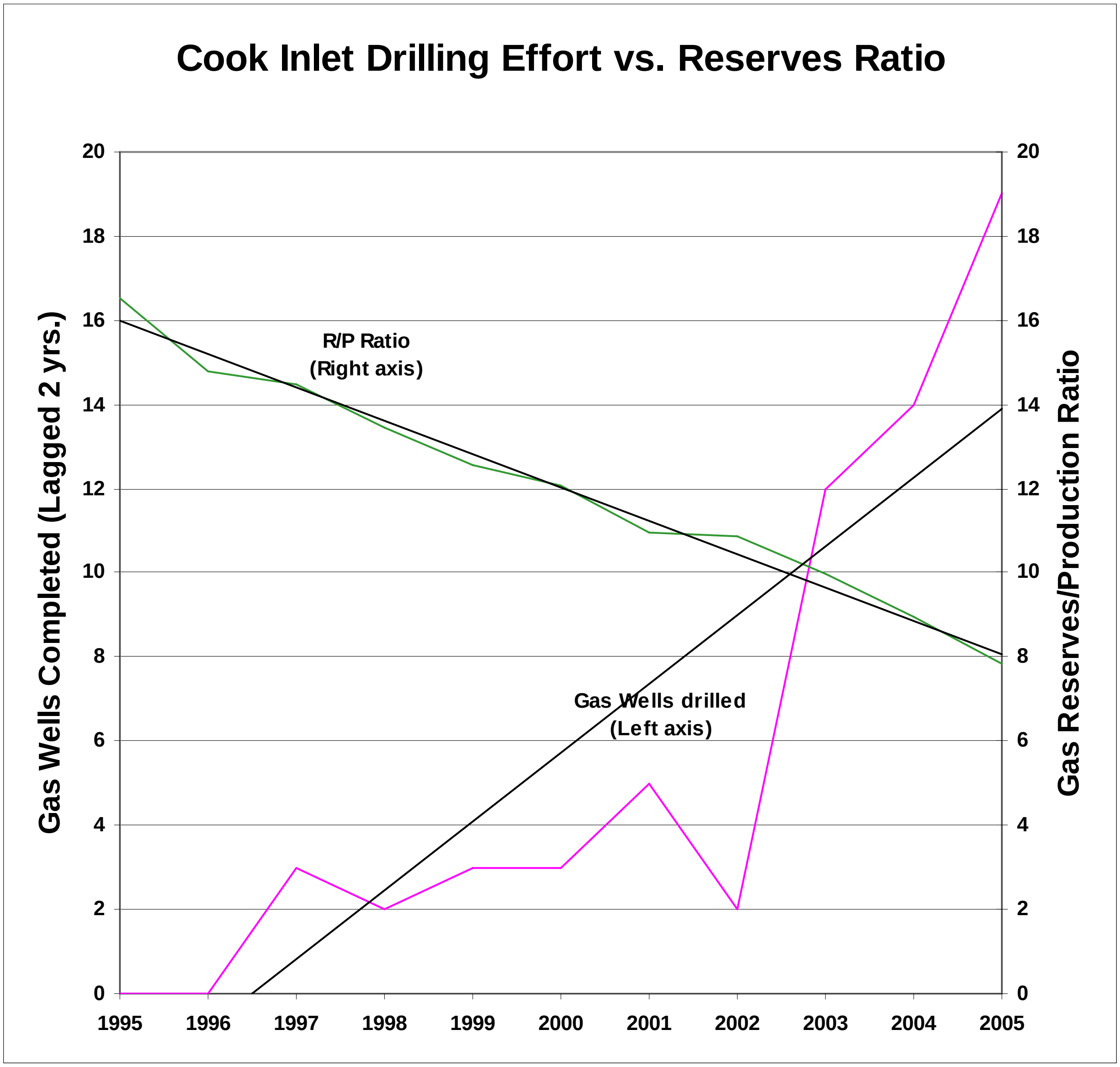

Figure 4.3

Sources: Wells: AOGCC well permit database (compiled by Resource Decisions); CI gas production: ADNR 2006, Table III.6; Reserves: ADNR, 2006.

4.2.2 *Natural Gas Price Influences on Exploration and Development*

Southcentral Alaska natural gas consumers have enjoyed the lowest natural gas prices in the United States due to the abundance of reserves prior to the past decade and relatively limited demand in the Southcentral Alaska market. Although prices have recently increased, they are still far below prices elsewhere in the United States. Figure 4.4 illustrates the relationship between Cook Inlet wellhead prices and Henry Hub prices. Cook Inlet prices have been consistently lower and less volatile than prices at Henry Hub. After decades of wellhead values below $2 per Mcf, Cook Inlet prices began to rise in 2000 when Enstar, the major natural gas utility in the region, in order to attract investment in gas exploration and development, began to index its utility gas rates to more competitive markets. Despite the gradual price increases, Cook Inlet prices currently remain well below Henry Hub prices.

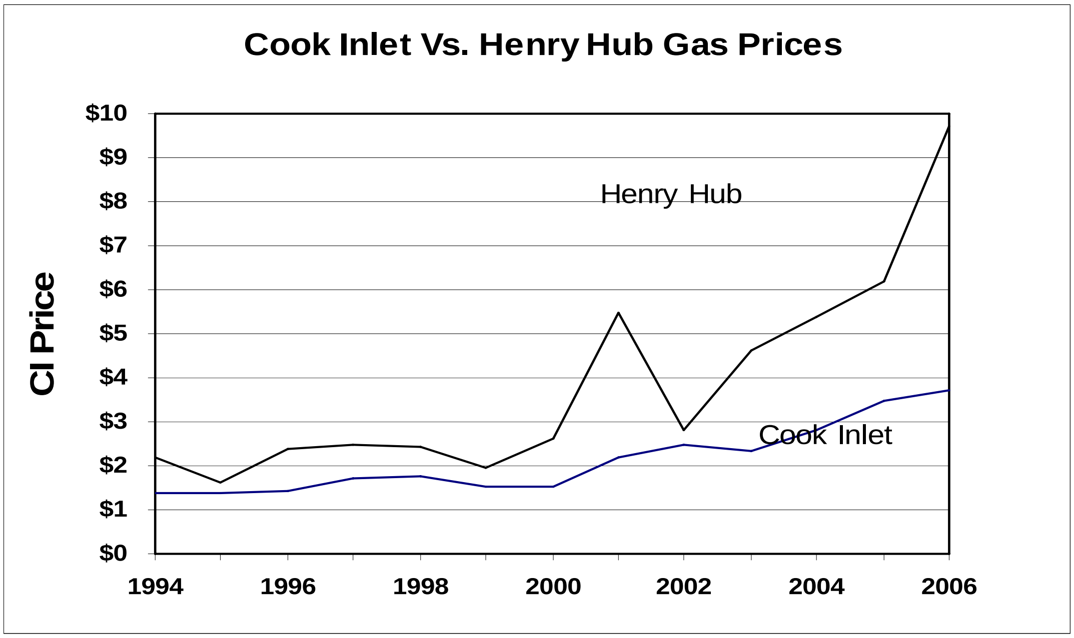

Figure 4.4

Source: Alaska Dept. of Revenue, 2006.[32]

As noted above, low natural gas prices and the lack of demand for incremental gas have served to reduce the incentive for Cook Inlet producers to invest in reserve replacement. Development incentives have been further depressed by the higher cost drilling in the Cook Inlet.

