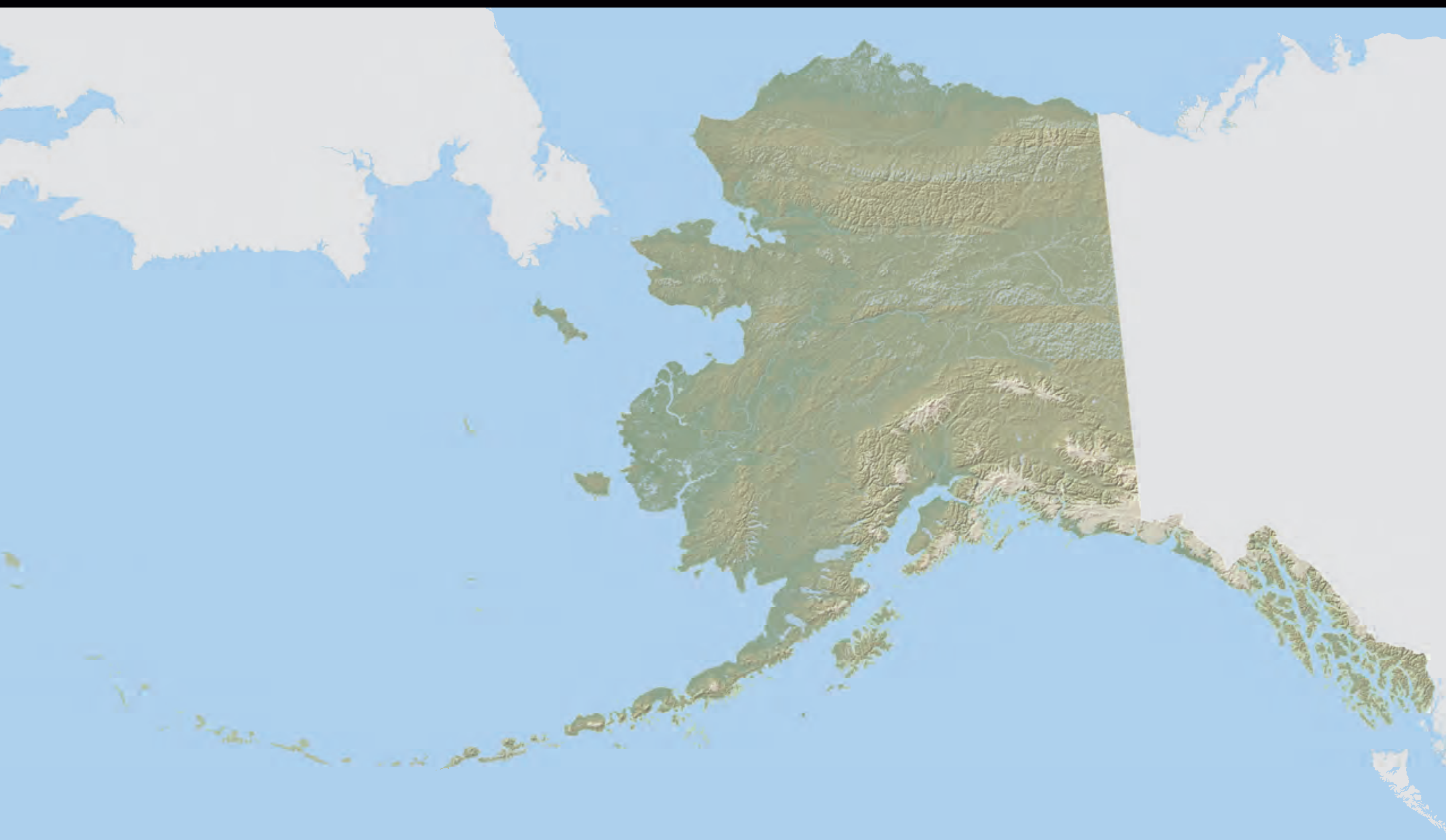
RENEWABLE ENERGY

ATLAS

OF ALASKA



A Guide to Alaska's Clean, Local, and Inexhaustible Energy Resources

May 2009

Why Renewable Energy is Important

As concerns about rising fossil fuel prices, energy security, and climate change increase, renewable energy can play a key role in producing local, clean, and inexhaustible energy to supply Alaska's growing demand for electricity, heat, and transportation fuel. Because there are little or no fuel costs associated with generating electricity from renewable sources, more Alaskans are looking to resources like wind, geothermal, hydropower, tides, waves, solar, and biomass to hedge against the price volatility of natural gas and diesel.

Renewable resources, over the long term, can provide energy at a known cost that is not susceptible to the vagaries of fossil fuel supply and demand. With some of the best renewable energy resources in the country, Alaska has an opportunity to be a leader in their development and bring new revenue streams into the state's economy.






The Renewable Energy Atlas of Alaska is designed as a resource for the public, policy makers, advocates, landowners, developers, utility companies and others interested in furthering the production of electricity and fuels from wind, solar, biomass, geothermal, hydro and ocean power resources. Produced with the use of GIS technology, this Atlas brings together the best renewable resource maps and data into a single comprehensive publicly available document. While the maps contained in this Atlas do not eliminate the need for on-site resource assessment, they do provide an estimate of the available resources.

The Atlas is posted on the Alaska Energy Authority website, www.akenergyauthority.org. Map data is available in interactive format at the State of Alaska's energy inventory web site at www.akenergyinventory.org.

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Above, left to right: Doug Ogden, Jim D. Barr, Michael DeYoung, Danny Daniels, Michael DeYoung, Doug Ogden.

Below, left to right: TDX Power, Cordova Electric Cooperative, Alaska Energy Authority, Ocean Power Delivery, Ltd., Alaska Energy Authority, Chena Hot Springs Resort.






Alaska's Energy Infrastructure

With 16% of the country's landmass and less than 0.3% of its population, Alaska's unique geography has driven development of its energy supply infrastructure—power plants, power lines, natural gas pipelines, bulk fuel "tank farms" and related facilities. Alaska has over 150 remote, stand-alone electrical grids serving villages as well as larger transmission grids in Southeast Alaska and the Railbelt. The Railbelt electrical grid follows the Alaska Railroad from Fairbanks through Anchorage to the Kenai Peninsula and provides 80% of the state's electrical energy.

