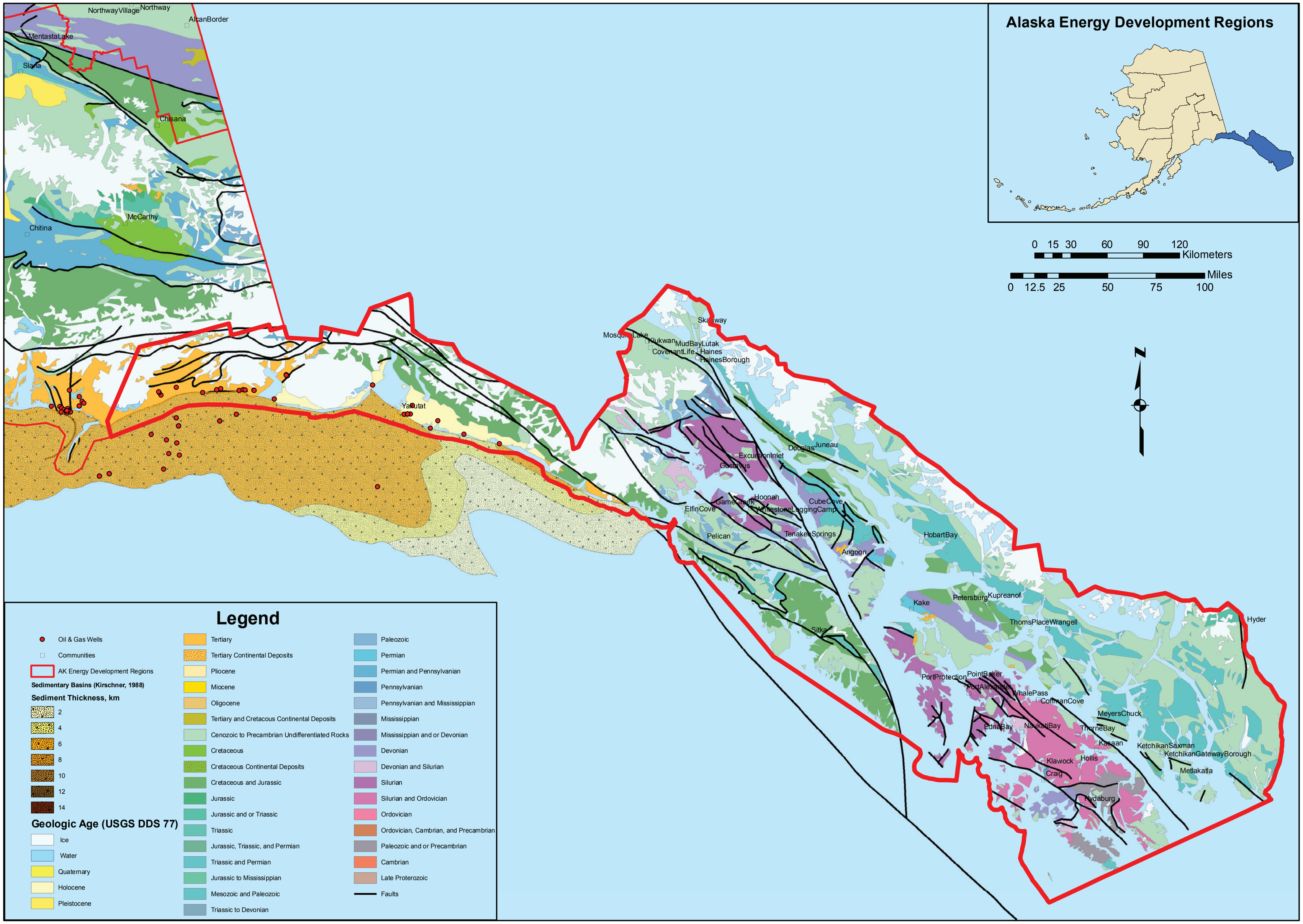
Geology of the Southeast Energy Region, Alaska



SUMMARY OF FOSSIL FUEL AND GEOTHERMAL RESOURCE POTENTIAL IN THE SOUTHEAST ENERGY REGION

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INTRODUCTION

Purpose of this report

Economic growth and stability in Alaska's rural areas hinges partially, if not primarily, on the availability of affordable and sustainable energy supplies. Recent price increases in oil and gas commodities have created severe economic hardship in many areas of the state that are dependent diesel and heating oil as their primary source of energy. All sectors of Alaska's economy rely on affordable energy sources with limited price volatility, highlighting the need to diversify the energy portfolio by developing locally available and sustainable resources that are not tied to the global market. Unfortunately, all areas are not created equal in energy accessibility; the resources available for local exploitation vary widely across the state. It is critical that funding decisions for expensive programs to reduce the dependence on diesel for heat and electricity take into account information concerning the entire suite of natural resources that exist in a given area.

This report draws from existing information to provide community and state leaders an objective summary of our current knowledge concerning the potential of locally exploitable fossil fuel and geothermal energy resources in the Southeast Energy Region (fig. K1), one of 11 regions recognized by the Alaska Energy Authority (AEA) in their Energy Plan (AEA, 2009). The potential geologically hosted energy resources considered here include exploitable coal, conventional and unconventional oil and gas, and geothermal resources. This report concludes with recommendations as to what additional data or strategies, if any, would provide the most leverage in helping to develop new energy resources in the region.

Readers without geological training are encouraged to peruse the geologic summaries of fossil fuel resources and geothermal energy in Chapter A. They provide an overview of the geologic elements that must be present in an area to economically develop coal, conventional oil and gas, unconventional oil and gas, and geothermal resources. These summaries will provide the necessary background to more fully understand the information presented in this chapter.