Figure 4.5 shows the affect that increasing gas prices have on the drilling of natural gas wells. In this figure, natural gas price trends (left scale) are compared with Cook Inlet drilling effort (right scale). This figure shows that as natural gas prices have trended upward over the past decade, so too has the level of gas drilling effort.

[32] ADOR, 2006. http://www.tax.state.ak.us/programs/oil/prices/prevailingvalue/cookinlet.asp.

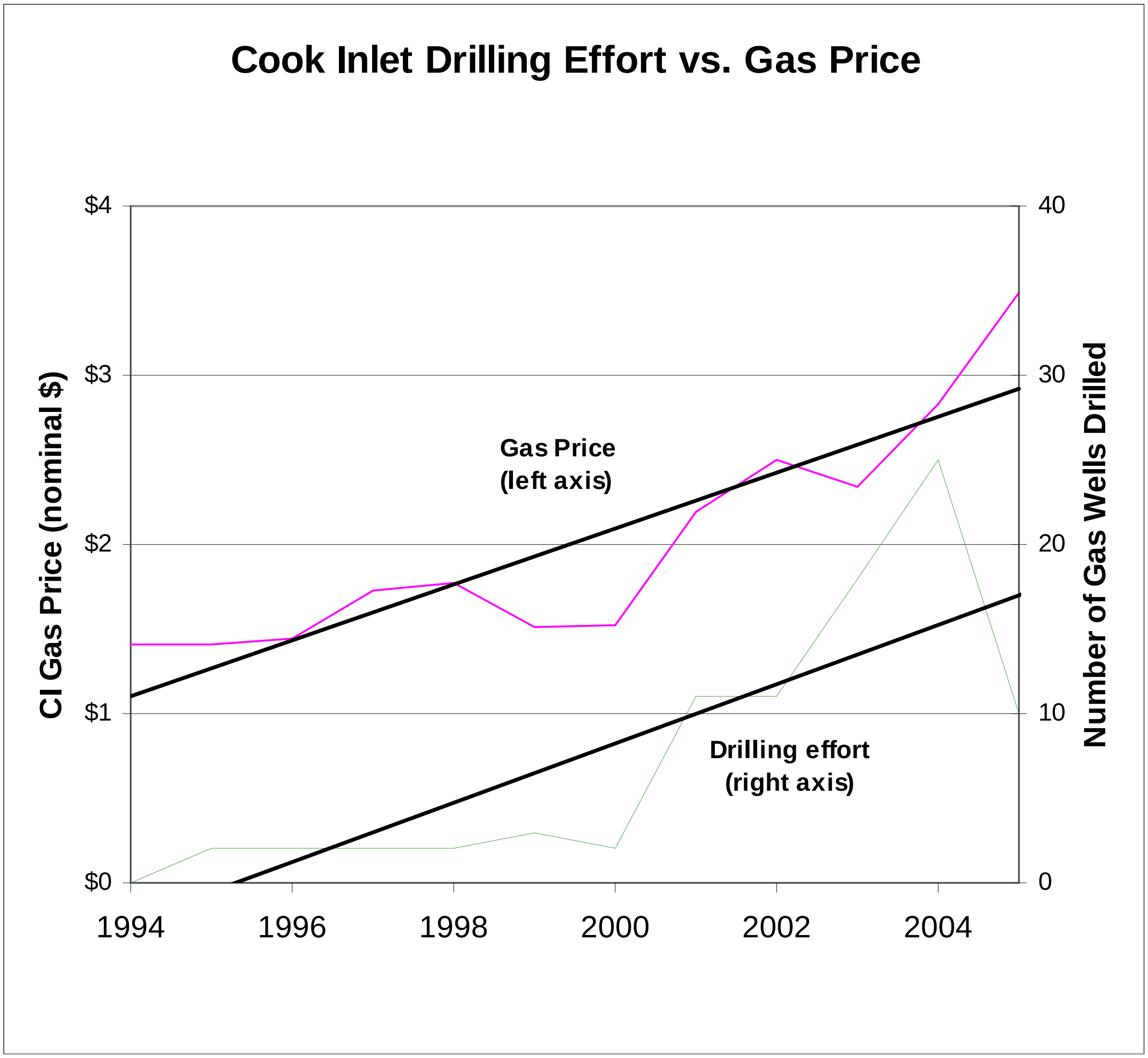

Figure 4.5

Sources: Prices: Alaska Dept. of Revenue, 2006; Drilling: well permit database; compiled by Resource Decisions.

Responding to the incentives of higher natural gas prices and new market demand, exploration efforts have increased markedly since 2000, with 22 natural gas exploration wells drilled in the 2000 to 2005 period, compared with 26 wells drilled during the previous 43 years. Development drilling has similarly increased. In the 2000 to 2005 period, Alaska Oil and Gas Conservation Commission statistics indicate that 55 development wells were drilled compared to only 12 natural gas development wells in the prior 20 years (1980 to 1999). The recent drilling efforts have yielded 5 new discoveries and an as yet undisclosed addition to reserves.[33]

[33] The Kasilof and West Fork Tyonek reserves have not yet been announced.

A recent MMS report[34] provides another perspective on the relationship between natural gas price and quantity of natural gas available in the Cook Inlet. Figure 4.6 is a supply curve based on the risked recoverable natural gas potential of the Alaska Outer Continental Shelf (OCS) available in the ***federal lease areas*** in the Cook Inlet region. The figure shows that using the mean resource curve (red), approximately 0.6 Tcf of natural gas resource can be expected to be discovered and economically developed from fields in the Cook Inlet area at a price around $4.50 per Mcf. If prices were to rise to $7 per Mcf, 1.0 Tcf would most likely be discovered and developed. This analysis demonstrates the positive price elasticity relationship between natural gas price and quantity available for supply. The timing of new reserve additions will be dependent upon market demand and the ability of Cook Inlet consumers to compete on prices sufficient to attract capital for exploration and development.