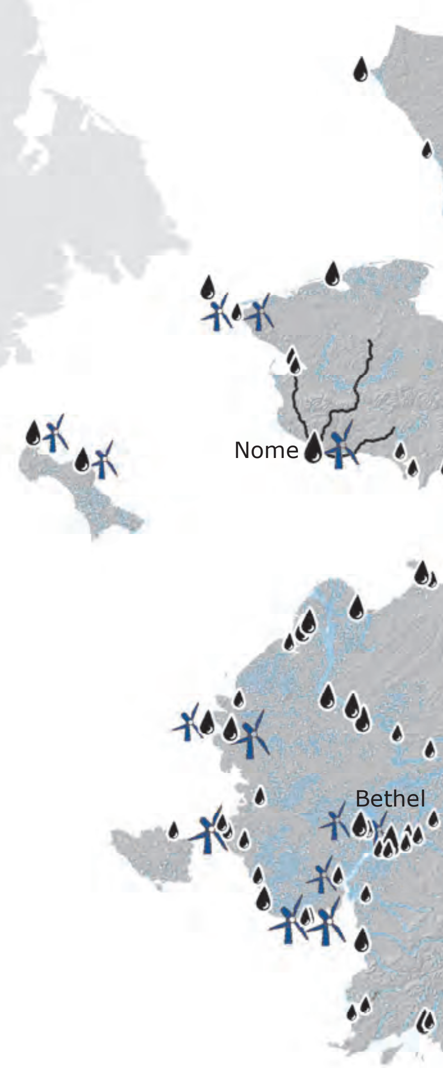
Powered by wood until 1927, Fairbanks switched to coal after the Railroad provided access to Nenana and Healy coalfields. The Anchorage area has enjoyed relatively low-cost heating and power since expansion of the Eklutna hydro plant in 1955 and the development of major Cook Inlet oil and gas discoveries in the 1960s.

Completed in 1986, the state-owned Willow - Healy Intertie now provides a diversity of energy sources to the six Railbelt electrical utilities.

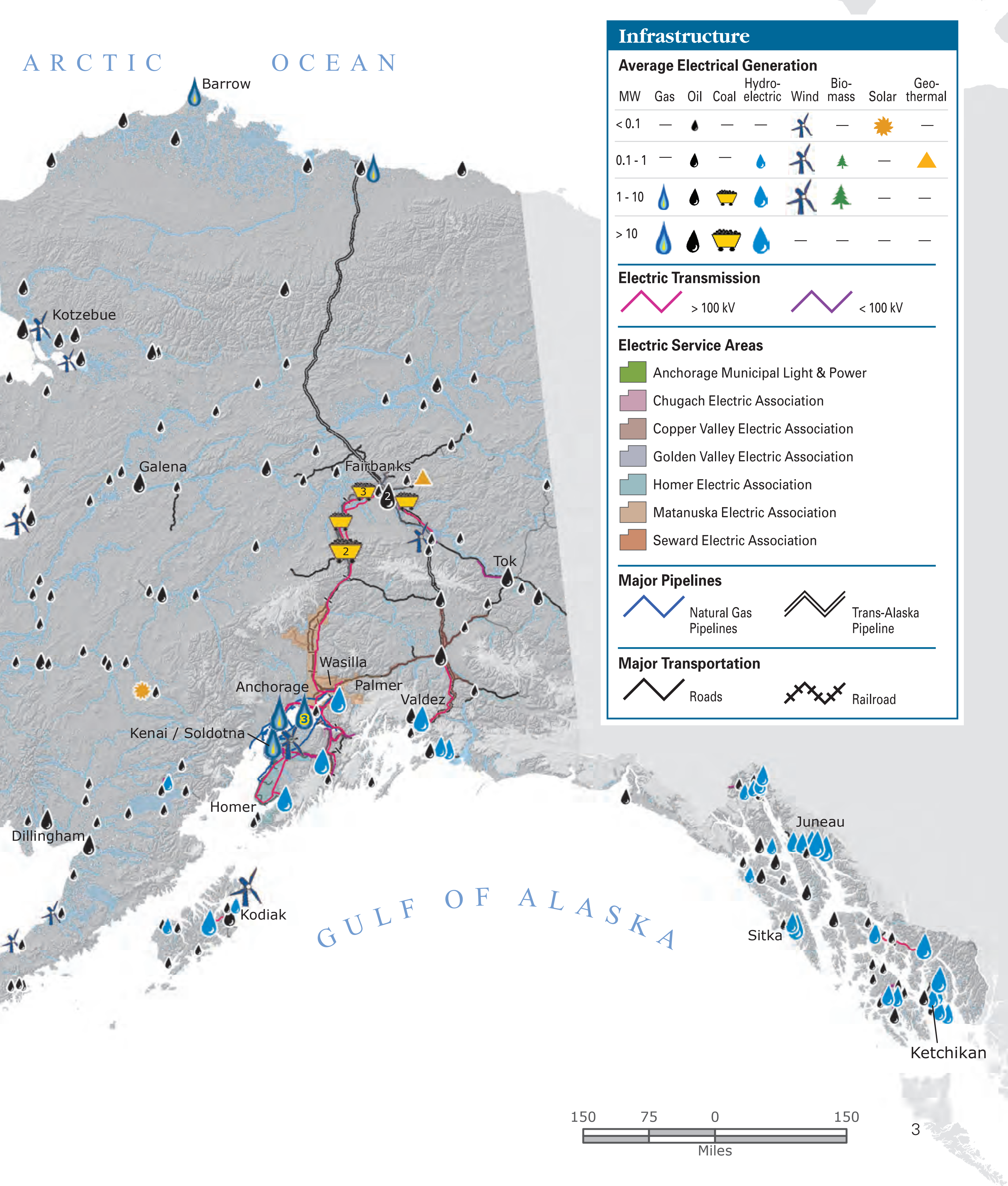
Approximately 70% of the Railbelt's electricity comes from natural gas generators. Major power generation facilities along the Railbelt include Chugach Electric Association's 430 MW natural gas-fired plant west of Anchorage at Beluga, Anchorage Municipal Light and Power's 266 MW natural gas-fired plant in Anchorage, Golden Valley Electric Association's 129 MW facility near Fairbanks fueled by oil from the Trans-Alaska Pipeline, and the 126 MW state-owned Bradley Lake hydroelectric plant near Homer. In total, 1,340 MW of installed power generation capacity exists along the Railbelt to serve an average load of approximately 500 MW and a peak load of over 800 MW.