Geographic and geologic setting

The Southeast Energy Region of Alaska extends more than 500 miles along Southeast Alaska's north Pacific coast from south of Metlakatla to north of Yakutat with an average width of approximately 100 miles (sheet 1). The region is dominated by the southeast archipelago, but also includes the Fairweather and Boundary ranges as well as the southern portion of the Saint Elias Mountains. The region's largest cities are Juneau, with a current population of more than 30,000 residents, and Sitka, with a current population of more than 8,600 residents. Other sizable communities include Ketchikan, Douglas, Petersburg, Wrangell, and Haines, with

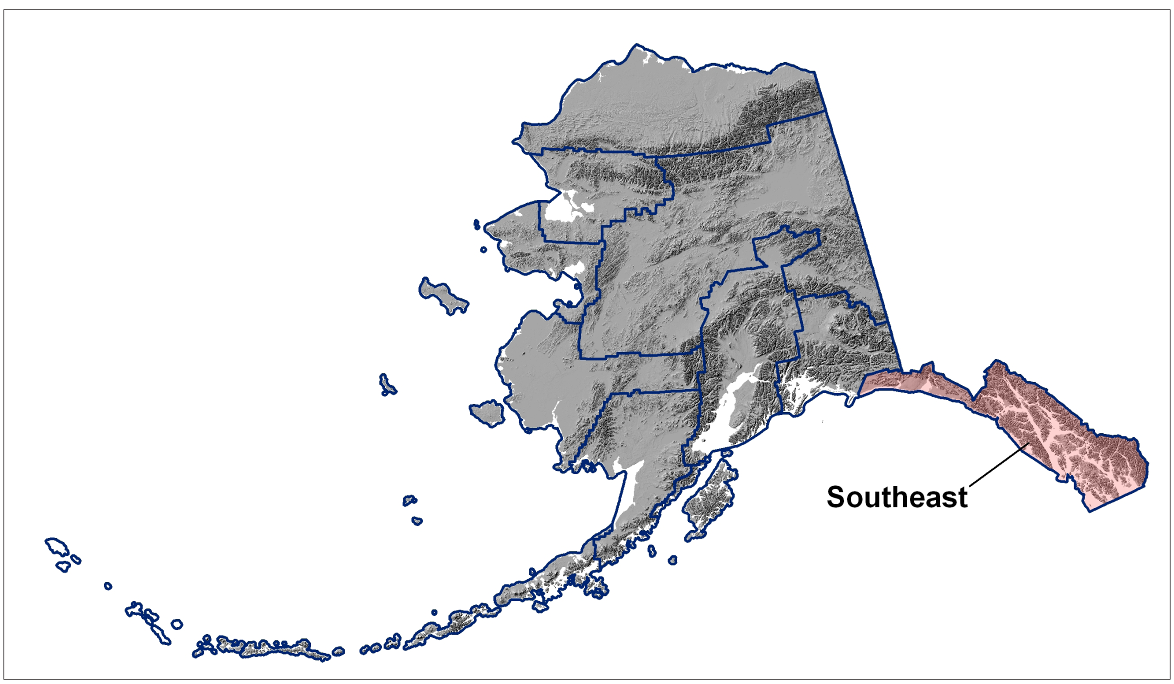

Figure K1. Location map of Southeast Energy Region.

populations ranging from nearly 8,000 to fewer than 1,500 residents. Smaller populations occupy at least 21 additional permanent villages.

Southeast Alaska lies within the circum-Pacific seismic belt that rims the northern Pacific Basin and has been tectonically active since at least early Paleozoic time (Lemke, 1975). Southeast Alaska can be divided into at least five separate geologic terranes based on distinct geologic records; these include the Alexander, Chugach, Stikinia, Taku, and Wrangellia terranes (Gehrels and Berg, 1994). The Alexander terrane comprises many units, the most widespread of which are the volcaniclastic turbidites, shallow-marine carbonate rocks, and Silurian-aged conglomerates (Gehrels and Berg, 1994). The Chugach terrane consists of coherent but strongly deformed graywacke, argillite, and slate in addition to a deformed and disrupted mélange composed of volcanic rock, chert, ultramafic rock, and limestone in a matrix of tuffaceous argillite (Gehrels and Berg, 1994). The most significant portion of the Stikinia terrane in southeastern Alaska is composed of Devonian carbonates, Carboniferous volcanic and sedimentary rocks, Permian basinal strata and platform limestone, and Jurassic–Triassic arc-type volcanic, plutonic, and clastic sedimentary rocks (Gehrels and Berg, 1994). The Taku terrane consists of deformed and metamorphosed strata of pre-Permian to Late Triassic age. Rocks of Triassic age include basalt, pillow basalt, basaltic breccias, carbonaceous limestone, slate, and phyllite (Gehrels and Berg, 1994). The Wrangellia terrane is characterized by a coherent sequence of unfossiliferous strata on Chichagof and Baranof islands distinguished by thick subaerial basalt flows, shallow- to deep-marine carbonates, and pelitic sedimentary rocks, with Jurassic tonalitic plutons being the youngest component of the terrane (Gehrels and Berg, 1994).

Tertiary- and Quaternary-age strata, which are most prospective for conventional and unconventional resources, occur at Mount Edgecumbe, in the Coast Mountains east of Ketchikan and Petersburg, in the Prince of Wales Island region, on islands in Cross Sound, and in many other areas of southeastern Alaska (Gehrels and Berg, 1994).

GEOLOGIC ENERGY RESOURCE POTENTIAL IN THE SOUTHEAST ENERGY REGION

Mineable coal resource potential

Coal resources and occurrences in southeastern Alaska are somewhat limited and discontinuous in areal extent and range in rank from lignite to bituminous. They occur only in erosional remnants of late Eocene or early Oligocene through Miocene-age (~37 to 5 million years ago) Kootznahoo Formation strata that were deposited on eroded Mesozoic and Paleozoic marine basement rocks that were uplifted in early Tertiary time. They are generally restricted to relatively small exposures on Admiralty, Kupreanof, Kuiu, Zarembo, and Prince of Wales islands (figs. K2–K4; Buddington and Chapin, 1929; Loney, 1964; Lathram and others, 1965; Muffler, 1967; White and Mitchell, 2004). It is likely that rocks assigned to the "Kootznahoo Formation" on Kupreanof and Kuiu islands that are considerably older (Paleocene) will be assigned to an older, separate stratigraphic unit with future stratigraphic studies (especially those exposed on Hamilton Bay, Kupreanof Island) (Blodgett, 2008, verbal commun.; Clough and others, in press). Coals in the Kootznahoo Formation rarely exceed 2 feet of thickness, and more typically are less than 16 inches thick and of lignite grade. An approximately 8-square-mile area on the south side of Kanalku Bay in the Kootznahoo Inlet on the southern end of Admiralty Island (fig. K2) contains the most abundant potential coal resources of these locations. The most recent discussions of the coal in the Kootznahoo Formation are those of White and Mitchell (2004) and Wahrhaftig and others (1994).