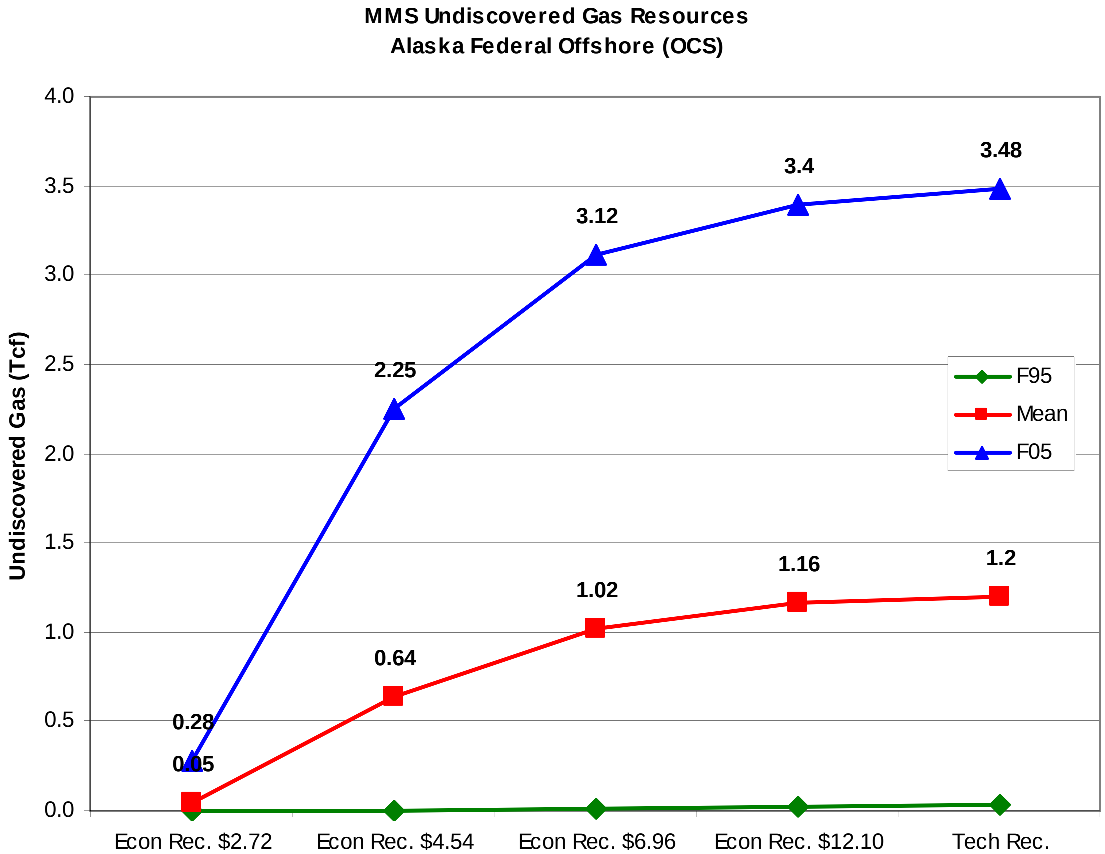

Figure 4.6

Note: F95 values have a 95% probability of being greater than or equal to those reported (conservative view). Mean values are the most likely values of gas potentially available. F05 values have a 5% probability of being greater than or equal to those reported (optimistic view).

Source: Compiled from MMS 2006, pages 7-10.

34 MMS 2006, pages 7-10.

4.3 COOK INLET NATURAL GAS RESOURCE POTENTIAL

4.3.1 *Resource Terminology*

Resources and reserves are generally described in terms of recoverable resources or recoverable reserves estimates which take into account the fact that physical and technological constraints mean only a portion of resources or reserves can be brought to the surface. The term "***reserves***" is used only for economically recoverable oil or natural gas that is known to exist in discovered fields. The term "***resources***" applies to oil and natural gas which may exist, but which have not yet been discovered.

The terms Probable, Possible and Speculative Resources are defined below, consistent with the PGC's definitions.

Probable Resources are that portion of potential resources which are:

> associated with known fields and are the most assured of potential supplies. Relatively large amounts of geologic and engineering information are available to aid in the estimation of resources existing in this category. Probable resources bridge the boundary between discovered and undiscovered resources. The discovered portion includes the supply from future extensions of existing pools in known productive reservoirs ... Although the pools containing this gas have been discovered, their extent has not been completely delineated by development drilling. Therefore, the existence and quantity of gas in the un-drilled area of the pool are as yet unconfirmed. The undiscovered part is expected to come from future new pool discoveries within existing fields either in reservoirs productive in the field or in shallower or deeper formations known to be productive elsewhere in the same geologic province or sub-province (PGC, 2004, page 318).

Possible Resources are less assured because they are not associated with known fields, but they are associated with productive formations in productive provinces.

Speculative Resources are the least assured supplies because they are expected in formations and provinces that have not been proven to be productive.

4.3.2 *Current Reserves*

The most recent publicly-available Cook Inlet reserves were estimated by ADNR in its 2006 Annual Report. As of December 31, 2005, ADNR estimated proved and probable reserves to be 1,648 Bcf. NSAI was contracted by the Applicants to prepare an independent evaluation of Cook Inlet reserves. Both the ADNR and NSAI reports used only publicly-available data. NSAI estimated both the proved and probable natural gas reserves to total 1,726 Bcf. Table 4-3 compares the ADNR and NSAI estimates of reserves. Both reserve estimates are in close agreement with each other (less than 5% difference in total). Small differences in reserve estimates are expected due to different interpretation of the data. The NSAI reserve estimate is used in subsequent sections of this report. Either reserve estimate would not materially alter the outcome of the analysis.

Table 4-3: Comparison of NSAI and ADNR Cook Inlet Reserve Estimates (Bcf)

FIELD	NSAI (1/1/2006 estimate)			ADNR 2006: Proved and Probable Reserves
	Proved Gas Reserves	Probable Reserves	Proved + Probable Gas Reserves	
Beaver Creek	39.6	1.5	41.1	36.4
Beluga River	473.3	36.1	509.4	539.4
Cannery Loop Unit	44.2	0.0	44.2	68.5
Kenai	98.0	75.2	173.2	140.4
McArthur River	89.4	85.5	174.9	110.2
Ninilchik	56.4	26.1	82.5	50.8
North Cook Inlet	350.3	259.9	610.2	320.8
All Other Fields	60.6	30.3	90.9	85.7
Subtotal Proved Reserves	1,211.8			1,352.2
Probable Reserves		514.6		296.2
TOTAL			1,726.4	1,648.4

Source: NSAI, January 2007, ADNR 2006.

