

CHAPTER 6. OTHER ECONOMIC ACTIVITIES

A changing climate could potentially affect all sectors of Alaska's economy (Box 6-1 gives the mission statement for the sector). Some of Alaska's major economic activities, such as tourism and shipping, are highly dependent on weather conditions and/or the natural environment, both of which can be significantly affected by climate change. Some activities, such as mining and oil and gas exploration, rely on engineered infrastructure that is also potentially affected by climate, weather, and underlying environmental conditions. For example, permafrost thaw could threaten the stability of oil pipelines in Alaska, and shorter winters would reduce the utility of seasonal ice roads for off-road navigation.

Box 6-1. Other Economic Activities Mission Statement

To identify adaptive actions and options that contribute to the ability of sectors of the Alaska economy not directly supported by living systems (e.g., fishing) to adapt to the effects of climate change and ensure the sustainability of a robust Alaskan economy based on the responsible development of its natural resources.

At the same time, a changing climate could create economic development opportunities in existing and new sectors. This chapter focuses on the impacts and vulnerabilities facing sectors of the Alaska economy that are not dependent on living systems. The recommendations are designed to assist these economic sectors in adjusting to a changing climate to ensure a continued healthy economy for Alaska. Measures to adapt the economy to a changing climate may also contribute to building resiliency in Alaska's economy to other external factors.

Overview of Economic Activities Options		
	Option Name	Level of Support
EA-1	Assess Arctic Capability Needs	Unanimous
EA-2	Develop Alaskan Economic Scenarios	Unanimous
EA-3	Improve Availability of Data	Unanimous

Impacts, Vulnerabilities, and Opportunities

Climate change could have numerous effects on the Alaska economy. Potential vulnerabilities, impacts, and opportunities within different sectors, as a result of climate change, include the following:

Oil & Gas: Oil and gas is the leading sector in the Alaska economy, generating more than 85% of State revenue from royalties and taxes as well as significant employment. Alaska's economic future will depend largely on maintaining robust oil and gas production. With thawing permafrost and changing weather patterns, oil and gas operations are likely to see impacts both on- and off-shore. This includes potential impacts to infrastructure such as pipelines, ice roads, and waste pits. Already, shorter and warmer winters have resulted

in reduced operation windows for exploration and development, and warmer summers have resulted in reduced efficiency of gas compression and reinjection. Engineering focused on proactively addressing challenges of the changing climate is already essential. Decreased sea ice creates the potential for impacts to North Slope oil fields. Increased local, national, and global energy demands may increase the need for and economic viability of oil and gas operations.

Mining: Mining is another important sector of Alaska's natural resource based economy (not dependent on living systems), especially in remote rural areas of the state where employment opportunities are limited. Mining is expected to face similar challenges and opportunities as the oil and gas sector. Currently, exposed permafrost and warmer temperatures have resulted in increased erosion and less stability in mining sites. Engineering challenges will arise as thawing permafrost and other climatic conditions affect existing and planned infrastructure and transportation related to mining. The same climate changes, however, may also highlight new mining opportunities and allow expanded seasons for exploration, development, and operations.

Tourism and Recreation: Tourism and recreation are also important industries in Alaska and are tied closely to the diversity and condition of the natural environment. Climate change may impact many of the natural resources that attract tourists to Alaska. Increased temperatures could lead to changes in seasons that support various activities (e.g., skiing, hiking, camping). Some regions of the state may experience increases in summer tourists due to a longer and warmer season. This could create more seasonal job opportunities in areas and times where they do not currently exist. Less ice in the Arctic Ocean may mean increased cruise and land-based tourism opportunities throughout the region, with requirements for additional infrastructure to support the industry.

Ocean Transportation: Less ice in the Arctic Ocean will have significant impacts for trade and ocean transportation for all countries in the Arctic region. New shipping lanes are likely to open and be available for longer periods, and there would be increased access to the Ocean's natural resources, such as fish, oil and gas, and minerals. Increased ocean transportation and activity will require increased vigilance for safety and environmental protection (e.g., oil spills) and may also lead to more disputes around boundaries and ownership of natural resources.

