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Alaska Natural Gas Pipeline: Employment Impacts Modeling

May 20, 2008

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Table of Contents

Tables

Figure

1. Introduction

Any natural gas pipeline built from the North Slope to market or tidewater will generate thousands of short-term construction jobs. When a pipeline or LNG project is up and running, hundreds of operations jobs will be created at the pipeline's compressor stations and other facilities.

Of greater importance is how the management of a pipeline will contribute to the State's long-term employment outlook. With a pipeline from the North Slope to market, the entire area north of the Brooks Range may be opened to exploration for natural gas. The estimated 137 trillion cubic feet of economically-recoverable natural gas on the North Slope holds the promise of better than 50 years of stable, high-wage employment for Alaskans.

This future, however, depends on the type of pipeline that is built and how it is operated. A pipeline that welcomes new shippers and offers reasonable tariffs will be more likely to encourage exploration and development work because newly-found gas can be shipped to market. Conversely, a pipeline that does not welcome new shippers or that does not offer reasonable tariffs may serve to discourage exploration and development work, and with it the creation of new jobs for Alaskans.

This report generates projections of the long- and short-term employment that may be generated by a pipeline built and operated by either TC Alaska or under the BP/ConocoPhillip's Denali proposal (the Producer Proposal or Producer project). Because Alaskans have expressed a long and continuing interest in an LNG project, this report also examines employment that could be generated by such a project.

The report is organized into the following sections:

- Section 2 provides an overview of the economic impact analysis. In particular, it discusses the IMPLAN model used to estimate potential employment impacts for the various projects
- Section 3 presents a discussion of exploration and development and well operations activities, associated costs and results of potential employment impacts
- Section 4 presents information on construction and operations costs and related employment estimates

- Section 5 provides discussion of the potential employment generated from expected state revenue from natural gas production

1.1 Summary of Findings

Examining the employment projections contained in this report leads to several conclusions:

1. The project proposed under the TC Alaska Application is expected to **generate more long-term exploration and development and well operations-related jobs, and to generate them sooner,** than either an LNG project or a Producer project. Exploration and development-related jobs could be realized as early as 2015 under the TC Alaska project scenario; these jobs may not be created until as late as 2026 under either a Producer project or LNG project.
2. **All three projects are projected to generate very large numbers of short-term construction jobs that will last only during the period from 2015 to 2020**. An LNG project is expected to generate more short-term construction jobs than an overland pipeline project.
3. **An LNG project is expected to offer greater numbers of project operations-related employment** due to the need to staff a large liquefaction facility in Prince William Sound.

2. Economic Impact Analysis

Construction and operation of the pipeline and associated facilities proposed in the TC Alaska Application, the conceptual LNG project, or as outlined in the Producer Proposal, and exploration and development of new natural gas resources, will have substantial effects on the Alaskan economy. These effects—typically referred to as the "economic impacts" of a project—can be measured by different metrics including employment, value added, income and taxes.

This report provides estimates of potential employment created by the projects proposed by TC Alaska and as could be generated from the conceptual LNG project or a Producer project.[1]

The objective of this analysis is to provide a comparison of potential employment impacts generated by the three projects; although this analysis provides some preliminary employment estimates, it is not intended to be a comprehensive assessment of employment effects within the State. As discussed in more detail below, the model results provide useful information to compare differences between the projects from an employment perspective.

2.1 Background on Economic Impact Analysis

The economic impacts of an infrastructure project are generally classified into three categories: Direct effects, indirect effects and induced effects.

- *Direct effects* are those realized from the expenditures of a project itself. In the analysis, this reflects the construction, operation and related activities associated with the projects.
- *Indirect effects* are the inter-industry effects that are linked to the direct effects. These are additional effects that are "stimulated" by the direct expenditures. For example, exploration and development activities indirectly generate jobs in Alaska's oil and gas support industries.
- *Induced effects* represent the response by households and employees spending their (additional) wages on goods and services in the local economy. The

[1] There is very limited publicly-available information on the project proposed by BP/ConocoPhillips Partnership. Because of the presumed similarities between the project proposed in the TC Alaska Application and the BP/ConocoPhillips Partnership project, many of the assumptions and costs provided by TC Alaska have been used as proxies for a Producer project.

additional spending further stimulates activity in the economy as industries respond to the increased spending, which creates additional jobs in the region.