During the early 1980s, the state completed four hydropower projects to serve Ketchikan, Kodiak, Petersburg, Valdez, and Wrangell. With a total generating capacity of 76 MW, the "Four Dam Pool" projects displace the equivalent of approximately 20 million gallons of diesel fuel per year for power production. Other major hydro facilities supply the communities of Juneau and Sitka.

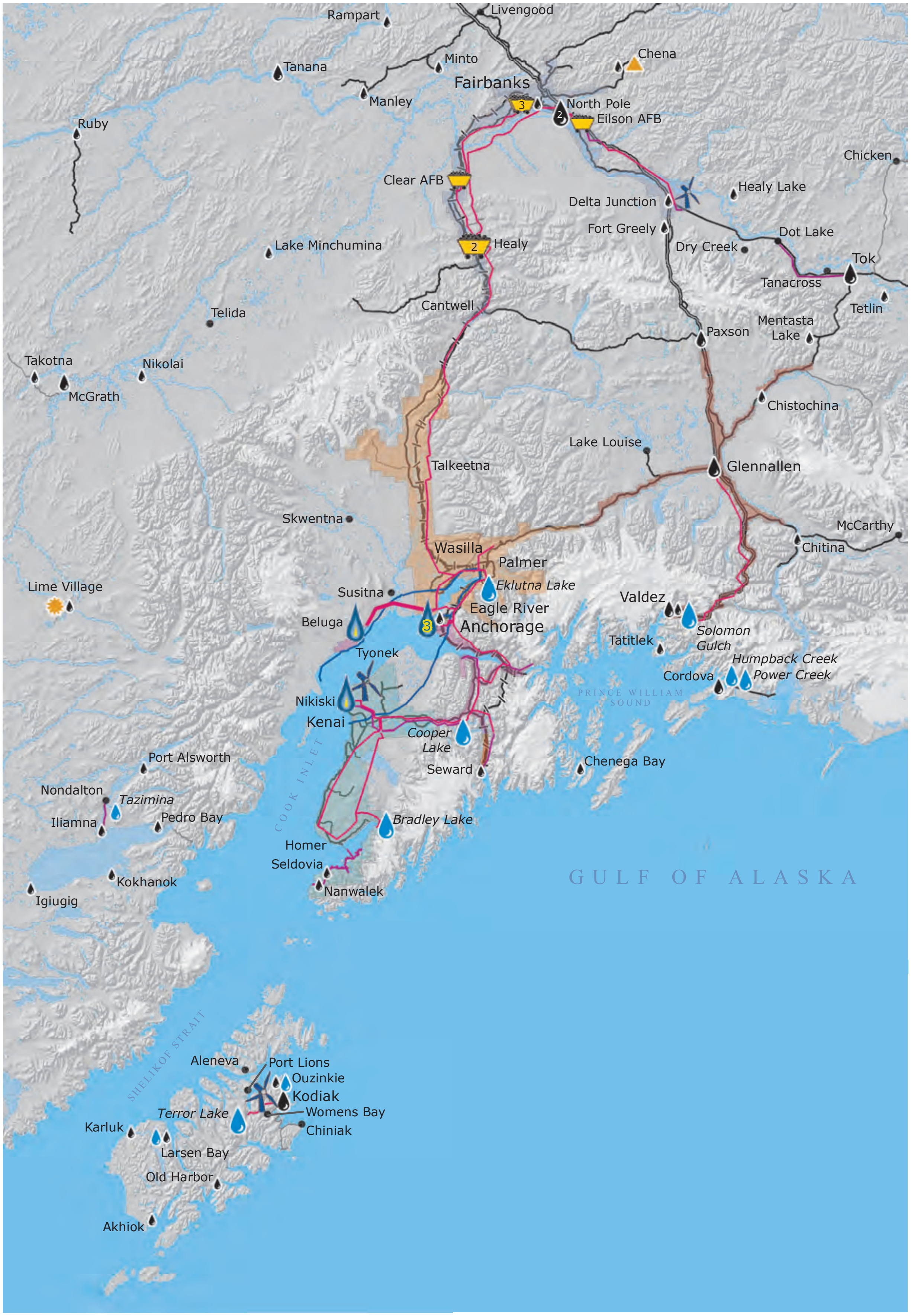
With a few notable exceptions, most of the rest of Alaska's power and heating needs are fueled by diesel that is barged from Lower 48 suppliers or transported from petroleum refineries in Nikiski, North Pole, and Valdez. After freeze-up, many remote communities must rely on the fuel that is stored in tank farms, or pay a premium for fuel flown in by air tankers. Currently state and federal authorities are supporting a large program to fix leaky tanks, improve power generation and end use efficiency, and exploit local energy sources such as wind and hydro.