Boundaries and Ownership: Changes in sea ice and glaciers, with potential concomitant erosion and sedimentation including river erosion and sedimentation, can result in changes in boundaries and issues about ownership in the Arctic. Receding glaciers will likely result in post-glacial rebound of lands previously submerged or covered by glaciers. Boundary and ownership disputes can affect a number of sectors, such as mining, oil and gas, tourism and recreation, fishing as well as locations of boroughs, municipalities, and villages.

Energy Production and Demand: Activities that address the needs of Alaskans for affordable energy are likely to be significantly affected by climate change. Changes in weather will affect how Alaskans generate energy and when they demand energy, with potential decreased demands in winter and increased demands in summer (for cooling). In addition, global demands and federal and state regulations could affect oil, gas, and coal operations. While global energy demand is expected to increase, requirements to reduce greenhouse gas emissions may affect the sources and costs of energy supplied, with increased interest in and opportunities for the use of alternative and renewable sources of energy.

Economic Activities Adaptation Strategy

The recommendations in this sector focus on broad issues relevant to the Alaska economy as a whole, rather than actions designed to address the individual concerns of a particular economic group or industry. Box 6-2 summarizes the EA recommendations. These recommendations represent high priority actions based on a number of criteria, including:

- **Significance:** the importance of the option to the State's economy, including tangible and intangible variables such as social justice and the viability of small communities.
- **Benefits and effectiveness:** consideration of the vulnerability of the economy if the option is not carried out and whether benefits are long- or short-term.
- **Costs:** expenses up-front and over time.
- **Feasibility:** ease and possibilities of implementing the option, including speed of implementation.
- **Timing of impact:** assessment of when the option must be undertaken (e.g., in response to immediate impacts or longer term). Shorter term needs were given higher priority.
- **Adaptive capacity:** ability of the system (e.g., economic sectors) to cope with the consequences of climate change.

Box 6-2. Overview of EA TWG Adaptation Options

EA-1: Evaluate Capability Needs for Potential Expansion of Arctic Economic Activities

This option recommends that the State recognize and address the potential for increased Arctic economic activities and identify gaps in infrastructure and the ability to provide an adequate presence in the Arctic coastal region to protect environmental resources, human health, and safety.

EA-2: Develop and Evaluate Scenarios for the Alaskan Economy

Components of the Alaska economy will experience varying impacts due to potential effects of climate change. An assessment of economic strengths, weaknesses, opportunities, and threats by sector is needed to better understand current and potential future components of the economy. This understanding will aid state agencies and other stakeholders in identifying and acting on optimum adaptive strategies and policies to help address future conditions. This option recommends conducting and managing a project to develop and evaluate possible economic scenarios for the State, based on potential climate change effects.

EA-3: Improve Availability of Mapping, Surveying, Charting, and Imagery Data

Accurate, timely information about the distribution and magnitude of changes is needed to better address economic challenges and opportunities. This option recommends improving the availability of data, specifically real-time mapping, digital elevation model, and imagery, to better track and understand the impacts of climate change. This option would build on the work of the Statewide Digital Mapping Initiative and aid in transitioning between locations at the water-land interface.

Assisting the Alaska economy to adapt to climate change requires meeting several broad needs: 1) improved understanding of the current Alaskan economy and identification of opportunities and risks for the future, 2) better data and improved access to data for decision-making, and 3) enhanced capabilities to respond to

climate change in specific environments that may experience significant changes in economic activities (such as the Arctic). The three EA options address these needs.

The three options are focused on state agency activities in conjunction with other parties to gather and analyze additional information to better understand potential economic challenges and opportunities from climate change. The rationale is that climate change adaptation actions and options specific to individual sectors are best addressed by industries within those sectors (as they are currently doing). State and federal agencies can assist by (1) improving available data about physical changes in the landscape (option EA-3), and (2) developing a deeper understanding of the potential impacts of climate change to the current economy how to maintain a robust economy in future climatic conditions (option EA-2). Option EA-3 calls for significant investments in new data collection. Option EA-2 requires funding to conduct additional scenario development and analyses. Option EA-1 is an assessment of likely needed state and federal support for safety and environmental protections as economic development occurs in the Arctic. Funding is needed to assess and evaluate these needs. Characteristics of the options are described in the table below.