The direct, indirect, and induced effects represent the total effects to the local economy. This process of stimulating the economy, spending and re-spending effects is called the "multiplier" effect. The multiplier effect continues until spending stops or "leaks" out of the economy (e.g., through savings or purchases of goods and services outside the region).

One method used to estimate the economic impacts of projects or policies involves the use of input-output (I-O) relationships or models. I-O models capture relationships among different industries within a region or economy, and through these relationships allows estimation of how changes in one industry can affect demand for other industries. The AGIA employment analysis applies a well-accepted model, IMPLAN (IMpact Analysis for PLANning), to estimate potential employment effects from the projects.

2.2 Estimation Approach: IMPLAN

IMPLAN is a well-accepted software package that can be used to calculate the economic impacts of projects or policies. IMPLAN was originally developed by the United States Department of Agriculture's Forest Service in cooperation with the Federal Emergency Management Agency and the United States Department of the Interior's Bureau of Land Management for land and resource management planning (IMPLAN, 2004). Currently, it is being managed by the Minnesota IMPLAN Group, Inc.

IMPLAN allows the user to build an input-output model tailored to examine the potential impacts of a proposed project on a specific region or state. The system is flexible and contains a database of more than 500 industrial sectors gathered from counties throughout the United States. ARCADIS developed an IMPLAN model for the State of Alaska to estimate potential employment effects of the different projects. Inputs to the model include engineering data (i.e., expenditures) related to the construction and operation of the three projects. These include, for example, cost estimates for project development, site preparation, construction of the gas treatment plant and liquefaction facility, and construction of the pipeline and compressor stations.

Where data was lacking, ARCADIS applied conservative assumptions (i.e., assumptions that tend to result in lower costs) to supplement the engineering data. Thus, the employment impact results presented herein are conservative.

It is important to note also that the expenditure estimates are preliminary given the uncertainties associated with such large and long-term projects; these uncertainties trickle down into the economic impact results generated by IMPLAN.

It is also important to consider the labor supply in Alaska. The IMPLAN model predicts the number of jobs that will be created in the State. However, it does not predict from where the labor supply will come. There is potentially an issue of a shortage of Alaska labor given the size of the project; such a shortage would minimize the multiplier effect predicted in the model (that is, if the labor supply is not sufficient to meet the demand for indirect and induced labor, labor markets outside of Alaska will react to fill those positions). However, with proper planning, such as state training programs to help prepare Alaskans to fill these jobs, the necessary skills could be developed to support a project of this magnitude.

Nonetheless, these preliminary results offer useful information related to the potential additional jobs that could be created from the projects. In addition, it is important to recognize that the model uncertainties impact all projects equally; therefore, evaluating the results on a relative basis provides a more useful comparison because the uncertainties "net out." [2]

[2] The IMPLAN model is widely used to evaluate the economic impacts of different projects or policies. Employment and other related economic impact estimates provide useful information for assessing and comparing the merits of different projects. The results suggest that the different projects are expected to generate a large number of jobs during different phases over time (construction, operations, exploration and development). Nonetheless, it is important to note some assumptions and limitations of the IMPLAN model and results.

An important assumption used in the modeling exercise is the assumption of *ceteris paribus*, or all other things being equal. It is an important assumption because it assumes that the there are no "shocks" to the Alaskan economy during the analysis period or that other potential influences were "held constant". This is a strong assumption given the duration of the analysis. In addition, the IMPLAN results are a direct function of the expenditures information for the projects. Variations or deviances in the costs over the duration will affect the employment projections.

Having noted the above assumptions/limitations, it is important to recognize that the results provide useful information, especially when the projected employment effects are compared on a relative basis.

3. Assessment of Potential Employment Generated from Exploration and Development Activities

This section discusses the potential exploration and development activities, costs and potential employment impacts for the different projects. To provide a more complete view of the types of employment that may be generated by any natural gas commercialization project, ARCADIS developed estimates of potential employment that may be generated as a result of natural gas exploration and development work on the North Slope, in addition to the construction-related employment (presented in Section 4 below).