The Stepphagen Mine, located on Kootznahoo Inlet (fig. K3), produced the first coal mined in southeastern Alaska in 1862, and some of the first mined in Alaska (Merritt, 1988), and approximately 51 tons were mined in 1868 and 1869 for the steamship *U.S.S. Saginaw* (DeArmond, 1997). The Harkrader Mine (fig. K3), also on Kootznahoo Inlet, opened in 1928 on an inclined shaft several hundred feet deep and extracted coal throughout 1929 and then closed (Merritt, 1988). There is no record of production after 1929, but the residents of Angoon remember local use of the coal in their school in the 1950s (Gabrial John, Angoon, verbal commun., July 2003). The total past production from the Kootznahoo Formation east of Angoon was less than 1,000 tons (Merritt, 1988). Coal from the spoils pile at the Harkrader mine petrographically analyzed by White and Mitchell (2004) indicates a sample rank of subbituminous A to high-volatile C bituminous. Bituminous coal less than 5 feet thick reportedly occurs in Murder Cove east of Point Gardner (Roehm, 1943). However, all of these occurrences are relatively small and are in the Admiralty Island National Monument wilderness area.

Other coal occurrences in the region include the south side of Kadake Bay on Kuiu Island (fig. K2), where chunks of lignite coal as thick as 2 feet have been observed lying on the beach, but have not been observed in outcrop due to thick vegetation on the slopes above (Roehm, 1945). A 2.5-foot-thick lignite bed has also been reported at Port Camden on Kuiu Island opposite Keku Strait (fig. K2; Roehm, 1943). At the head, and on the west side of Kupreanof Island along the south shore of Hamilton Bay (fig. K2), coal-bearing strata occur in the shallow subsurface and in outcrop (Roehm, 1945). The coal-bearing beds are only exposed during low tide and are reported to contain lignite beds generally less than 8 inches thick, but have been observed at 16 inches thick (Roehm, 1945). Merritt and Hawley (1986) describe local occurrences of lignite and, rarely, subbituminous coal southeast of Sitka on Baranof Island, Snow Dome northeast of Glacier Bay, and near Lituya Bay on the Gulf of Alaska coast