4.3.3 *Cook Inlet Natural Gas*

As noted above, exploration for natural gas in the Cook Inlet has been fairly limited, with only 48 exploration wells drilled through 2005. The results of a major study effort by DOE produced a report entitled "Southcentral Alaska Natural Gas Study" (DOE, 2004). The DOE study concludes that 13 to 17 Tcf of conventionally recoverable resource remain in the Cook Inlet region. The DOE study notes that most of this natural gas will likely be found in stratigraphic or combination traps. It further observes that "no exploration has yet occurred for stratigraphic accumulations."[35]

The PGC estimates the probable, possible and speculative resources in the Cook Inlet region in its Alaska assessment.[36] The PGC estimates are summarized in Table 4-4 which presents three probability estimates for each of the three undiscovered resources categories. The same information is presented graphically in Figure 4.8. The probabilities refer to the likelihood that the resources to be discovered are at least as high as specified. The "**Minimum**" estimate

[35] DOE 2004, Executive Summary, page ix.

[36] PGC, 2004, pages 318-19.

implies "an approximately 100 percent probability exists that at least this much gas resource is present. Such conditions lead to a minimum (100 percent probability) estimate of the resource."[37] The "**Most Likely**" estimate indicates that "the probability is highest that these conditions prevail in the estimator's judgment and that the estimated quantity of gas resources would be present. Such conditions lead to the **most likely** estimate of the resource."[38] The "**Maximum**" estimate indicates the upper bound of potential gas resource, with a near zero probability that this resource level will be present.[39] It is also important to note that these estimates have already been discounted to reflect the probability that hydrocarbons traps and/or accumulations might not be present.[40]

Table 4-4: PGC Estimates of Potential Resources in the Cook Inlet Region (Bcf)

Cook Inlet-Susitna Basin Onshore (PGC Area P-707)			
	Probable	**Possible**	**Speculative**
Minimum	400	700	0
Most Likely	650	1,400	2,400
Maximum	1,600	2,800	4,800

Cook Inlet Basin Offshore (PGC Area P-995)			
	Probable	**Possible**	**Speculative**
Minimum	200	350	0
Most Likely	400	700	1,000
Maximum	800	1,400	2,400

Total Cook Inlet Onshore & Offshore			
	Probable	**Possible**	**Speculative**
Minimum	**600**	1,050	0
Most Likely	**1,050**	2,100	3,400
Maximum	2,400	4,200	7,200

Note: Highlighted values are used in the Supply Cases.
Source: PGC, 2004, page 266-267.

37 PGC, 2004, page 320.

38 Ibid.

39 Ibid.

40 Ibid.

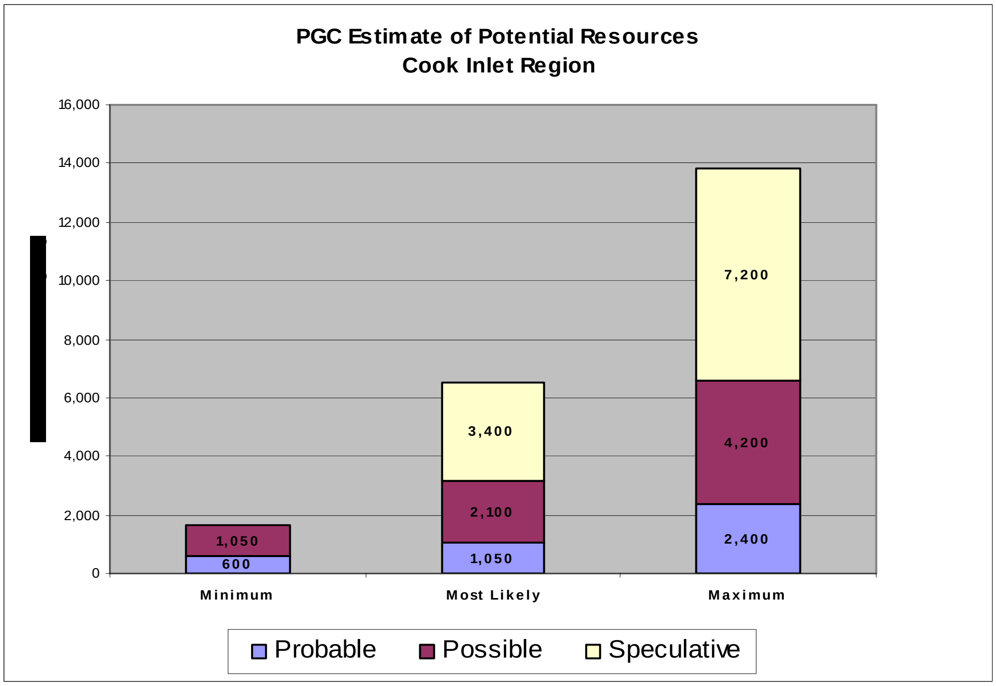

Figure 4.7

Source: PGC, 2004.

The Supply Cases analyzed in this report use the most conservative estimate of remaining reserves in Cook Inlet, namely the PGC's Minimum and Most Likely estimates of Probable resources. However, the resource potential is significantly greater. As shown in the PGC estimate, the range for onshore and offshore Probable and Possible resources is from 1,650 Bcf to 6,600 Bcf. When Speculative resources are considered, the total resource number rises to 13.8 Tcf.

The 2004 and 2006 DOE studies referenced earlier puts potential resources at 13 to 17 Tcf, in line with the Speculative resources of the PGC study. The 2006 DOE study states that the Cook Inlet is a "highly prospective natural gas basin," and that the "current price signals based on Henry Hub index prices are encouraging reserves growth and aggressive reservoir management to improve recovery."[41] Additional natural gas will likely be discovered, provided access to prospective areas is available and natural gas prices remain high enough to encourage exploration.

In all likelihood, the actual natural gas reserve picture for Cook Inlet is significantly more robust than the assumptions used in this report. However, for the sake of conservatism, this report has used the most certain resource category (probable) estimates to underscore the adequacy of natural gas supplies for Cook Inlet during the time frame of the export extension.

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[41] DOE 2006, pages 2 and 15.

4.3.4 *Other Gas Supplies Available to Cook Inlet*

At least five other sources of potential natural gas may be available to Southcentral Alaska: Susitna Basin and Lower Cook Inlet Basin dry gas, ANS natural gas, coalbed methane, and the Kenai LNG regas terminal.

Susitna Basin and Lower Cook Inlet Dry Gas: While information in Table 4-4 is for the Cook Inlet Basin only, additional resources may be found in the Susitna Basin and in Lower Cook Inlet, where limited drilling has occurred to date.[42] These resources are not included in the quantities shown in Table 4-4 because they are located far from existing infrastructure and any natural gas discoveries of this size range would be expensive to develop. It is anticipated that industry would seek to explore and develop other geologic structures closer to the present production area before developing the Lower Cook Inlet or the Susitna Basin for natural gas. Up to now, there has been little incentive for these resources to be explored, as natural gas supplies have been available at relatively low cost. These resources would be classified as "possible resources" under PGC nomenclature.

North Slope Gas Reserves: As noted in Section 2.2.3 of this report, delivery of ANS natural gas to Southcentral Alaska is a possibility for the future, but will not provide natural gas to Southcentral Alaska within the export authorization period studied in this report.