As discussed in the Findings document, the development of a natural gas pipeline from the North Slope to market may open the entire North Slope basin to natural gas exploration and development. The number and duration of natural gas exploration and development jobs created on the North Slope will be directly tied to the availability of capacity in the pipeline, access to the pipeline by all who wish to commit natural gas to the pipeline, and by the tariffs charged to transport gas through the pipeline.

3.1 Exploration and Development Assumptions and Project Scenarios

The following assumptions were used to develop the exploration and development-related employment estimates. The assumptions for the TC Alaska project are based on the characteristics of their Application under AGIA; the LNG project assumptions are drawn from information presented by Gas Strategies Consulting on the engineering and commercial characteristics of LNG projects around the world. (Appendix I; Gas Strategies Consulting, 2008) The assumptions regarding the Producer project were developed after a review of the past operations of the producer-owned Trans-Alaska Pipeline System and other pipelines owned by BP and ConocoPhillips (see Chapter 5 of the Findings document for a discussion of these points).

- **The TC Alaska Scenario.** As presented in their Application, the TC Alaska project will be open to all shippers, will expand its capacity as demanded by shippers, and will offer a reasonable tariff structure for all shippers. These attributes are expected to encourage exploration and development work on the North Slope; this exploration and development will be timed so that new fields are brought online when the pipeline comes on-line and as capacity in the pipeline is available. New natural gas production will be brought on-line to the volumes available through engineering increment expansion up to 5.9 billion cubic feet per day (bcf/d).

- **The LNG Scenario.** Due to the market and operating structure of LNG projects, the conceptual LNG project is conceived to demand additional natural gas only at the time necessary to fulfill delivery contracts or to keep the project operating at its design capacity.
- **The Producer Proposal Scenario.** For the Producer Proposal scenario, it is modeled that the pipeline's capacity will not be expanded until such time as reserves on producer leases begin to decline in production and pipeline capacity becomes available.

3.2 Exploration and Development Employment Calculation Methodology

Calculating the potential employment from exploration and development under each of the three project scenarios requires (1) an estimation of how much natural gas will be required and when given the assumptions for each scenario, and (2) an understanding of the costs of exploration and development to bring new natural gas resources online. This information and data can then be used to generate employment projections for each project.

3.2.1 Exploration and Development, Production Timing

To determine how much natural gas will be required, and when it will be needed, this report draws upon the 4.5 bcf/d base case scenario developed for the Findings report. This base case assumes that natural gas will be produced from the Prudhoe Bay Unit at a rate of 3.0 bcf/d; from the Point Thomson Unit at a rate of 0.9 bdf/d; and from other currently-producing fields (e.g., Kuparuk and Endicott) at a rate of 0.6 bcf/d.

LNG and Producer Proposal Scenarios. For both the LNG and Producer Proposal scenarios, calculations suggest that additional natural gas volumes will be required in 2031 (State of Alaska, 2008). Assuming a five year lag between exploration and first gas from a new field, exploration work may commence as early as 2026.[3]

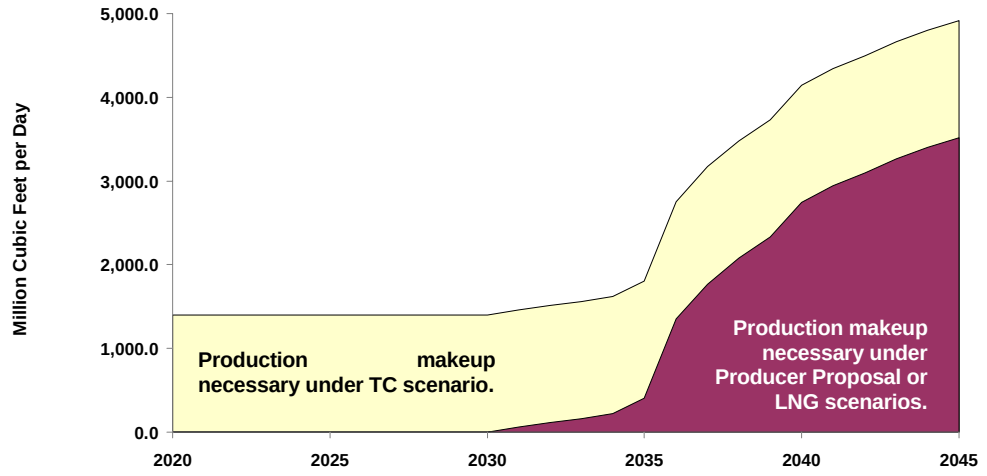
TC Alaska Scenario. Under the TC Alaska scenario, it is conceived that the pipeline's capacity may be expanded during the design and construction phases if sufficient additional gas is committed to the pipeline to justify the expansion cost. Because of the