Southeast

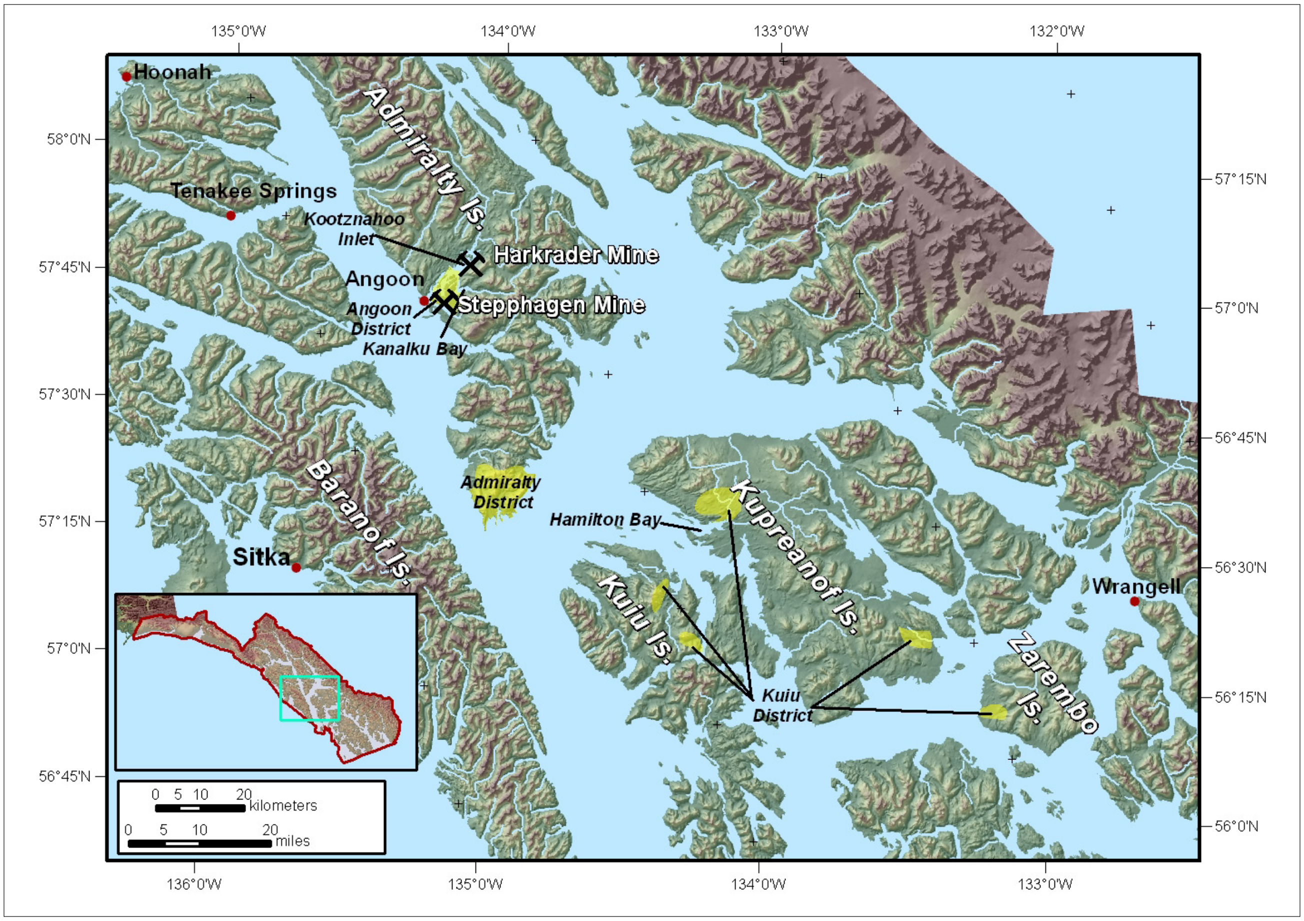

Figure K2. Location map of the central part of the Southeast Energy Region, showing selected geographic references noted in the text. Yellow shaded areas are inferred to be underlain by coal-bearing rocks; pick-axe symbols indicate locations of historic coal mines.

between Yakutat Bay and Cross Sound (figs. K2 and K5). These exposures are in the South Baranof Wilderness area and Glacier National Park and Preserve, respectively, and little is known about them. Yet other local occurrences of lignite and bituminous coal are reported by Merritt and Hawley (1986) near Yakutat Bay, north of Malaspina Glacier, and southeast of Bering Glacier. The latter includes a coal deposit from strata that are laterally equivalent to coal-bearing rocks of the Bering River field in the Copper River/Chugach Energy Region (Merritt, 1986). Individual coal beds in this region encompassing the Robinson Mountains are reportedly up to 6 feet thick, but otherwise there is little information about the potential resource.

Conventional oil and gas resource potential

As explained in the discussion of requirements for exploitable oil and gas resources (Chapter A), functioning petroleum systems occur in thick, sedimentary basins, and require three basic elements: Effective source rocks, reservoirs, and traps. Each of the elements must be in existence and connected at the time hydrocarbons are generated. This section considers each of these necessary elements of petroleum systems in turn to evaluate whether conventional oil and gas resources may play a role in supplying rural energy in Alaska's Southeast Energy Region.

Overview of sedimentary basins. The northwestern part of the Southeast Energy Region contains most of the onshore and nearshore portions of the Gulf of Alaska sedimentary basin (sheet 2). This basin continues westward into the Copper River/Chugach Energy Region and the adjacent federal offshore outer continental shelf (OCS). Exploitable petroleum systems could exist offshore and along a belt of the coastal plain and adjacent mountains that extends inboard up to 50 kilometers. Cenozoic sedimentary fill in the Gulf of Alaska basin ranges from zero to more than 9 km in thickness. These basin-filling strata belong to the Yakutat terrane, a crustal block consisting of sedimentary units deposited on slightly older Cenozoic and Mesozoic basement. Geologic and paleomagnetic evidence indicate that the Yakutat terrane originated approximately 50 million years ago near