Alaska's Renewable Energy Resources

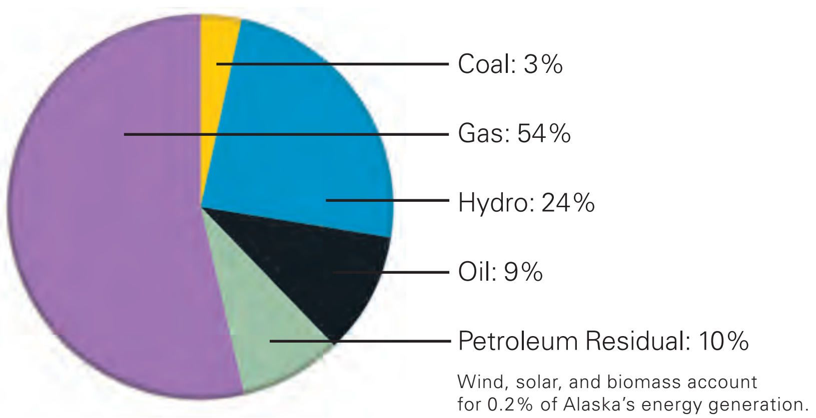


Infrastructure: Fairbanks to Kodiak

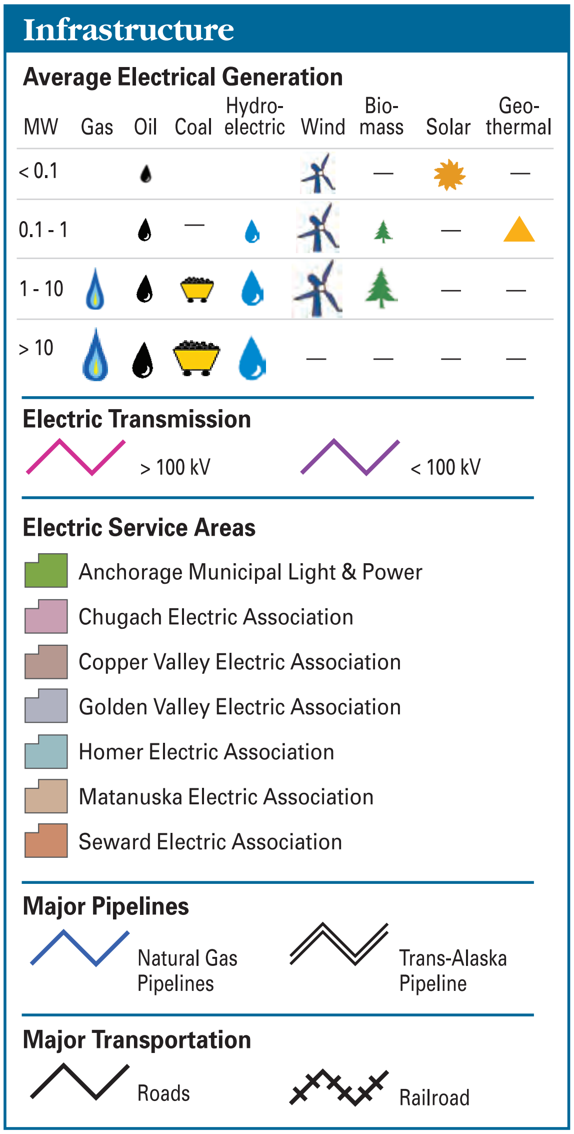


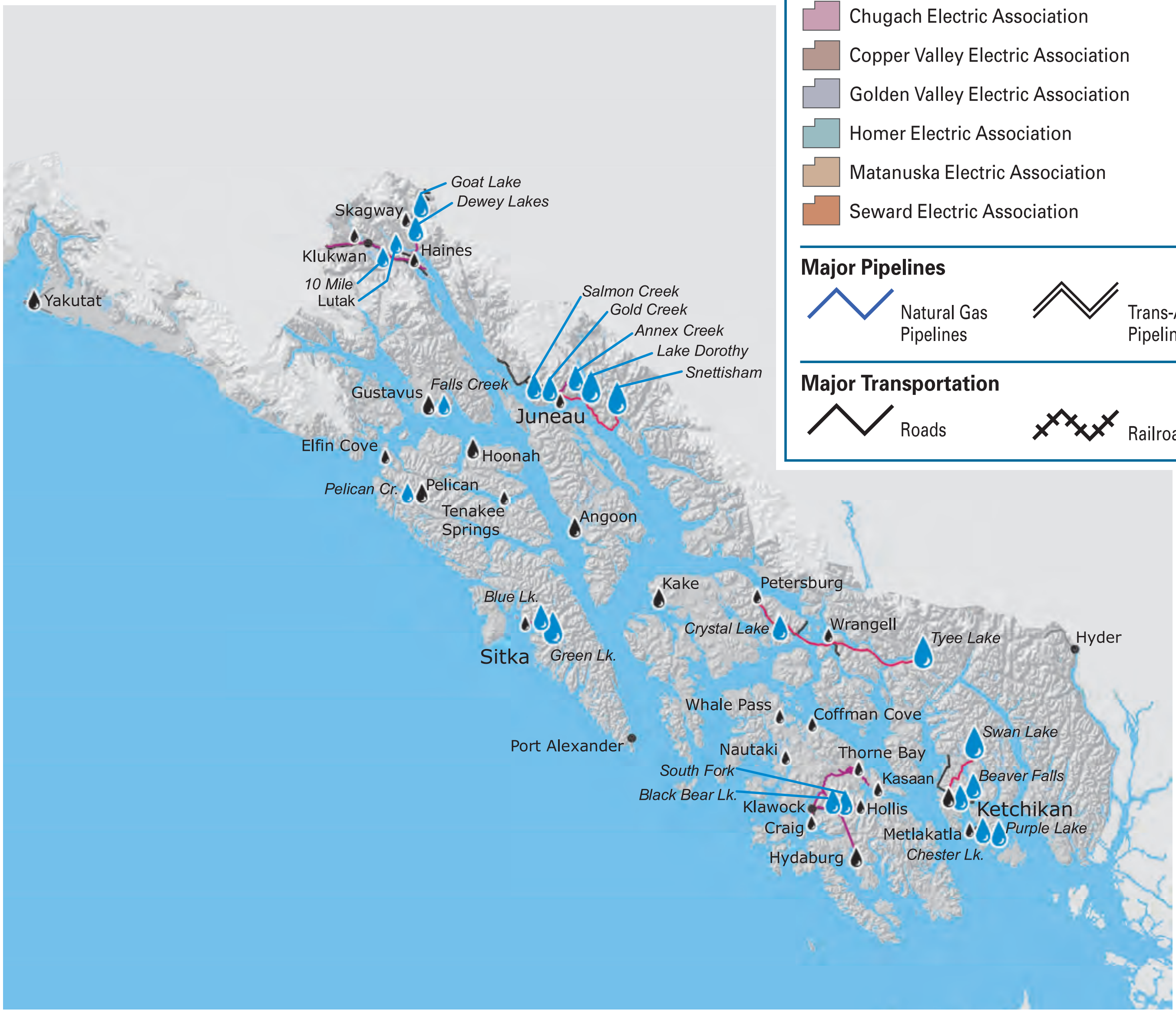
Infrastructure: Southeast Alaska

Statewide Electrical Generation in Alaska by Energy Source



Wind, solar, and biomass account for 0.2% of Alaska's energy generation.





Biomass

Alaska's primary biomass fuels are wood, sawmill wastes, fish byproducts, and municipal waste.