[3] The assumptions made regarding the LNG project and the BP/ConocoPhillips Partnership result in identical outcomes: Exploration and development work is not expected to occur until such time as production from existing resources (Prudhoe Bay, other currently-producing field such as Endicott and Kuparuk, and the Point Thomson Unit) declines below the volumes necessary to maintain a flow rate of 4.5 bcf/d through the pipeline.

ability to increase capacity in engineering increments through the addition or upgrading of compressor stations, it is modeled that explorers would begin work as soon as a pipeline is approved so that pipeline capacity equal to 5.9 bcf/d are available coincident with pipeline startup in 2020.[4]

The differences in the volumes of additional natural gas that may be demanded by a TC Alaska operated pipeline or the BP/ConocoPhillips Partnership or LNG projects is shown in Figure 1. As discussed above, it is modeled that a TC Alaska pipeline will be expanded during the design and construction phase so that it is capable of accepting volumes up to 5.9 bcf/d; it is also modeled that any Producer Proposal project and the LNG project will not transport additional gas until such time as existing fields' natural gas production comes off plateau and begins to decline.

Figure 1. Production Timing of Project Scenarios



Estimating when exploration and development companies will begin to search for new natural gas resources on the North Slope is rife with difficulties and uncertainties; the further into the future that such estimations are made, the greater the difficulty in making those estimates and the greater the uncertainties associated with those them.

[4] This report assumes that the pipeline will be expanded as necessary to meet or exceed production volumes from new fields as they come online.

However, some reasonable assumptions can be made:

1. The first area to be explored and developed is expected to be the Foothills region. This area has been explored in the past, and is the focus of current work by at least one independent production company. It is located close to the route of any pipeline, and contains relatively dry, unassociated gas. The Foothills region will likely provide the first volumes of additional natural gas on the North Slope, and will also contribute over the long-term.
2. The National Petroleum Reserve-Alaska (NPR-A), located to the west of Prudhoe Bay, holds the promise of significant natural gas discoveries and developments in the mid- to long-term timeframes.
3. The Beaufort Sea and Chukchi Sea Outer Continental Shelf areas offer significant long-term potential. However, due to their distance from existing infrastructure, these regions are not expected to begin producing in the timeframe examined in this report.[5]

Given these assumptions, and drawing from information contained in the State of Alaska's "Outlook for Yet-to-Find North Slope Natural Gas Resources" (Outlook paper; State of Alaska, 2008), it is possible that natural gas from the Foothills may be produced as early as the date of pipeline startup under the TC Alaska Application. As these reserves come off their production plateau and the volumes of natural gas from them begins to decline, it is a logical extension that natural gas from fields in NPR-A and in the near-shore areas of the Beaufort Sea could be potentially brought on-line beginning in 2023 and 2024. In the longer-term, additional fields in the Foothills area could be brought on-line, followed by new fields in NPR-A. While this is a rather simplistic view of potential production of natural gas from North Slope reservoirs, it nonetheless allows for a comparison of the level and timing of employment impacts resulting from exploration and development in the basin.

3.3 Exploration and Development, Production Costs

Estimated costs for exploration and development in the Foothills, NPR-A and Beaufort Sea areas were obtained from the Outlook paper (State of Alaska, 2008: Tables 2 and 3).