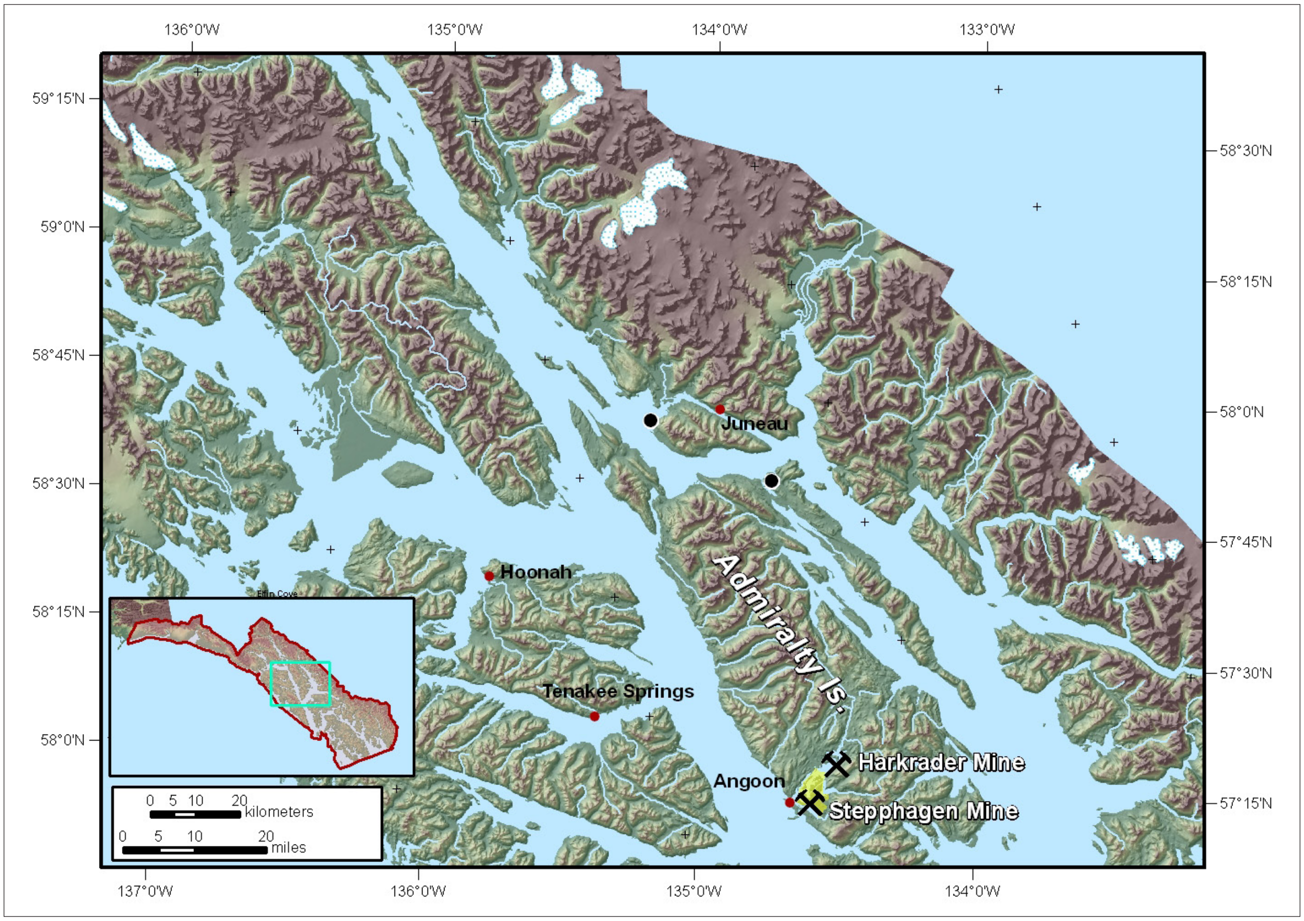

Figure K3. Location map of the central part of the Southeast Energy Region, showing selected geographic references noted in the text. Yellow shaded areas are inferred to be underlain by coal-bearing rocks; pick-axe symbols indicate locations of historic coal mines; black dots show locations of additional reported coal occurrences.

the present-day coast of British Columbia, 1,100 to 1,800 kilometers south of its current position (Risley and others, 1992). Since then, plate tectonic processes have transported the Yakutat terrane north along the western edge of North America, resulting in collisional deformation and mountain building in southern Alaska that continues into modern times.

The narrow coastal plain of the Southeast Energy Region has been tested by 23 onshore oil and gas exploration wells drilled between 1927 and 1963. The onshore belt explored by drilling stretches from the Kaliakh River in the Yakataga district on the northwest to the mouth of the Alsek River southeast of Yakutat. Thirteen more wells were drilled in nearby OCS waters between 1975 and 1983. The basin does not currently support commercial oil or gas production, but the Katalla oil field (in the adjacent Copper River/ Chugach Energy Region) was the site of shallow, small-scale commercial oil production from 1902 to 1932.

Source rocks. Natural oil and gas seeps are prevalent in Cenozoic outcrops along the northern margin of the Yakutat terrane, constituting conclusive proof of effective source rocks on the onshore edge of the Gulf of Alaska basin. Literally dozens of seepages have been reported in strata now assigned to the Poul Creek Formation, spanning distances of approximately 25 miles in the Katalla district and some 18 miles along the length of the Sullivan anticline in the Yakataga district (Martin, 1921; Miller, 1951a, 1951b, 1957, 1975; Risley and others, 1992). Many more seeps have been mapped in the slightly older Kulthieth Formation in the Samovar Hills adjacent to the Malaspina Glacier. Shales of the Poul Creek Formation and some coals of the Kulthieth Formation have been shown to be source rocks for both oil and gas (Risley and others, 1992; Magoon 1994; Larson and Martin, 1998; Van Kooten and others, 2002), and most of the seeps are interpreted to have been sourced directly from the formations in which they occur. Thermal maturity increases toward the northwest in the Yakutat terrane and these source rocks are interpreted to be marginally mature to mature for generation of oil and gas in much of the onshore part of the basin (Barnes, 1967; Bruns, 1982, 1983; Mull and Nelson, 1986; Bujak Davies Group, 1989a, 1989b, 1989c, 1989d; Magoon, 1994). The southeastern portion of the basin near Yakutat is devoid of seeps. The Poul Creek Formation appears