Wood remains an important renewable energy source for Alaskans, with over 100,000 cords per year used for space heating statewide. Closure of the major pulp mills in Sitka and Ketchikan in the 1990s ended large-scale wood-fired power generation in Alaska. However, the price of oil has raised interest in using sawdust and wood wastes as fuel for lumber drying, space heating, and small-scale power production. In 2008, the City of Craig installed a sawmill waste-fired boiler to heat the city pool building, pool water, and school buildings. The boiler will save the city an estimated $120,000 per year and displace about 19,000 gallons of oil and 33,000 gallons of propane. Additional wood-fired boilers have been installed in Kasilof and Tanana, and over 15 projects in other communities are under development. Alaska has also seen renewed interest in converting low-value wood and wood wastes to liquid fuels such as ethanol.

Groundfish processors in Unalaska, Kodiak and other locations produce approximately 8 million gallons of pollock oil every year as a byproduct of fishmeal plants. Much of the oil is used as boiler fuel for drying the fishmeal or exported to Pacific Rim markets for livestock and aquaculture feed supplements and other uses. In 2001, with assistance from the State of Alaska, processor UniSea Inc. conducted successful tests of raw fish oil/diesel blends in a 2.2 MW engine generator. Since then, the company has expanded the operation and now uses approximately one million gallons of up to 70% fish oil for power production each year. Currently state, federal, university, and industry groups are testing fish oil biodiesel generators and developing a portable demonstration module for recovering a portion of the estimated 13 million gallons of fish oil returned to the ocean each year as processing waste.

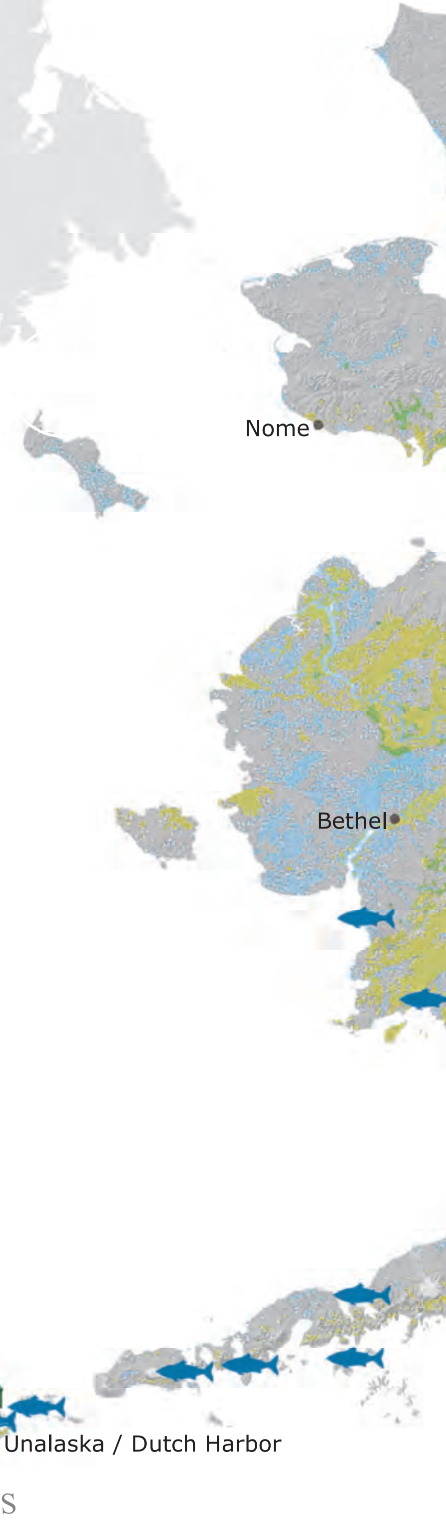
Alaska Energy Authority

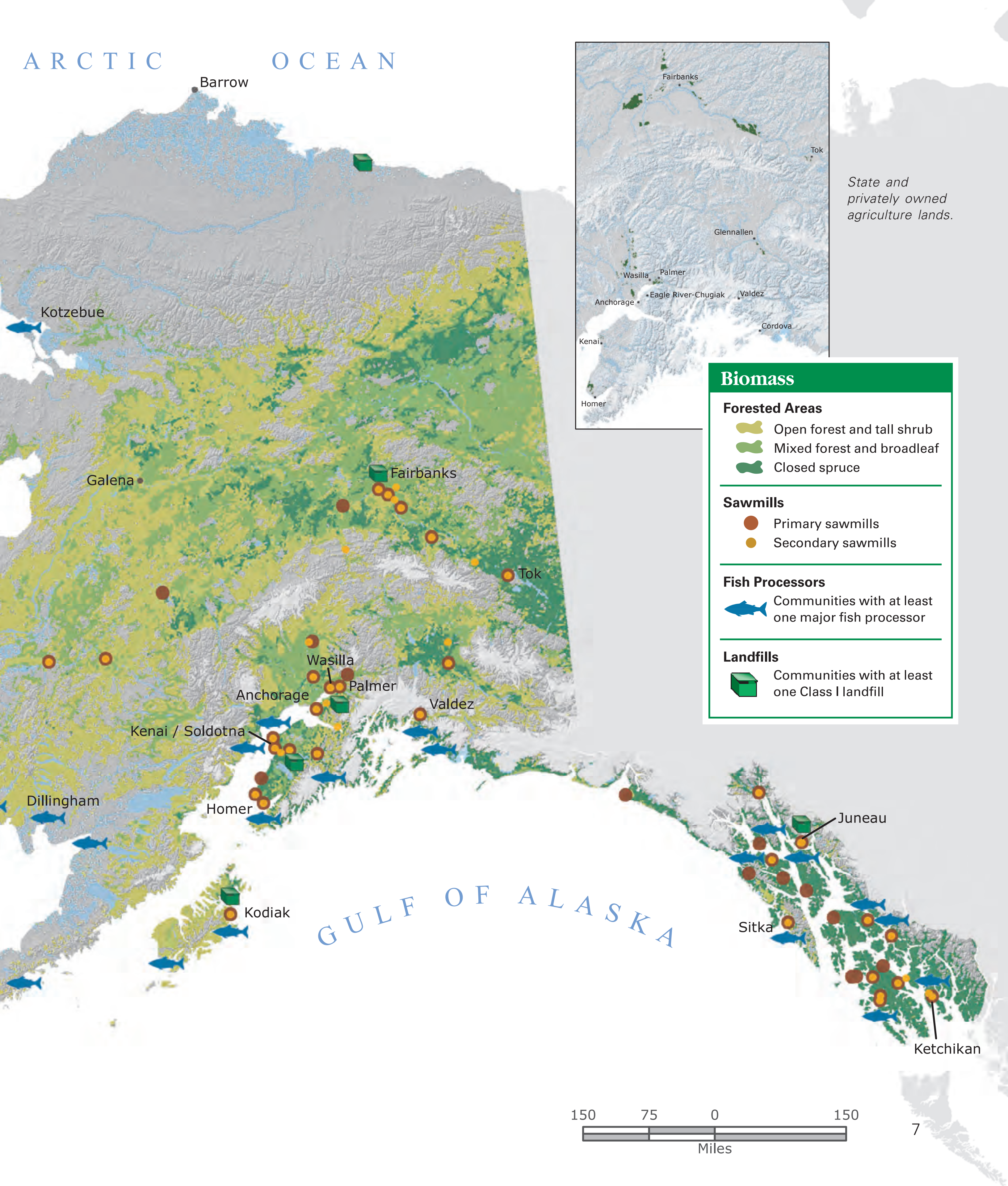
Raw fish oil and fish oil biodiesel from the Unisea plant in Dutch Harbor.