[5] Near-shore fields located in the Beaufort OCS could produce gas in the near-term for shipment due to the presence of nearby infrastructure.

3.4 Exploration and Development, Employment[6]

Using cost and production information from the "Outlook" paper and its supporting data, employment projections were generated for the TC Alaska scenario and the Producer Proposal and LNG scenarios. The assumptions outlined in Section 3.1 above represent the extremes of potential exploration and development scenarios—reality will lie somewhere between the two. However, using the extreme cases allows for an evaluation of the magnitude of differences between the three scenarios and allows for an understanding of what is at stake for Alaska and Alaskans.

Table 1. Estimated Employment Generated by the TC Alaska Scenario Over the Duration of Potential Exploration and Development Timeframes

	Direct Employment	Indirect Employment
Foothills Exploration and Development, 2015-2023	8,900	1,900
NPRA Exploration and Development, 2019-2027	3,800	790
Beaufort Sea OCS Exploration and Development, 2018-2026	2,600	560
Foothills Exploration and Development, 2026-2041	35,500	7,500
NPRA Exploration and Development, 2035-2045	20,900	4,700
TOTAL EMPLOYMENT OVER 2015-2045 STUDY PERIOD	**71,700**	**15,500**

[6] The exploration and development employment calculation conceives that production facilities will be constructed in Alaska rather than built out of state and barged/trucked to the North Slope.

Table 2. Estimated Employment Generated under either the LNG or the BP/ConocoPhillips Partnership Scenarios Over the Duration of Potential Exploration and Development Timeframes [7]

	Direct Employment	Indirect Employment
Beaufort Sea OCS Exploration and Development, 2026-2034	2,600	560
NPRA Exploration and Development, 2029-2037	3,800	790
Foothills Exploration and Development, 2031-2039	8,900	1,900
Foothills Exploration and Development, 2034-2045	31,600	6,400
TOTAL EMPLOYMENT OVER 2015-2045 STUDY PERIOD	**46,900**	**9,700**

3.4.1 Potential Exploration and Development Employment, Analysis

Examination of the results presented in Tables 1 and 2 above suggests that there is a significant employment time lag incurred under either the LNG or the Producer Proposal scenarios. Because of the time it will take existing fields on the North Slope to drop off their production plateaus, there is a greater than 10 year time lag between when exploration and development work may start under the TC Alaska scenario and when it may start under the Producer Proposal or LNG scenarios. Note that the employment estimates presented above and developed using the IMPLAN model include both full-time and part-time workers.

The importance of this time lag between the two scenarios becomes evident when considering employment on the North Slope employment *in toto*. Production in existing fields is declining; as these fields reach exhaustion, they will no longer generate the levels of employment that they once did. However, exploration and development work on the North Slope spurred by an open and competitive basin will generate employment opportunities that may allow for displaced oil field workers to transition to jobs in natural gas fields.

[7] The difference seen between Tables 1 and 2 in the employment generated by Foothills Exploration and Development in the 2034-2045 period is due to some long-term Foothills-related work that extended past 2045 being 'cut off' in the calculations.

3.5 Field Operations

As new natural gas fields are developed and wells begin producing, field operations and well maintenance jobs are created. Operational expenditures for production wells are divided into fixed costs ($1 million per well per year (State of Alaska, 2008)), and variable costs that are field-specific and expressed in terms of dollars per million cubic feet of gas. The level of detail pursued in this report does not warrant calculating employment generated from variable cost expenditures. However, using the fixed operating cost per well, we have estimated the number of direct well operations jobs that may be generated under each scenario. They are presented below in Table 3.[8]

Table 3. Well Operations and Maintenance, Direct Employment per Year

	TC Alaska Scenario	BP/ConocoPhillips Partnership Scenario	LNG Scenario
2025	**310**	**0**	**0**
2030	**530**	**0**	**0**
2045	**1,600**	**800**	**800**

3.5.1 Analysis of Exploration and Development and Well Operations Employment Projections

Comparing the employment that may be generated from new exploration and development work on the North Slope spurred by construction of a natural gas pipeline, and the well operations and maintenance employment that will follow development, it is obvious that significantly greater numbers of jobs are likely to be made available sooner if an open access, expandable pipeline offering reasonable tariffs is constructed versus a project that may not offer these attributes.