Coalbed Methane: As discussed in Section 2.2.2, coalbed methane has been shown to exist in the Matanuska Valley in Southcentral Alaska, but it is uncertain whether this gas will be economically feasible as an energy source. The Alaska State Geologist has noted that the potential for Nenana coal bed methane and conventional natural gas is positive because good reservoir rocks are associated with thick coal seams, and deep source and reservoir rocks and geothermal history are conducive for formation and entrapment of conventional natural gas. The Alaska State Geologist also noted that the Tertiary sedimentary section is time-equivalent to Cook Inlet's productive Kenai Group.[43]

Kenai LNG Regasification Terminal: As discussed in Section 2.2.2 of this report, the Kenai LNG plant has the potential for being converted into an LNG import and regasification facility at some point in the future after LNG production ceases. The large LNG storage tanks and pipeline infrastructure could be used to provide the utilities with another option for potential natural gas supply. Assuming that ANS natural gas is an economic option for Cook Inlet, the regasification option may be an economically viable means to bridge any supply gap that may develop before ANS gas is delivered to Southcentral Alaska. Continuation of LNG exports provides a means of economically preserving the plant infrastructure for future use.

[42] DOE 2004, page 11.

[43] Oil and Gas Potential in Interior Alaska, Robert F. Swenson, Deputy Director Alaska Department of Natural Resources Division Geological & Geophysical Surveys. http://www.dog.dnr.state.ak.us/oil.

4.4 SUPPLY CASE SUMMARY

As discussed previously, uncertainty with regard to supplies of Cook Inlet natural gas and other substitute energy sources to meet Southcentral Alaska's energy needs will be addressed by two scenarios — an Expected Supply Case and a Stress Supply Case. The Expected Supply Case is based on the most likely outcomes of uncertain supply issues, while the Stress Supply Case assumes that lower probability outcomes will result in lower supplies.

The Expected Supply Case and Stress Supply Case are described in Sections 4.4.1 and 4.4.2, respectively.

4.4.1 *Expected Supply Case*

Reserves: Under the Expected Supply Case, proven reserves estimated by NSAI are 1,212 Bcf plus the probable reserves of 514 Bcf as of January 1, 2006. Total reserves are estimated to be 1,726 Bcf. The NSAI reserve estimate is used for the Expected Supply Case because it is an independent estimate of Cook Inlet reserves based on publicly-available data.

Resources: Under the Expected Supply Case, it is assumed that the PGC Most Likely estimate of Probable onshore and offshore resources (1,050 Bcf) is added to the supply base. It is assumed that these resources will be discovered and developed into proven reserves when market conditions and prices warrant. For the sake of conservatism, no Possible or Speculative resources are included in this total.

4.4.2 *Stress Supply Case*

Reserves: Under the Stress Supply Case, total reserves estimated by NSAI are 1,726 Bcf as of January 1, 2006. The same reserve estimate is used in both the Stress and the Expected Supply Cases.

Resources: Under the Stress Supply Case, it is assumed that only the PGC Minimum (near 100% probability)[44] estimate of Probable onshore and offshore resources are available to supply the need for natural gas in the Cook Inlet during the extension period. It is assumed that 600 Bcf of resources will be discovered and developed into proven reserves when market conditions and prices warrant.

[44] PGC, 2004, page 320.

5 SOUTHCENTRAL ALASKA SUPPLY-DEMAND BALANCE

This section compares the results of the previous supply and demand analyses. In comparing supply and demand under the Expected Supply and Demand Cases and Stress Supply and Demand Cases, four scenarios are possible. Scenario I represents the most likely (Expected) situations with respect to natural gas supply and demand. Scenario IV combines Stress Supply with Stress Demand to represent a very unfavorable stress scenario. Both Scenarios II and III represent intermediate situations. Scenario II combines the Expected Demand Case and Stress Supply Case. Scenario III combines the Stress Demand Case with the Expected Supply Case. The amount of natural gas remaining and the final year R/P ratio at the end of the export authorization period under each of the four Scenarios is shown in Table 5-1.

The R/P ratios presented reflect the reduced demand when LNG exports cease as of March 31, 2011. The term "remaining resource" discussed in this section includes both ***reserves*** identified by NSAI as proven and probable reserves as of January 1, 2006 as well as the PGC probable ***resources***. As noted in the previous section, these probable resources are technically and economically recoverable and will be developed and made available as reserves when market demand and prices justify their need. The R/P ratios shown in Table 5-1 illustrate the remaining reserves and probable resources divided by the annual production volume after the LNG plant ceases operation.

Table 5-1: Cook Inlet Natural Gas Available to Southcentral Alaska at the end of the Export Application Period (2Q of 2011)

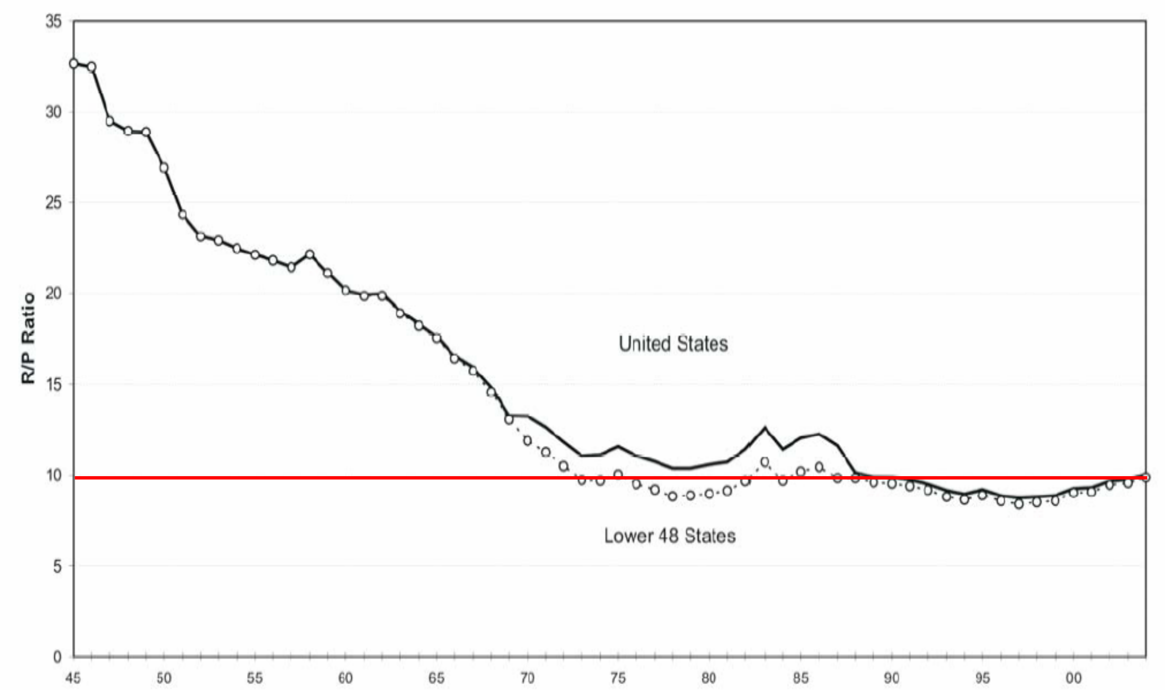
		Expected Supply	Stress Supply
Expected Demand		**Scenario I:**	**Scenario II:**
	Remaining Resource* (Bcf)	1,806	1,423
	R/P Ratio	22.8	17.9
Stress Demand		**Scenario III:**	**Scenario IV:**
	Remaining Resource* (Bcf)	1,702	1,320
	R/P Ratio	14.1	10.9

* "Remaining Resource" includes both proven and probable reserves and probable resources.