Local groups in Anchorage, Fairbanks, and other communities are converting waste fry oil into fuels for heating and transportation. Alaska Waste will open the first large-scale biodiesel refinery in Alaska in 2009, producing 500,000 gallons annually from waste vegetable oil from local restaurants. Alaska Waste plans to use the biodiesel to fuel up to 20% of its vehicle fleet.

Alaskans generate approximately 650,000 tons of garbage per year. In North Pole, Chena Power is developing a 400 kW power plant that will burn 4,300 tons of waste paper and other biomass annually. The Municipality of Anchorage and its partners are planning to convert methane gas from the city's landfill into electricity. The landfill gas project will produce 3 MW of power, yielding the equivalent energy of 2 million gallons of diesel per year, enough to supply 3,000 homes along the Railbelt.

It is also possible that Alaska's agricultural lands may be used to produce energy crops, such as rapeseed, to produce biodiesel.

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Barrow
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Galena
Fairbanks
Tok
Wasilla
Palmer
Anchorage
Valdez
Kenai / Soldotna
Dillingham
Homer
Kodiak
GULF OF ALASKA
Juneau
Sitka
Ketchikan
Fairbanks
Tok
Glennallen
Wasilla
Palmer
Eagle River-Chugiak
Valdez
Anchorage
Cordova
Kenai
Homer
State and privately owned agriculture lands.
Biomass
Forested Areas
Open forest and tall shrub
Mixed forest and broadleaf
Closed spruce
Sawmills
Primary sawmills
Secondary sawmills
Fish Processors
Communities with at least one major fish processor
Landfills
Communities with at least one Class I landfill
150
75
0
150
Miles

Geothermal

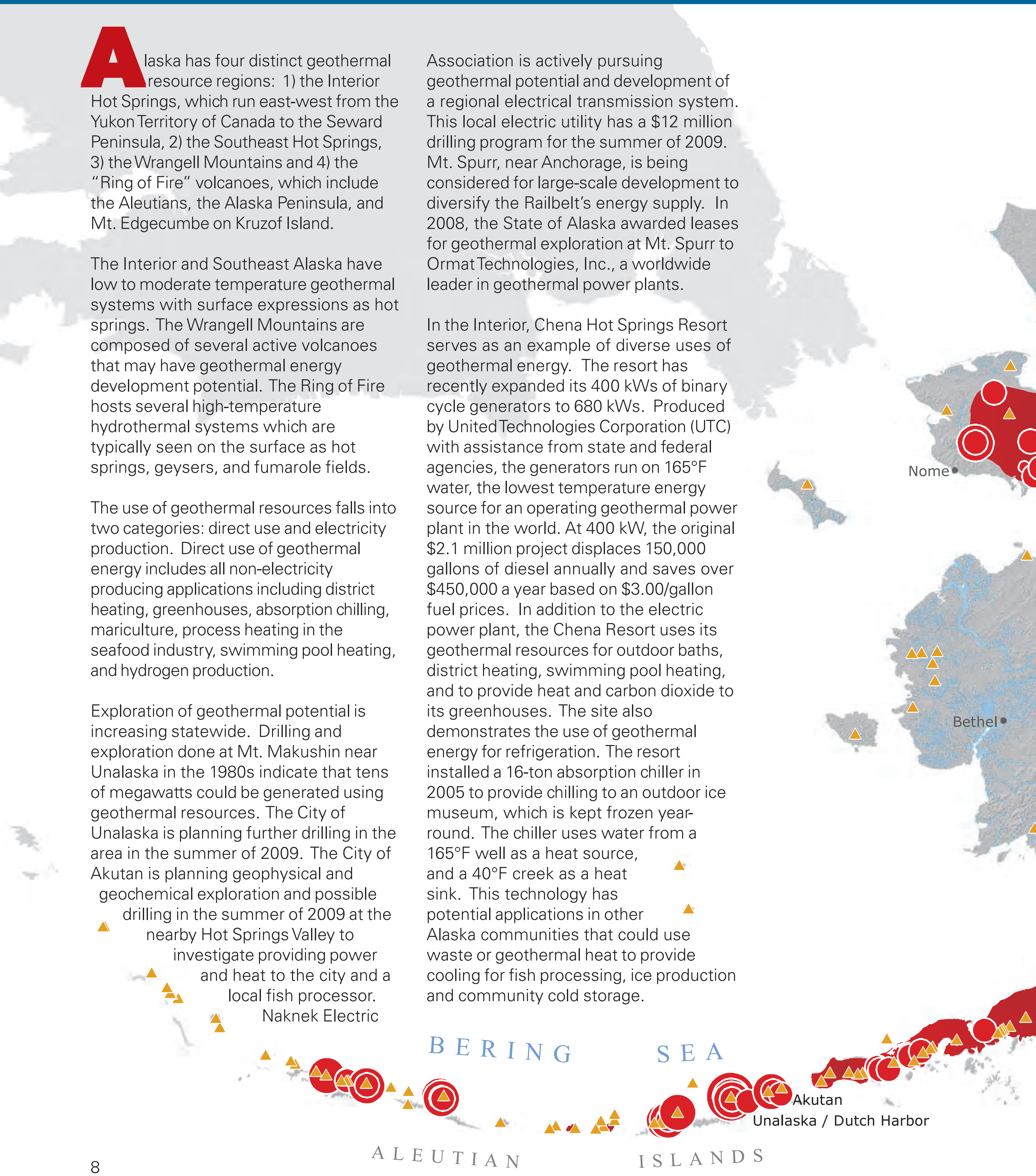
Alaska has four distinct geothermal resource regions: 1) the Interior Hot Springs, which run east-west from the Yukon Territory of Canada to the Seward Peninsula, 2) the Southeast Hot Springs, 3) the Wrangell Mountains and 4) the "Ring of Fire" volcanoes, which include the Aleutians, the Alaska Peninsula, and Mt. Edgecumbe on Kruzof Island.