[8] Because the figures contained in Table 3 do not include variable operating expenses, they are conservative and underestimate the numbers of jobs that will be created as fields come into production.

4. Construction and Operations Assessment

This section provides an assessment of construction and pipeline operations-related costs and employment impacts for the different projects.

4.1 Construction Costs

4.1.1 IMPLAN Input Data: TC Alaska Construction Costs

The major construction and related activities associated with the TC Alaska project include development and construction of a gas treatment plant (GTP), the pipeline and compression stations. The analysis assumes that these construction activities would begin in 2010 and end in 2020, with first gas delivery in 2020.

The model uses information from the TC Alaska Application to estimate the potential employment effects. Table 4 reproduces the cost information provided by TC Alaska for the development and execution phases for the GTP and Alaska section of the pipeline. TC Alaska also provided the State with a more detailed breakout of these costs that allowed the modeling team to isolate labor expenditures from material expenditures; this information is considered confidential, and cannot be provided here. However, this information was used to generate the employment impacts described below in Section 4.3

Due to the presumed similarities between the project proposed in the TC Alaska Application and in the Producer Proposal, the reader may assume that the construction-related employment generated by the development of a pipeline under the Producer Proposal are likely to be very similar to the project proposed in the TC Alaska Application.

Table 4. TC Alaska Construction Costs (2007 million $)

TC Alaska	2009[9]	2010	2011	2012	2013	2014	Phase Total
Development Phase							
GTP	8	14	25	25	25	12	**109**
Alaska Section	21	38	67	66	67	33	**292**
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**Phase Total**
Execution Phase							
GTP	62	985	1,20	2,15	1,26	15	**5,69**
Alaska Section	166	1,26	2,22	3,77	2,32	32	**9,79**

Source: TC Alaska correspondence dated 14 December 2008.

4.1.2 IMPLAN Input Data: LNG Construction

This section provides construction cost information for the conceptual LNG proposal. Because the LNG-based Applications submitted under AGIA were incomplete, the construction cost information presented below is drawn from the work of experts retained by the commissioners. Details of the methods used to generate these cost estimates is provided in Appendix F of the Findings.

The major construction and related activities associated with the LNG project involve the development and construction of a gas treatment plant, a pipeline from the North Slope to the vicinity of Valdez, and a liquefaction facility to be sited at tidewater in Prince William Sound. The analysis assumes that construction activities to develop these project components begins in 2009 and ends in 2021. The scheduling of these activities was presumed to roughly parallel the schedule presented by TC Alaska in their Application.

[9] The schedule presented in the TC Alaska correspondence has been advanced to account for the extensive review of the TC Alaska Application and the subsequent summer scheduling of the Legislature's special session and to account for schedule risk. We assume that should TC Alaska be issued a license under AGIA, their work will begin in 2009, not 2008 as presented in their Application.

Table 5. LNG Construction Costs (2007 million $)

LNG	2009	2010	2011	2012	2013	2014	Phase Total
Development Phase							
GTP	12	20	36	36	36	17	**157**
Alaska Section	27	47	83	83	83	40	**364**
LNG	32	55	99	99	99	47	**431**

	2014	2015	2016	2017	2018	2019	2020	2021	Phase Total
Execution Phase									
GTP	139	1,059	1,867	3,160	1,949	27			**8,200**
Alaska Section	207	1,576	2,777	4,701	2,899	40			**12,200**
LNG	3,074	23,361	28,930	30,738	34,354	30,738	28,930	687	**22,500**

4.2 Operation Costs

This section provides the operations costs for the projects.

4.2.1 IMPLAN Input Data: GTP, Pipeline and LNG Operations Costs

Operation of the TC Alaska or a Producer Proposal pipeline is estimated to begin in 2019; the LNG project is estimated to start shipments in 2020. The estimated operations costs for the GTP, pipeline, and liquefaction plant were communicated to ARCADIS by Energy Project Consultants, LLC, one of the commissioners' expert authorities. (Energy Project Consultants, 2008: Email communication dated April 18) Operations costs for the TC Alaska project and any pipeline constructed under the Producer Proposal are modeled to be equal.