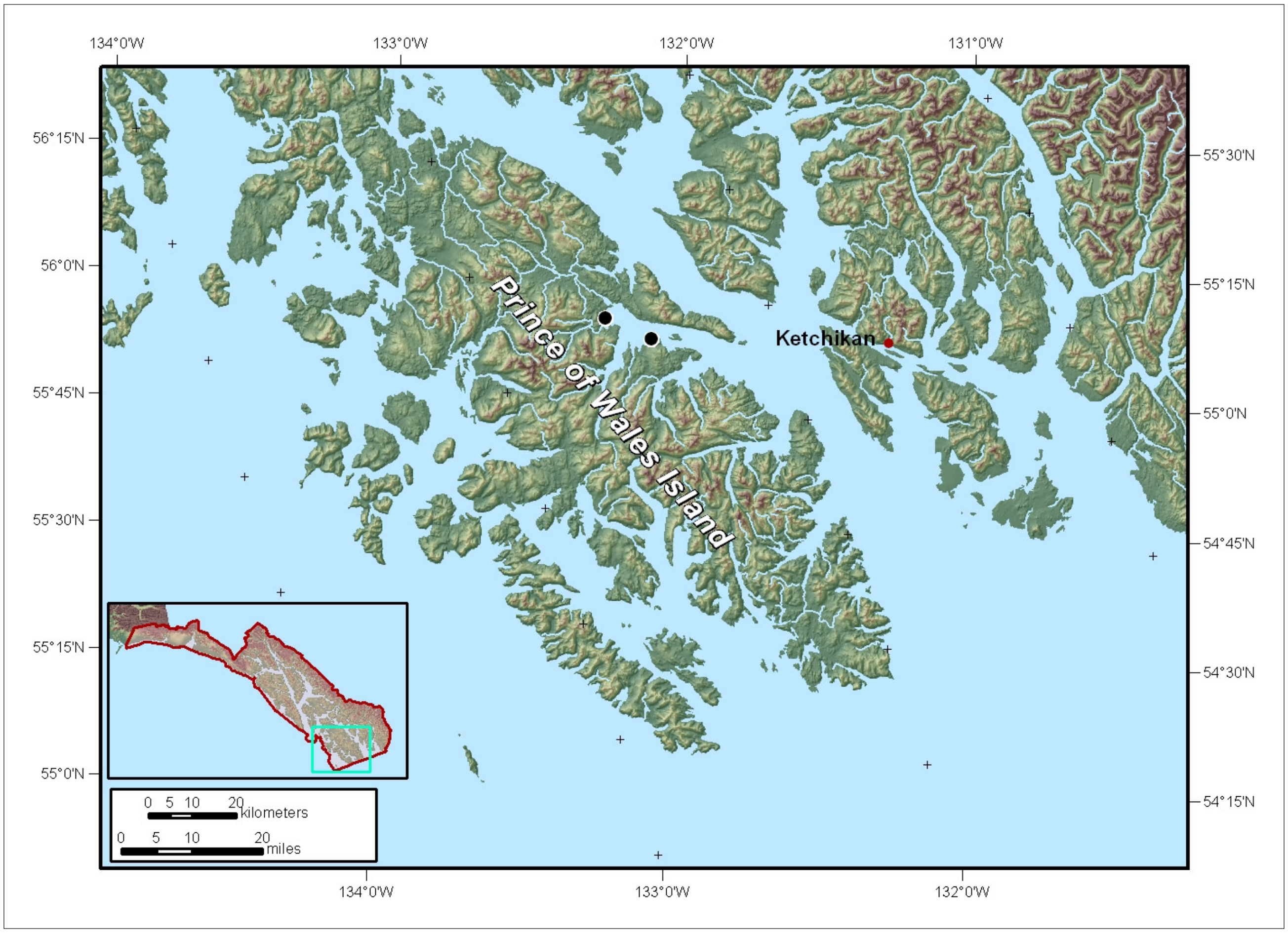

Figure K4. Location map of the southern part of the Southeast Energy Region, showing locations of reported coal occurrences (black dots) on Prince of Wales Island.

to be present offshore, but absent from most onshore wells in this area due to non-deposition, but probable source rocks are known in the Kulthieth Formation in this sector, which extends onshore (Risley and others, 1992). Thermal maturity levels in the Kulthieth Formation in the Yakutat area range from immature to overmature for oil and gas generation (Pawlewicz, 1990a, 1990b; Risley and others, 1992), but oil and gas shows were poor to moderate, and no zones were found to contain producible hydrocarbons.

Reservoir rocks. Potential conventional reservoir rocks in the Gulf of Alaska basin are restricted to the Yakutat terrane; other terranes in the region are made up of highly altered or metamorphosed formations with negligible porosity and permeability. Reservoir candidates in the Yakutat terrane include wave-reworked sandstones of the upper Cenozoic Yakataga Formation, local sandstones in the upper part of the mid-Cenozoic Poul Creek Formation, and nonmarine to deltaic sandstones of the lower Cenozoic Kulthieth and Tokun Formations (Risley and others, 1992; Larson and Martin, 1998). Reservoir quality in each of these formations varies considerably. The Yakataga Formation consists mainly of poorly sorted glaciomarine beds with unstable mineralogy, but is known to maintain local zones of good porosity and permeability at depths exceeding 11,000 feet in offshore wells (Larson and Martin, 1998). The Kulthieth Formation in the Southeast Energy Region contains abundant sandstone beds with adequate thickness and fair to good porosity. However, permeability is limited due to compaction and alteration of the sands upon burial. Kulthieth Formation reservoir properties generally improve northeastward and toward the top of the unit (Risley and others, 1992). The Poul Creek Formation is dominantly composed of fine-grained rock types, but does contain locally significant thicknesses of glauconitic sandstone. The formation was not considered in Risley and others' (1992) analysis of potential reservoir units, despite the fact that the Katalla oil seeps originate from shallow, fractured mudstone of the Poul Creek Formation. Both the Kulthieth and Poul Creek Formations contain organic-rich source rocks, increasing the likelihood that any potential reservoir sandstones are in direct contact with and may have received hydrocarbon charge.

Southeast

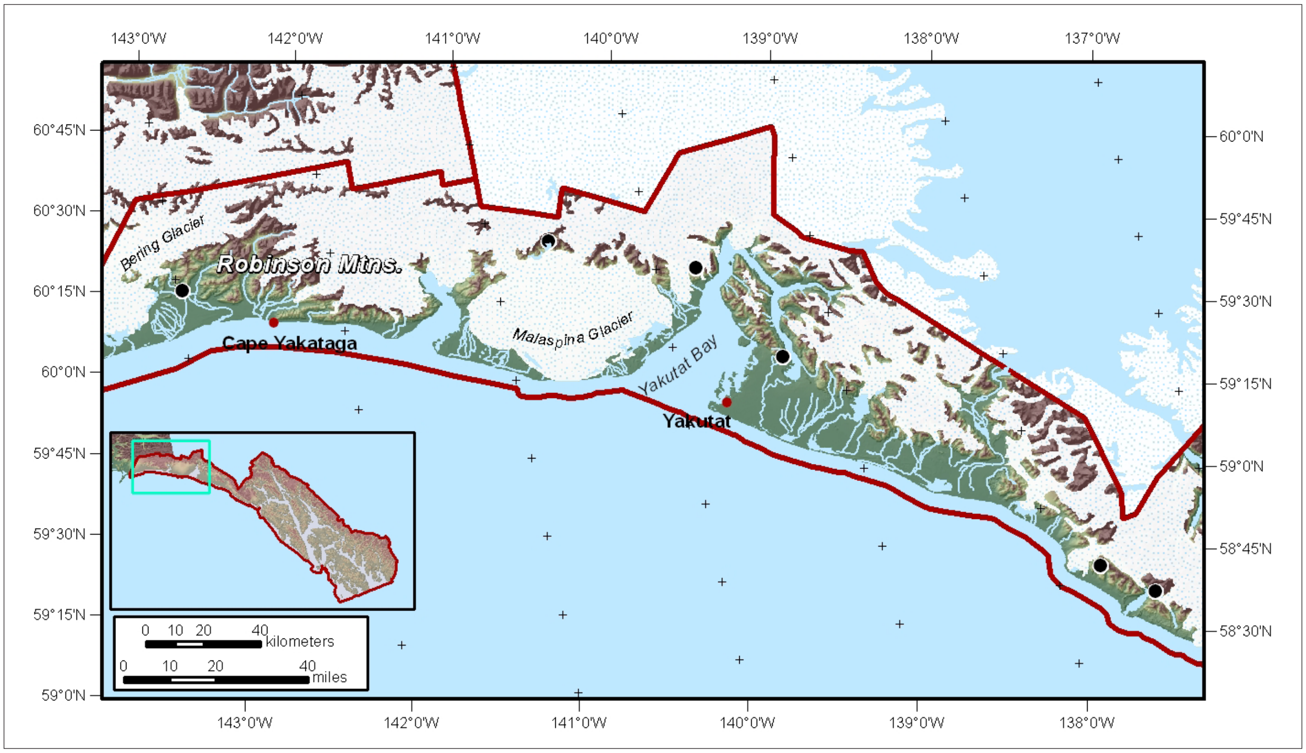

Figure K5. Location map of the northwestern part of the Southeast Energy Region, showing locations of reported coal occurrences (black dots).