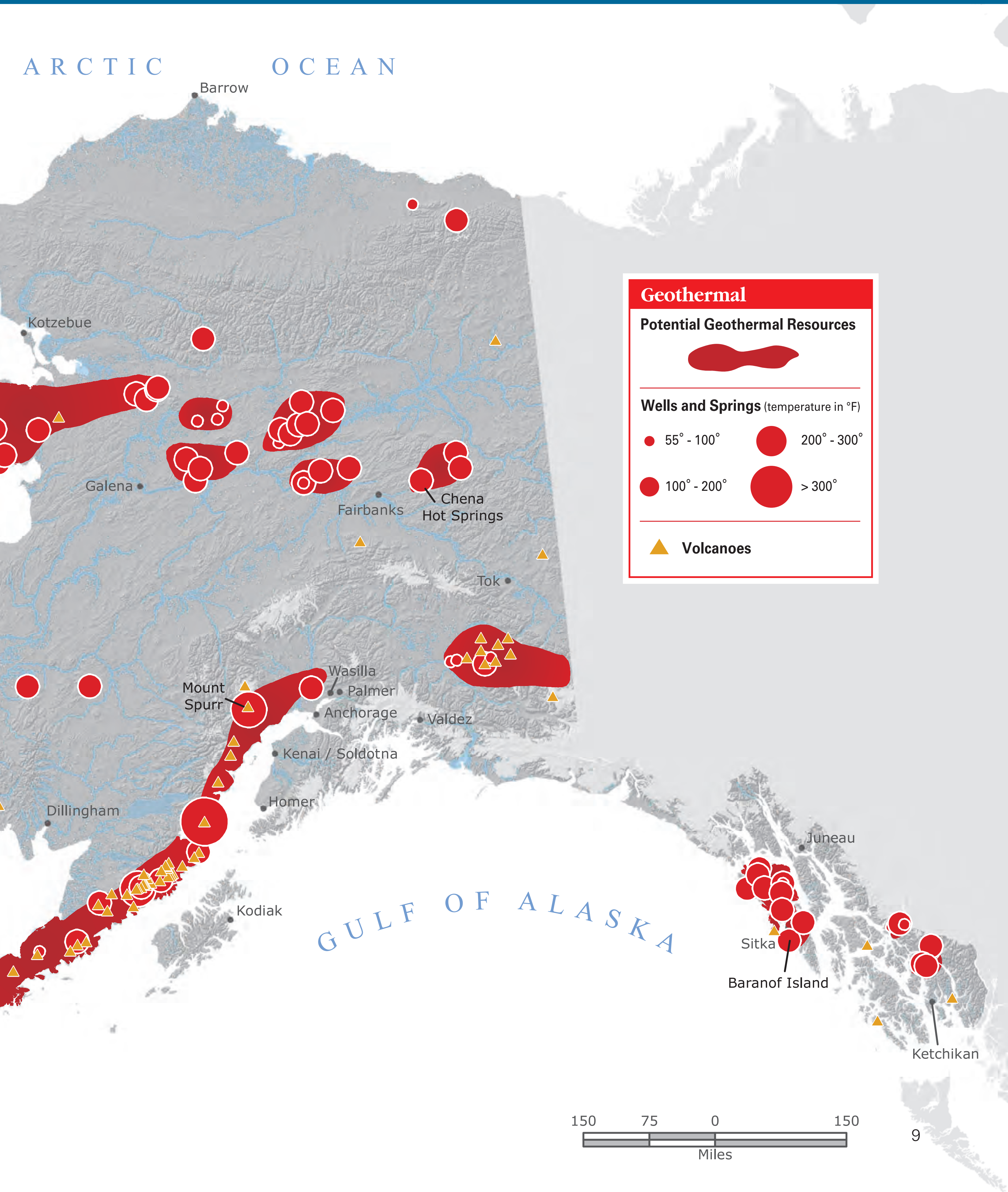
The Interior and Southeast Alaska have low to moderate temperature geothermal systems with surface expressions as hot springs. The Wrangell Mountains are composed of several active volcanoes that may have geothermal energy development potential. The Ring of Fire hosts several high-temperature hydrothermal systems which are typically seen on the surface as hot springs, geysers, and fumarole fields.

The use of geothermal resources falls into two categories: direct use and electricity production. Direct use of geothermal energy includes all non-electricity producing applications including district heating, greenhouses, absorption chilling, mariculture, process heating in the seafood industry, swimming pool heating, and hydrogen production.

Exploration of geothermal potential is increasing statewide. Drilling and exploration done at Mt. Makushin near Unalaska in the 1980s indicate that tens of megawatts could be generated using geothermal resources. The City of Unalaska is planning further drilling in the area in the summer of 2009. The City of Akutan is planning geophysical and geochemical exploration and possible drilling in the summer of 2009 at the nearby Hot Springs Valley to investigate providing power and heat to the city and a local fish processor. Naknek Electric Association is actively pursuing geothermal potential and development of a regional electrical transmission system. This local electric utility has a $12 million drilling program for the summer of 2009. Mt. Spurr, near Anchorage, is being considered for large-scale development to diversify the Railbelt's energy supply. In 2008, the State of Alaska awarded leases for geothermal exploration at Mt. Spurr to Ormat Technologies, Inc., a worldwide leader in geothermal power plants.