Table 6. GTP, Pipeline and LNG Operating Costs (2007 million $)

	Per year	Total (2019-2045)
GTP	130	**3,510**
Pipeline	63	**1,701**
LNG	388	**10,476**

4.3 IMPLAN Construction and Operations Employment Results

This section provides the estimated employment resulting from construction of the TC Alaska, LNG, and the Producer Proposal projects. As discussed earlier, IMPLAN provides employment effects in terms of direct effects, indirect effects and induced effects. Note that the IMPLAN employment estimates include both full-time and part-time workers.

4.3.1 IMPLAN Construction Employment Results

The IMPLAN-generated results for construction-related employment are provided in Table 7 below. Estimated total direct, indirect, and induced employment effects and comparison of the three projects are shown.

Table 7. Construction Employment[10,11]

	TC Alaska Application	Producer Proposal	LNG Project
	Direct Employment	Direct Employment	Direct Employment
2009	600	600	750
2010	770	770	970
2011	970	970	1,300
2012	970	970	1,200
2013	970	970	1,200
2014	1,300	1,300	2,400
2015	5,200	5,200	6,000
2016	9,100	9,100	10,000
2017	15,000	15,000	16,000
2018	9,800	9,800	11,700
2019	620	620	3,600
2020	0	0	3,000
Total average construction employment per	**3,800**	**3,800**	**4,800**

IMPLAN model results

[10] It is thought that the GTP and LNG facilities will be constructed outside Alaska and then barged to either the North Slope or Prince William Sound. The cost estimates generated by the commissioners' technical teams for the GTP and LNG facilities were created on a unit basis, and as such do not include a detailed labor breakout that would allow for direct calculation of the number of jobs in Alaska necessary to prepare the installation sites and to install and commission the facilities for commercial operation. Using publicly available information on past infrastructure preparation and installation work on the North Slope and the conceptual schedules created by the technical team, site preparation and facility installation employment demands were estimated and added to the IMPLAN results for pipeline construction. It is estimated that 200 direct jobs will be created on the North Slope in each of the years 2016 and 2017 to create the infrastructure necessary for installation of the GTP. It is further estimated that 500 direct jobs will be created in each of the years 2018 and 2019 to install the GTP. The estimates for the number of jobs at the LNG facility site were constrained by the capacity of the project camp, which has been cited as 3,000; this information is drawn from the technical team reports. It is estimated that employment at the LNG site will ramp-up from a low of 500 direct jobs during camp construction and early site preparation activities to a sustained level of 3,000 direct jobs during the years 2018 and 2019 as the first LNG modules are sealifted to the site, installed, and readied for operation.

[11] Note that the data presented here are annualized and do not take into account the seasonality of some of the work that will be conducted during pipeline construction.

4.3.2 Summary of Construction Employment Projections

Examining the data in Table 7 makes it clear that the TC Alaska project, any Producer Proposal project, or the LNG project are all expected to generate a very significant numbers of short-term jobs during the peak of the construction period. All three projects are estimated to generate between 15,000 and 16,00 direct positions throughout the economy at the peak of construction.

4.3.3 IMPLAN Operations Employment Results

Table 8 provides the estimated direct employment impacts for the TC Alaska and LNG projects.

Table 8. Operations Employment, Per Year

	TC Alaska Application	Producer Proposal	LNG Project
	Direct Employment	Direct Employment	Direct Employment
GTP	150	150	150
Pipeline	70	70	70
LNG	--	--	440
Total	**220**	**220**	**660**

IMPLAN Results

4.3.4 Summary of Operating Employment Projections

The results indicate that the conceptual LNG project is expected to offer more long-term operations-related jobs than an overland pipeline route built and operated by either TC Alaska or the Producer Proposal sponsors. This is due to the need to staff the large liquefaction facility in Prince William Sound.