Traps. The northern Gulf of Alaska basin has been affected by faulting and folding accompanying compressional and strike-slip tectonics, creating numerous fold and fault structures that have the potential to trap hydrocarbons. Although several of these structures were unsuccessfully tested by exploration wells, many promising and large structures remain undrilled (Risley and others, 1992). Additional traps may be stratigraphic in nature, established by lateral variations in thickness, grain size, permeability, and other sedimentary characteristics inherent in geologically complex settings.

Summary of conventional oil and gas resource potential. Major seeps of both oil and gas are present on the northern margin of the Yakutat terrane, indicating that the northern Gulf of Alaska basin does contain a viable petroleum system. Despite the lack of any commercial discoveries to date, potential remains for future production of conventional hydrocarbons. Many large structural and stratigraphic traps have not been drilled and the province is underexplored relative to comparable basins in North America. The most recent available estimates of technically recoverable resources from the Gulf of Alaska region report a mean resource of 630 million barrels of oil and 4.65 trillion cubic feet of natural gas (Minerals Management Service [MMS], 2006). These numbers reflect undiscovered, hypothetical resources that have not been identified by drilling, and the actual amount that could be discovered and produced may be significantly smaller when filtered against the high costs of offshore development. Nevertheless, the large estimates reflect the overall promising nature of the region for future hydrocarbon exploration.

Unconventional oil and gas resource potential

Coalbed methane. As noted above, coal resources in southeastern Alaska are areally limited, discontinuous, and typically of low grade (Roehm, 1943). Coals in the Kootznahoo Formation rarely exceed 2 feet in thickness, and typically are less than 16 inches thick and of lignite grade. Other coals in the area are also of lignite grade and typically less than 2 feet in thickness. The low quality of these coals combined with their limited thickness and limited areal footprint renders them ineffective as potential sources of coalbed methane.

Tight gas sands. The Eocene Kulthieth Formation in southeastern Alaska may locally have potential as a tight gas sand. It consists of relatively thick nonmarine to deltaic sandstones with variable reservoir quality. While much of the unit has fair to good porosity, zeolite cements (particularly laumontite), have locally degraded reservoir quality to the extent that sands have permeabilities less than 0.01 millidarcy. Potential source rocks in the lower part of the Kulthieth Formation consist of gas-prone shallow marine deltaic to basinal marine sediments (Plafker and others, 1994) that could act as an intra-formational source. Local fractures have been observed in thin sections of the Kulthieth Formation (ARCO White Lake #1) and may signal the existence of a more regionally extensive fracture system necessary for an effective unconventional, fractured reservoir. The ARCO OCS Y-0211 (Yakutat No. 1) well encountered significant oil and gas shows in the Kulthieth sandstones.

Shale gas. One of the primary requirements for shale gas is an organic-rich source rock present in the thermogenic gas window that is sufficiently brittle to host a natural fracture system (see Chapter A). Shales of the Poul Creek and Kulthieth Formations are potential source rocks for both oil and gas, with most of the observed seeps in the region believed to be inter-formational. The highest stages of thermal maturity for these source rocks approach marginally mature to mature for generation of oil and gas. Thermal maturity levels in the Kulthieth Formation in southeastern Alaska area range from immature to overmature for oil and gas generation. It is therefore unlikely that a significant volume of brittle source rocks are present within the thermogenic gas window.

Gas hydrates. The main occurrences of gas hydrates in nature are in modern marine sediments and in arctic regions with well developed, continuous permafrost. Permafrost is not well developed in the Southeast Energy Region and, where locally present, is discontinuous. Consequently the potential for economic concentrations of gas hydrates in the region is low.

Geothermal resource potential

Geothermal prospectivity in the Southeast Energy Region is second only to geothermal prospectivity in the Aleutians Energy Region. Three occurrences of thermal spring temperatures in excess of 165°F (74°C) have been measured at various locations in the Southeast Energy Region (sheet 2). By comparison, only two such occurrences have been measured in Alaska outside the Aleutians and Southeast energy regions (Motyka and others, 1983).

Bell Island has thermal springs situated 1,300 feet inland and 16 feet above high tide line with surface discharge temperatures ranging from 153°F to 165°F (67°C–74°C) (Motyka and Moorman, 1987). A direct-use application has previously been employed by utilizing five concrete basins to collect thermal water discharge at a rate of 22 gallons per minute to heat the main lodge and several cabins at the Bell Island fishing resort (Motyka and Moorman, 1987). Geothermometers predict an estimated reservoir temperature of 275°F (135°C), suggesting wells could be drilled to access higher temperature fluids to provide broader direct-use applications to the community of Bell Island (Motyka and others, 1983).

The Bailey Bay hot springs site, located 50 miles north of Ketchikan near Behm Canal, has the highest measured surface discharge temperature, at 196°F (91°C), in the Southeast Energy Region. The estimated reservoir temperature underlying these springs is 302°F (150°C) (Motyka and others, 1983). Ten principal springs and numerous seeps account for a combined total discharge of 66 gallons per minute issuing from granitic bedrock on a steep northwest-facing slope of Spring Creek valley and draining into Lake Shelokum (Motyka and Moorman, 1987). High spring discharge rates and close proximity to the fishing community of Bell Island could make a direct-use application at Bailey Bay hot springs a viable project.