Source: Resource Decisions calculations.

As illustrated in Figure 5.1, in the United States (including Alaska) and in the Lower 48 States, the reserves to production ratio has remained relatively stable for the past 30 years.[45] This means that exploration and development activities have kept pace with production, adding new reserves when the R/P ratio has fallen into the 8-10 range. It is expected that in the Cook Inlet region probable resources identified in PGC 2004 will be developed into proven reserves at similar R/P ratios.

U.S. Reserves to Production Ratio for Wet Natural Gas



Sources: Annual reserves and production - American Petroleum Institute and American Gas Association (1945–1976) {33} and Energy Information Administration, Office of Oil and Gas (1977–2003){1-27}. Cumulative production: *U.S. Oil and Gas Reserves by Year of Field Discovery* (1977-1988).{34}

5.1 EXPECTED SUPPLY: SCENARIOS I AND III

Scenarios I and III both utilize the Expected Supply Case assumptions. Scenario I is based on the Expected Demand Case whereas Scenario III is based on the Stress Demand Case.

As shown in Table 5-1, by the end of the export authorization period (*i.e.*, March 31, 2011), estimated remaining reserves and Most Likely Probable Resources under Scenario I (Expected

45 Energy Information Administration Crude Oil, Natural Gas and Natural Gas Liquids Reserves 2005 Annual Report, page 16. The spread between the open dots and the solid line represents ANS natural gas. In the late 1960's, ANS natural gas was included in United States reserve estimates, By the mid-1980's, it was recognized that the natural gas was uneconomic and the reserves were deleted from such estimates.

Demand Case and Expected Supply Case) total 1,805 Bcf. The R/P ratio of 22.2 means that the then available reserves would last for more than 20 years at an annualized rate of consumption projected to occur at the end of the export authorization period. For Scenario III (Expected Supply Case and Stress Demand Case), the estimated remaining reserves are 1,701 Bcf by the end of the export authorization period. The R/P ratio indicates that 14 years of reserves would remain at the then current (Stress Demand Case) level of consumption.

5.2 STRESS SUPPLY: SCENARIO II AND SCENARIO IV

Scenarios II and IV both utilize the Stress Supply Case assumptions. Scenario II is based on the Expected Demand Case, whereas Scenario IV is based on the Stress Demand Case.

As shown in Table 5-1, the estimated remaining reserves for Scenario II total 1,422 Bcf at the end of year 2011. The R/P ratio would be more than 17.9. In Scenario IV (Stress Supply with Stress Demand), which represents the worst case combination, estimated remaining reserves total 1,319 Bcf at the end of the export authorization period. The R/P ratio would be almost 11. Thus, even under the unfavorable supply and demand assumptions in Scenario IV, considerable reserves would still remain at the end of the export authorization period.

It should be noted that the combination of assumptions in Scenario IV is unrealistically pessimistic. In reality, both the available natural gas supply and the quantity demanded are somewhat elastic and adapt to changing conditions. On the supply side, as Cook Inlet supplies become tighter, exploration and development efforts increase. On the demand side, as demand increases and supplies become tighter, prices rise and consumers respond by conserving or using natural gas more efficiently. Even using the pessimistic combination of assumptions embodied in Scenario IV, remaining natural gas reserves are sufficient to satisfy almost twelve more years of demand. This conclusion constitutes compelling evidence that the requested LNG export will not result in regional scarcity.

5.3 REGIONAL AVAILABILITY OF SUPPLIES TO MEET REGIONAL CONSUMPTION

Another way of assessing the adequacy of domestic supplies is by comparing regional expected demand with currently contractually obligated supplies. Table 5-2 shows the expected utility gas supply requirements in Southcentral Alaska for electricity and space heating and the projected demand that is presently under firm contract.

Table 5-2: Utility Projected Demand and Contracted Supplies 2007 to 1Q 2011

	Gas Heating			Electric Power			Heating + Power		
	Req'd	Contract	Contract %	Req'd	Contract	Contract %	Req'd	Contract	Contract %
2007	36.1	36.1	100%	36.8	36.8	100%	72.9	72.9	100%
2008	36.9	36.9	100%	36.9	36.9	100%	73.8	73.8	100%
2009	36.7	34.1	93%	35.3	35.3	100%	72.0	69.4	96%
2010	38.4	29.1	76%	33.1	33.1	100%	71.5	62.2	87%
1Q 2011	9.8	7.3	75%	7.5	7.5	100%	17.4	14.9	86%
Total	157.9	143.5	**91%**	149.6	149.6	**100%**	307.6	293.2	**95%**

Note: The requirements shown in Table 5-2 differ slightly from the demand projections elsewhere in this analysis as the utilities' projected requirements have been adjusted slightly in recent months. The current projections are 6.4 Bcf lower than the Expected Demand Case total for electricity and hearing demand for the same period.

Source: The requirements and uncontracted supplies were compiled by ConocoPhillips based upon the most recent 10-year forecasts from Enstar, ML&P and CEA.

As seen in Table 5-2, 100% of electricity requirements and 91% of the heating requirements are currently under firm contracts through 1Q of 2011.[46] This is a very strong indication that supplies for these users will be adequate throughout the requested export authorization period.

The heating supply category includes direct access or "market-out" customers. These large and small commercial customers have opted to contract directly with natural gas suppliers rather than receiving bundled supply and distribution services from a natural gas utility. By accepting the responsibility for contracting for their own supplies (with its attendant risks), these customers expect to save on their natural gas costs. Even this category has contract options for 98% of its overall requirements.

46 Enstar contracted with Marathon for the remaining volumes in their APL-5 contract. On December 29, 2006, the RCA, on a motion of reconsideration, denied this contract with a split vote of 3-2. Had the RCA accepted this contract, the market would have been filly contracted through the LNG export authorization period.