Due to the presumed similarity in design and operation of an overland pipeline route, it is assumed that the GTP and pipeline operations staffing would be equal between the TC Alaska project and any pipeline built under the Producer Proposal.

4.4 Employment Generated from State Revenue from Natural Gas Production

This section discusses the potential macro-level employment impacts of increased state government revenues that may be derived from the projects proposed by TC

Alaska, the conceptual LNG project and the BP/ConocoPhillips Partnership. As discussed above in Section 1.1, induced employment includes employment created by government spending of oil and gas revenues to the State. Induced employment includes employment by suppliers of goods to the government and Alaskan households as well as employment by other entities that support those suppliers.

When State revenue generated from oil and gas development is spent, it affects the broader regional economy—producing jobs and income in trade and services that may be far removed, in economic terms, from natural gas exploration and development activities. For example, when a natural gas discovery is developed, firms hired to drill the wells are direct beneficiaries, but the citizens of Alaska also benefit when the State government spends revenues from that natural gas discovery and development on new capital investment projects and new State government jobs that re-circulate money throughout the State's economy.

There are four major sources of State revenues anticipated from the proposed projects –State and Federal mineral lease revenues including royalties, property taxes, production severance taxes, and corporate income taxes. The employment and economic impact generated from these States revenues will depend on (1) how much revenue each project generates for the State, and (2) how the money is used by the government. The revenues will most likely be split along three pathways: the Alaska Permanent Fund, the State operating budget, and the State Capital Projects budget. For fields leased prior to 1980, at least one quarter (25 percent) of all mineral lease royalties received by the State must be deposited in the Permanent Fund. For fields leased after 1980, a 50 percent contribution to the Permanent Fund is required. In addition, a contribution of 0.5 percent of all royalties and bonuses must be deposited in the Public School Fund Trust. Of the remaining balance, it is assumed that approximately 95 percent will be spent through the State operating budget and the remainder allocated to the Capital Projects budget (McDowell Group, 2002).

4.5 Permanent Fund Dividend Impacts on Employment

It is anticipated that fully 25 percent of all royalty revenue generated from the proposed projects would be deposited in the Permanent Fund. These deposits will continue to generate dividends for Alaskan citizens and spending of those dividends will re-circulate in the economy with a significant share going to fund big-ticket purchases that produce jobs and income in the trade and service sectors (Goldsmith, 2002). The overall economic impact of the Permanent Fund program was addressed by the Institute for Social and Economic research in 1989 (ISER, 1989). The study found that

the dividend created approximately 13 jobs per million dollars generated. Another important macro-economic effect of the Permanent Fund is the stable cash flow it provides to rural Alaska.

4.6 State Operating Budget Impacts on Employment

Generally speaking, economists tend to split state and local government general operating budget expenditures into two groups: education and non-education (IMPLAN, 2004). Education tends to have relatively high direct employment multipliers because payroll is usually a school district's largest budget item. For example, in a recent analysis of the economic impacts of oil development in ANWR, the McDowell group reports that approximately 29 jobs are generated for every million dollars of state revenue expenditure while state spending on other operating budget items creates a total of approximately 20 jobs per million dollars.

4.7 Capital Projects Budget Impacts on Employment

Finally, while it is anticipated to be a small part of the overall induced impact from the proposed projects, the employment and economic effects of capital budget expenditures generally are considered separately from the other two streams because they tend to be isolated to impacts on sectors related to construction and infrastructure development. Economists tend to split capital budget expenditures into two separate groups: New highways and streets and new government facilities (IMPLAN, 2004). In their recent analysis, the McDowell Group estimates that approximately 14 jobs tend to be created from every million dollars spent on capital budget projects in Alaska.

4.8 Summary of State Revenue-generated Employment

Due to uncertainties surrounding how state revenue will be spent, the employment impacts generated by increased State revenues from natural gas production cannot be accurately estimated at this time. A pipeline project that sufficiently maximizes state revenues per cubic foot produced will generate the greatest employment impacts; conversely, a pipeline project that offers high tariffs will offer lower revenues, and hence lower government spending-related employment. Similar relationships can be seen in the link between state revenue and expansion and open access.

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