Option	Option name	Type of option										Implementation				
		Coordination				Data collection (research, monitoring, observation, etc.)	Regulatory/programmatic change or addition	Assessment, evaluation, or planning	Capacity building , education, outreach	Direct or indirect financial assistance (e.g., tax incentives)	Capital improvements	Requires new institutions/government agency	Requires new staffing	Requires funding	Requires new legislative authority	Lead role for state government
State interagency coordination	Community response and assistance	Data management	Access to data and "knowledge" sharing													
EA-1	Assess Arctic Capability Needs	✓	✓	✓	✓	✓	✓	✓			✓		✓		✓	
EA-2	Develop Alaskan Economic Scenarios	✓	✓	✓	✓	✓		✓					✓		✓	
EA-3	Improve Availability of Data	✓		✓	✓	✓					✓		✓		✓	

In addition to the recommendations presented in this chapter, there is also a need for better coordination of knowledge-sharing relative to Arctic activities, including participation in meetings and development of policies. This option is presented in Chapter 8, "Common Themes," as Common Themes Option #1, establishment of an *Alaska Climate Change Knowledge Network*. Research will also be a critical part of these recommendations, as described in Box 6-3. The recommendations are also intended to build on existing public and private sector programs and activities as described in Box 6-4. Both these boxes appear at the end of this chapter.

Description of Other Economic Activities Recommendations

This section describes the options recommended for the Other Economic Activities sector.

EA-1 Evaluate Capability Needs for Potential Expansion of Arctic Economic Activities

Many scientific models predict that Arctic sea ice will continue to retreat, creating longer ice-free summers along the Alaska Arctic coast. This will result in growth of maritime economic activities in the region such as shipping, mining, fishing, tourism, and oil & gas exploration. The oil & gas industry is estimated to have the greatest potential for substantial economic growth in the Arctic. To support increased economic activity, ports, infrastructure, and other facilities are expected to develop as warming temperatures result in longer seasonal access. This will bring increased ship traffic and a greater human presence, not only creating job and business opportunities, but also requiring investments to ensure essential government functions such as safety, security, and environmental protection are provided. Potential gaps may exist in emergency response and regulatory oversight capabilities. This option recommends that the potential for increased Arctic economic activities be recognized as well as the need to address potential gaps in infrastructure and the ability to protect environmental resources, human health, and safety.

To implement this option, the EA TWG recommends that a Capital Improvement Project (CIP), managed by the Alaska Department of Transportation and Public Facilities (AKDOT&PF) and involving other stakeholders, be undertaken to plan for and collaboratively identify the infrastructure and capabilities required to address response and regulatory needs concerning the Arctic maritime industry. Implementing this option will provide the State with needed information to plan for services and capabilities to support future economic growth, including better positioning the state to compete for federal funding. Moreover, extending government programs into the Arctic is resource intensive. Tremendous opportunities exist to share costs, facilities, equipment, and responsibilities, thus increasing efficiency and strengthening interagency partnerships. An adequate understanding of the capabilities available is needed before these opportunities can be fully explored.

EA-2 Develop and Evaluate Scenarios for the Alaskan Economy

Components of the Alaska economy could experience varying impacts due to potential effects of climate change. Better understanding the potential range of economic impacts based on possible climate changes, as well as other ancillary effects such as growth or loss of jobs, is needed to anticipate challenges and opportunities. This understanding will aid state agencies and other stakeholders in identifying and acting on optimum adaptive strategies and policies to help address future conditions.

This option recommends that Alaska provide funding to conduct and manage a project that develops and evaluates economic scenarios for Alaska, based on potential climate change effects. Scenarios will be developed that take current variables and conditions (e.g., socio-economic-demographic) as a starting point and examine the effects of various future conditions, such as changes in climate, land use, energy use, water availability, regulations, demographics. Future economic scenarios will examine both challenges in terms of economic variables such as possible job losses, economic investments staying or leaving Alaska, sustainability, etc. and opportunities that may result in both existing and new sectors. The scenarios developed would provide potential ways to maintain a robust economy based on responsible natural resource development. They will consider the future of the Alaskan economy and aid in planning and investment decisions in response to the needs and opportunities to adapt to climate change.

EA-3 Improve Availability of Mapping, Surveying, Charting, and Imagery Data

Accurate, timely, and high resolution information about the distribution and magnitude of topographic changes resulting from climate change is needed to better address economic challenges and opportunities. To assess change, a good baseline of existing conditions is needed along with real-time updating of rapidly changing conditions, such as shorelines and coastal areas.