Tenakee Inlet thermal spring, located north of Tenakee Village on Chichagof Island, has a measured surface temperature of 176°F (80°C). Tenakee Village has 18 springs situated along its shoreline with temperatures ranging from 86°F to 106°F (30°C–41°C). Geothermometry at Tenakee Village yields reservoir temperature estimates of 149°F–212°F (65°C–100°C). The springs appear to originate as meteoric waters that circulate along deep fractures associated with nearby fault zones (Motyka and others, 1983; Motyka and Moorman, 1987). To investigate direct-use applications, six shallow test wells were drilled at Tenakee to depths ranging from 23 to 177 feet. The deepest well produced 98°F (37°C) water at a rate of nearly 1.5 gallon per minute (Motyka and others, 1983). Water temperature and flow rate were deemed insufficient for district heating following the study; however, based on geothermometry, it remains likely that deeper wells would yield higher fluid temperature, making direct-use applications in Tenakee Village potentially viable.

When considered as a whole, the southeast archipelago contains a widespread number of geothermal springs (sheet 2), including three thermal springs with discharge temperatures greater than 165°F (74°C), ten thermal springs with discharge temperatures in the range of 100°F–165°F (38°C–74°C), and two thermal springs with surface discharge temperatures greater than 69°F (21°C). In addition, six shallow wells drilled in the Tenakee region yielded an average surface discharge temperature of 99°F (37°C) (Motyka and others, 1983).

RECOMMENDATIONS

Geothermal resource recommendations

There are numerous possibilities for direct-use applications in small villages across the southeast archipelago. There may also be sufficient geothermal resources for a low-temperature Organic Rankin Cycle (ORC) geothermal power plant similar to the one utilized to generate electrical power at Chena Hot Springs in the interior. Because success or failure at this level of development will provide needed insight on the viability of larger-scale projects, funding a direct-use pilot project or ORC project is recommended. It is recommended that the State facilitate a revised assessment aimed at expanding previously proven direct-use applications at Bell Island by drilling test wells into the geothermal reservoir. It is likewise recommended that the State consider supporting a deeper test well at Tenakee Village to reassess the viability of direct-use applications that were previously deemed not feasible.

Conventional oil and gas recommendations

Patterns of land ownership and the location of rural communities are important considerations in weighing the state's options for oil and gas energy development in the Southeast Energy Region. State-controlled lands in the Gulf of Alaska basin are limited to the Yakataga area between Cape Suckling and Icy Bay, and much of that is designated as game refuge. Most of the rest of the onshore Gulf of Alaska basin is federal national forest, national park, BLM, Native corporation, and private land. The only permanent community in the Southeast Energy Region in the Gulf of Alaska basin is Yakutat; all other communities are located at least 200–600 kilometers away in the archipelago region where petroleum systems cannot exist. Of the wells drilled near Yakutat, none appear to be capable of sustaining production, but there remains potential that future exploration in the vicinity might yield a different result, perhaps one or more discoveries capable of delivering local-use gas or oil supply. The Yakataga district, with its numerous seeps and subsurface oil and gas shows, probably has the region's best potential for conventional hydrocarbon production. However, the lack of a permanent local population there means that a viable transportation system, built to withstand a variety of potentially severe geologic hazards (Combellick, 1994), would be required to deliver producible hydrocarbon resources to consumers.

To summarize, the complex geology, prior exploration history, land status, and population distribution of the Southeast Energy Region suggest that undiscovered hydrocarbon resources are most likely to occur hundreds of kilometers remote from the communities in need of energy. Future exploration for these resources in this frontier province would mostly likely be undertaken by industry and aimed at major commercial discoveries, rather than local markets. Reliable estimates of the ultimate conventional oil and gas resource potential in the Gulf of Alaska are hampered by limited published geologic data. Exploration risk could be reduced through the acquisition of significant new geologic mapping and associated field data.

Coal resources

Due to the limited stratigraphic and areal extent of coals, previous statewide assessments classified Southeast Alaska as a region of low coal potential (Merritt, 1987). However, significant coal occurrences have been noted in Kootznahoo Inlet and Murder Cove. Although these may be suitable for local energy use, they are presently inaccessible for extraction due to their location in the Admiralty Island National Monument wilderness area. The coal beds reported from the Robinson Mountains are likely broadly equivalent to the Bering River coal field about 50 miles to the west. However, little data is available to assess the viability of these coals for local use. Further reconnaissance field work may be warranted to evaluate the local geology in this area and determine whether utilization of this potential resource should be considered further.

Unconventional oil and gas resource recommendations

Coalbed methane. Due to the limited stratigraphic and areal extent of coals in the region, the volume of available coal does not appear sufficient to produce commercial quantities of coalbed methane.

Tight gas sands. The possibility exists for encountering fractured tight gas sands in portions of the Cenozoic section in the region, although available data suggest the probability of recovering commercial quantities of gas is low. Exploration for this type of resource in a frontier province would most likely be led by industry, although the geologic uncertainties indicate significant risk would be present.

Shale gas. Shales of the Poul Creek and Kulthieth Formations have some potential as a resource play, particularly within the fold and thrust belt, where a significant natural fracture system may be present. This was confirmed by the limited production of oil from fractured Poul Creek strata in the Katalla area. Additional geologic information is needed to ultimately evaluate this play type, particularly data on the distribution of source rock quality and thermal maturity. However, development of unconventional resource plays typically requires closely spaced wells and artificial stimulation, both of which add significantly to exploration and development costs. Given the geologic uncertainties and the costs of exploring in this remote area, shale gas is unlikely to be a primary target for industry and will thus not contribute to local energy supplies in the near future.

Gas hydrates. Due to the lack of extensive, continuous permafrost in most of southeastern Alaska, the likelihood of finding gas hydrates in the region are very low; therefore no further action is recommended.

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