6 REGIONAL AND NATIONAL ECONOMIC IMPACT ANALYSIS AND ALTERNATIVES

The DOE decision regarding the extension of the ConocoPhillips and Marathon LNG export authorization could result in three outcomes:

- Extension of LNG export from the present termination date of March 31, 2009, for an additional two years to March 31, 2011. Export to Japan and/or one or more countries in the Pacific market.
- Continuation of LNG production with transport to the Lower 48 States instead of Japan.
- LNG plant closure and shut-in of associated natural gas feedstock production.

Sections 2 through 5 of this report have examined natural gas supply and demand from an Alaska perspective. Section 6.1 examines the regional socioeconomic impacts of LNG production. Section 6.2 shifts to national and international perspectives to examine the strategic importance of LNG export. Section 6.3 discusses the feasibility of delivering Kenai LNG to terminals located in the Lower 48 States. In Section 6.4, the impact of the LNG plant closure is discussed.

6.1 LOCAL/REGIONAL EFFECTS OF LNG PRODUCTION

Southcentral Alaska's 2004 population of 419,000 resided in 149,000 households. Approximately 42% of the population was employed and earned a combined $14.7 billion per year.[47] The average household income in 2004 was over $95,000, well above the national average.[48]

The Kenai Peninsula Borough (KPB), within which the Kenai LNG facility is located, had an estimated 2004 population of 51,000 residing in 19,000 households. The KPB houses about 12% of Southcentral Alaska's population, and 13% of its households. Approximately 18,000 KPB residents were employed for wage and salary income (35% of the total population) earning an annual personal income of $1.6 billion. The average annual income of KPB households was $82,000 which was 14% lower than the Southcentral Alaska regional average. Most of the population is concentrated in the Central Peninsula around the twin cities of Kenai and Soldotna where over 60% of the population resides. Other population centers include Homer to the south and Seward to the southeast.[49]

[47] ISER 2005, page 53-55.

[48] Ibid.

[49] Ibid.

6.1.1 *Regional Economic Base*

Petroleum, commercial fishing and tourism dominate the economy of the KPB region. Over 1.3 billion barrels of oil and 7.1 Tcf of natural gas have been produced since petroleum production began in the Cook Inlet region in 1959.[50] Oil production peaked in 1970, and with annual production currently at less than 9% of the peak year, the fields are well into their decline. In contrast, natural gas production continues to expand slowly, controlled by regional market demand. In 2003, oil and natural gas production directly employed about 6% of the workforce, but because these jobs are especially well-paid, they accounted for 12% of the wage and salary income in the KPB.[51]

The Kenai LNG facility is located on the shores of Cook Inlet north of the City of Kenai. The facility is one of three hydrocarbon processing installations in the area which includes the Tesoro refinery and the Agrium ammonia-urea plant. Together, these plants form the petroleum processing component of the economic base of the economy and employed 391 people in 2004.[52]

A second basic industry of the area is commercial fishing, which consists of fish harvesting and processing. Both activities are highly seasonal, and fluctuate dramatically from year to year and over longer cycles with the size of the salmon, bottom fish and shellfish harvests. Statistics on the number of workers engaged in fish harvesting are unavailable because most fishermen are independent proprietors, but data on fish processing illustrate the cyclical nature of the industry. In 2004, average annual fish processing employment was 626 people. Employment is concentrated in the summer months with July employment ten times the winter employment levels (KPB, 2005).[53]

Tourism is a significant basic industry due to the region's many parks, excellent fishing and spectacular scenery. This industry has grown in response to growth in the nearby population center of Anchorage where the majority of tourist visitors to the Peninsula originate. A significant portion of the jobs in the trade, service, and transportation sectors of the economy can be attributed to tourism.

6.1.2 *Regional Employment*

In 2004, non-agricultural wage and salary employment in the KPB totaled 18,000 jobs.[54] State and local government employment represents the largest component with a total of 4,600 jobs. The government sector, which has always been significant to the economy, has grown in size in recent years. Government employment, however, is subject to fluctuations based upon the

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[50] ADNR 2006, Tables III.3 and III.6.

[51] Alaska Dept. of Labor, 2004; Economic Trends, November 2004, page 5.

[52] Kenai Peninsula Borough, 2004 Situations and Prospects, page 192. http://www.borough.kenai.ak.us/Econ/2004/S&P%20PDF/S&P2004.pdf,

[53] Ibid.

[54] Ibid., page 68.

volatility of state petroleum revenues, which are the source of the majority of state and local revenues. The construction industry, largely dependent upon government spending and capital expenditures of the petroleum industry, is also important to the regional economy, and accounted for about 6% of the jobs in 2004.[55] This industry is also seasonal.

The economy can thus be characterized as small, with a few basic sectors depending largely on natural resource production and processing. The economic base tends to be cyclical, not only over seasons but also from year to year, as commodity prices and resource stocks fluctuate. A significant number of people living on the Kenai Peninsula commute to petroleum-related jobs on the North Slope, and a significant number of jobs in the private sector are dependent upon state and local government grants funded from petroleum revenues. Thus, the dependence of the economic base on a few resources is greater than the employment numbers alone would suggest.

6.1.3 *Role of LNG Facility in the Regional Economy*

The constant rate of production of the Applicants' LNG plant provides an important source of stability to the regional economy, helping to offset both seasonal and cyclical fluctuations in other basic activities. The LNG plant currently (2006) provides full-time employment for 58 Alaskans.[56] Although accounting for only 0.3% of the non-agricultural wage and salary employment in the KPB, the economic stimulus provided by the LNG plant operations have a disproportionate impact on the Borough economy due to the high tax revenues it contributes, the multiplier effects of its expenditures and the purchases of supplies, utilities and other goods from the regional economy.

Economic Impacts of LNG Plant Operations

The total income and employment added to the economy by the LNG plant includes a number of other direct activities of the facility as well as the multiplier effect from local purchases by employees. Other direct effects on the economy are associated with the local purchase of commodities and services by the plant in the normal course of operations and maintenance, the periodic purchases for repair, replacement and upgrading of facilities including construction employment, the ships which dock at the facility to transport the LNG, and local taxes paid by the plant.

The local purchases for the LNG plant are estimated to average $3 million annually. The purchases to support the LNG tanker (supplies, bunker fuel, etc.) add an additional $2 million in local purchases. Thus, a total of $5 million in local purchases is associated with LNG export.[57]

Local taxes paid by the LNG plant add significantly to local government revenues. In 2005, the plant owners paid approximately $0.9 million in annual property taxes to KPB. This is a

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55 Ibid.

56 Data supplied by the Applicants indicates that there are 41 employees, 17 contract worker FTE

57 Ibid.

significant proportion (3%) of the total Borough property tax revenues which currently total about $30 million in 2005.