This option proposes that the State of Alaska and others invest in an accurate and high-resolution statewide digital base map that includes a digital elevation model and an acquisition system for imagery. The State also must ensure that the associated data are available to all users. This option would improve the availability of real-time mapping, surveying, charting, digital elevation models, and imagery data to provide means to better track changing conditions and understand economic impacts of climate change and opportunities to address the impacts. Additionally, this option would provide support for ongoing management and distribution of this spatial information through a geographic information system and open standards web service. This option recommends using the existing program that is creating a digital basemap, the Statewide Digital Mapping Initiative (SDMI), as a vehicle of implementation, as well as continued coordination with University of Alaska (UA) Research Centers, the U.S. Coast Guard, and the National Oceanic Atmospheric Administration (NOAA).

6-3. Economic Activities Recommended Research Needs

The Research Needs Work Group identified several needs both to assist implementing the recommendations and to help the State of Alaska better understand the impact of climate change on its economy.

IMPACTS AND OPPORTUNITIES

EA/RN-2,3,4,7 Analyze the potential rise or decline of various industries and consequent impacts on state revenues.

EA/RN-1.7 Assess new or expanded economic opportunities that may become available with climate change

EA/RN-5,6,8 Assess impacts, opportunities, and adaptation needs for ocean, road, rural-non-road, and other forms of transportation and transportation infrastructure

BOUNDARIES AND OWNERSHIP

EA/RN-9.1 Improve mapping and surveying to accurately and efficiently establish boundaries, address boundary disputes as needed, and aid charting for safe navigation.

ENERGY DEMAND

EA/RN-10.1 Assess how climate change will impact application of federal, state, and local laws, regulations, and policies on energy demand and use.

EVOLVING ALASKA'S JOBS AND ECONOMY

EA/RN-11.1 Assess how climate change will impact application of federal, state, and local laws, regulations, and policies on economic development activities.

INFORMATION COLLECTION AND DISSEMINATION

EA/RN-12.2 Identify climate trends and downscale models leading to establishing environmental information, analysis tools, and design criteria for use in adapting to climate change.

EA/RN-12.3 Provide resources for good Digital Elevation Model (DEM) and GIS data, and current and high resolution imagery to establish a more robust information infrastructure to plan and adapt.

EA/RN-12.4 Invest in monitoring and data dissemination programs to enhance information available for safe and efficient resource development.

For additional information on each recommendation, and for a broader set of identified needs, see Research Needs Work Group (2009). The numbering system above, in general, refers to the last two subsection numbers in the appropriate chapter in the report, except for single digit numbers.

Box 6-4. A Sampling of Relevant Current Activities

The examples presented below are not intended to be exhaustive, but rather to illustrate ongoing and proposed initiatives and activities.

EA-1: Evaluate Capability Needs for Potential Expansion of Arctic Economic Activities

The U.S. Coast Guard, 17th District (Alaska), has conducted an Arctic capabilities analysis. In addition, the U.S. Arctic Research Commission has developed an Arctic Marine Shipping Assessment that explores some of the infrastructure and service needs with a more navigable Arctic Ocean. The Institute of the North is coordinating several programs relating to current and future Arctic industry. Finally, Alaska's FY10 funding proposal has \$0.5 million set aside for a long term harbor study, which may be matched by the Denali Commission.

EA-2: Develop and Evaluate Scenarios for the Alaskan Economy

Decision makers in Alaska need data and information on projected changes in climate and associated impacts, on socioeconomic conditions, and on the likelihood of these changes, to support taking adaptive action. Future climate scenarios can be developed in a number of ways, including using downscaled data from General Circulation Models (GCMs) (as described in Chapter 2 of this report), using historical analogues, and trend data. One relevant effort that is underway is occurring at the University of Alaska - Fairbanks Scenarios Network for Alaska Planning (SNAP) program, which is developing predictions for Alaskan climate.

EA-3: Improve Availability of Mapping, Surveying, Charting and Imagery Data

Currently, the Statewide Digital Mapping Initiative (SDMI) is underway and would be a vehicle of this option. A related effort for this option is NOAA's GRAV-D program is an airborne gravity survey to improve the accuracy of the vertical datum, by mapping the mean sea level elevation, which, for Alaska, can be several meters off with the current data. Alaska is the top priority to be mapped under this program, but it will need federal funding.