These direct economic impacts of tax revenues, local purchases, and employment have indirect and induced effects as they reverberate through the economy. The leverage which direct economic factors have can be calculated through the use of "multipliers" which show how the local economy responds to employment, income and revenues from these "basic" or export activities. Table 6-1 summarizes the direct and indirect and induced effects on the KPB economy resulting from LNG plant operations. With the inclusion of these indirect and induced effects, the annual contribution of the LNG plant to the local economy is estimated to be $15.9 million in personal income, with 186 full-time equivalent (FTE) jobs.

Table 6-1: Economic Impacts on the KPB Economy Due to LNG Plant Operations

	LNG Plant Impacts					
	Local Employment (Full-Time)			Local Personal Income (Million 2005$)		
	Direct	Multiplier	Total	Direct	Multiplier	Total
Payroll	58	2.4	139	$7.3	1.5	$11.0
Local Purchases	16	1.4	22	$2.1	1.4	$2.9
Local Taxes	12	2	25	$1.2	1.6	$2.0
Subtotal Plant	86		186	$10.6		$15.9

Sources:
Multipliers: McDowell 2002, Table 2.
Payroll: Direct impacts—personal communication with plant operators.
Local Purchases: Direct income $4.8 million @ 44% value added per McDowell 2001 Tables 19 and 20. Direct employment 3.2 retail employees per $1 million output based on KPB, 2005.
Local Taxes: Estimated 60% value-added for government revenues yields $2 million in government payroll. Estimate 10 employees per $1 million payroll.

Upstream Economic Impacts

In addition to the LNG plant operations impacts discussed above, natural gas production for LNG feedstock also provides significant economic impacts on local employment, personal income and government revenues. Approximately 35% of the Cook Inlet natural gas production is used for LNG plant feedstock. Much of this production would likely be shut-in if the Applicants' export authorization is not granted. Therefore, it is relevant to consider the economic impacts of the share of Cook Inlet natural gas production operations that is attributable to LNG feedstock use.

Approximately $20.7 million in royalties were paid for natural gas feedstocks used by the LNG plant. Severance tax payments associated with LNG plant feed stocks added approximately $11 million to state revenues. In addition, state income tax payments from LNG manufacturing totaled approximately $16 million. Thus, in 2005, state tax revenues associated with LNG plant feedstocks totaled $47.7 million. Local property taxes and local employment effects are not included in these totals, nor are the indirect and induced effects associated with them.

6.2 STRATEGIC AND ECONOMIC SIGNIFICANCE OF LNG EXPORT

Thus far this report has focused on the importance of Cook Inlet natural gas from the Alaska perspective. This section shifts the focus from the local to national and international perspectives. The balance of trade benefits from continued LNG exports are small, but strategically important. The United States has maintained a substantially negative foreign balance of trade with Japan and most major Pacific Rim nations in recent years. Although no single export project can be expected to reverse the trade balance between the two nations, LNG export is significant in both its absolute and its symbolic significance in correcting the trade imbalance. The Kenai LNG sales contributed $387 million toward the trade balance with Japan in 2005.

6.3 KENAI LNG DELIVERY TO THE LOWER 48 STATES

Kenai LNG could conceivably be shipped to the Lower 48 States for domestic consumption. However, the economic conditions which would render LNG delivery to the Lower 48 States economically viable are quite improbable.

There are four operational LNG terminals in the Lower 48 States: (1) Everett, Massachusetts, (2) Cove Point, Maryland, (3) Elba Island, Georgia and (4) Lake Charles, Louisiana. A fifth LNG import terminal was completed in Puerto Rico in 2000. Additional import terminals are being considered or constructed on the Gulf Coast and the East Coast. On the West Coast of North America, an import terminal in Baja California, Mexico is currently under construction (the initial regasification plant is already contracted) through which regasified LNG may be shipped by pipeline to California and/or the Southwestern United States. In addition, Kitimat LNG Inc. has proposed to construct and operate an import terminal near the Port of Kitimat in British Columbia, Canada. However, the timing of the project is uncertain as is the availability of unsubscribed capacity. Other terminals on the West Coast are also being considered, but it is unlikely that any of these terminals will be completed within the export authorization period.

Despite the existence of these terminals, delivery of Kenai LNG to United States ports is economically infeasible for several reasons. As discussed earlier in this report, the main obstacle to domestic shipping of LNG is the Jones Act. In order to comply with the requirements of the Jones Act, the Applicants would need to acquire new tankers that are constructed in the United States and operated by crews that are United States citizens. These Jones Act requirements would greatly increase transportation costs. Even if the Applicants were able to receive exemptions from the Jones Act requirements, the distance from Kenai to the existing Gulf Coast and East Coast terminals is significantly longer than the distance to foreign Pacific Rim terminals. Although there may be one operational regasification terminal in Baja California, Mexico (Energía Costa Azul) that could supply gas to the United States West Coast, it is highly unlikely that there would be spare capacity to accept firm contracted LNG deliveries from Kenai.

However, should the barriers discussed above be overcome and an economic source of feed gas becomes available, LNG from the Kenai plant could be shipped to the Lower 48 States. Continued LNG exports would provide a means of preserving the plant infrastructure in the event it becomes possible to restart LNG exports

6.4 IMPACT OF LNG PLANT CLOSURE

The final alternative described in this section is that the LNG export extension application is denied and the LNG plant is shut-down as of March 31, 2009. This outcome would result in a number of detrimental impacts which are listed below.

1. Cessation of LNG export would result in the direct loss of 58 jobs and $7.3 million per year in personal income in the Kenai Peninsula Borough from LNG plant operations alone. After accounting for indirect and induced impacts, cessation of LNG export would result in the loss of 186 FTE jobs and $15.9 million in personal income for Kenai residents.
2. The immediate loss of upstream feedstock related direct jobs and personal income associated with any shut-in of wells and facilities that supply the LNG plant would be substantial and incremental to the losses of the LNG plant described above.
3. Feedstock related indirect and induced job and income losses would increase as well.
4. Shut-in of the LNG plant would result in the loss of at least $47.7 million per year in state revenues.
5. Eliminating a large, competitively priced gas market (LNG exports), could result in the shut-in of wells that provide feedstock to the LNG plant. If a portion of the wells are shut-in, the reserves and production capacity associated with these fields would be reduced.
6. Significant capital investment in reworking existing wells and the drilling of new wells would be required to partially restore production capacity and reserves that are lost when producing wells are shut-in for extended periods of time.
7. Eliminating the LNG export market immediately reduces the incentive to explore for more reserves and develop those reserves that are already available.
8. Shut-in of the LNG plant will remove an emergency source of gas for peak usage periods by gas utilities and electricity generators. The Kenai LNG plant has been used multiple times for this purpose in cold weather periods.
9. The ability to restart this plant for use as LNG export or as a regasification import terminal and retain the use of the LNG tankers will be much more difficult and costly if the plant is shut down or mothballed prematurely.
10. Over $300 million per year of Kenai LNG sales will no longer be available to help the United States balance of trade with its Pacific Rim trading partners.

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