In the Interior, Chena Hot Springs Resort serves as an example of diverse uses of geothermal energy. The resort has recently expanded its 400 kWs of binary cycle generators to 680 kWs. Produced by United Technologies Corporation (UTC) with assistance from state and federal agencies, the generators run on 165°F water, the lowest temperature energy source for an operating geothermal power plant in the world. At 400 kW, the original $2.1 million project displaces 150,000 gallons of diesel annually and saves over $450,000 a year based on $3.00/gallon fuel prices. In addition to the electric power plant, the Chena Resort uses its geothermal resources for outdoor baths, district heating, swimming pool heating, and to provide heat and carbon dioxide to its greenhouses. The site also demonstrates the use of geothermal energy for refrigeration. The resort installed a 16-ton absorption chiller in 2005 to provide chilling to an outdoor ice museum, which is kept frozen year-round. The chiller uses water from a 165°F well as a heat source, and a 40°F creek as a heat sink. This technology has potential applications in other Alaska communities that could use waste or geothermal heat to provide cooling for fish processing, ice production and community cold storage.

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Valdez
Kenai / Soldotna
Homer
Dillingham
Kodiak
GULF OF ALASKA
Juneau
Sitka
Baranof Island
Ketchikan
Geothermal
Potential Geothermal Resources
Wells and Springs (temperature in °F)
55° - 100°
200° - 300°
100° - 200°
> 300°
Volcanoes
150
75
0
150
Miles

Hydroelectric

Hydroelectric power, Alaska's largest source of renewable energy, supplies 24% of the state's electrical energy. In 2009, 37 hydro projects provided power to Alaska utility customers, including the 126 MW state-owned Bradley Lake project near Homer, which supplies 8% of the Railbelt's electrical energy.

Most of the state's developed hydro resources are located near communities in Southcentral, the Alaska Peninsula, and Southeast – mountainous regions with moderate to high precipitation. Outside the Railbelt, major communities supplied with hydropower are Juneau, Ketchikan, Sitka, Wrangell, Petersburg, Kodiak, Valdez, Cordova, and Glenallen.

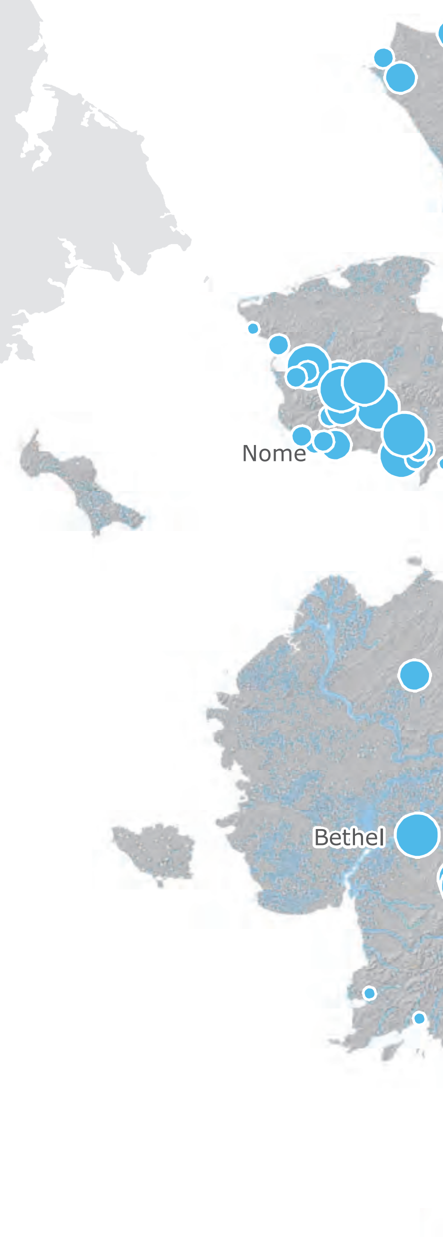
The 6 MW Blue Lake project near Sitka is an example of a project that stores energy by impounding water in a reservoir behind a dam. The dam is approximately 145 feet high with a spillway 342 feet above sea level and supplies 60 percent of Sitka's average electricity requirements. Plans are in the works to raise the dam 83 feet and increase the generating capacity to 18 MW.

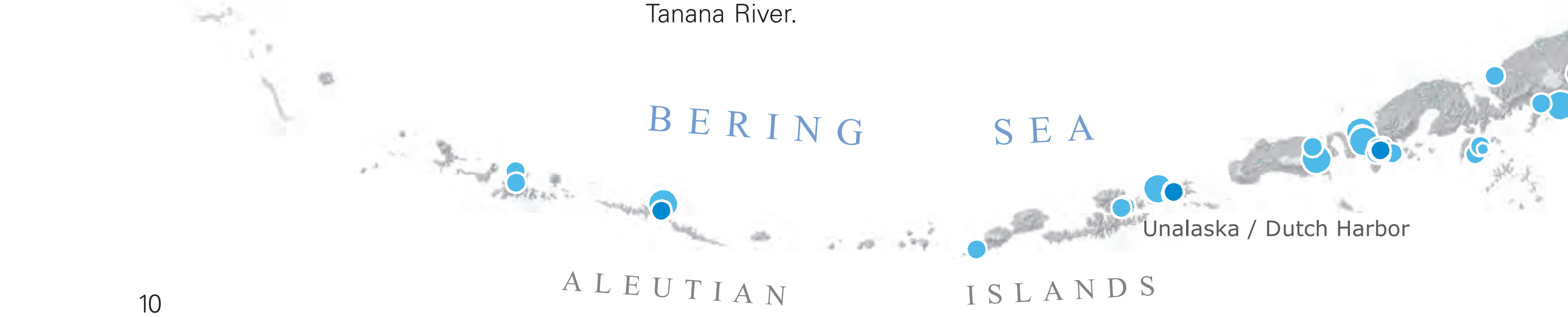
Other projects provide hydro storage without dam construction through the natural impoundment of an existing lake. The 31 MW Crater Lake project, part of the state-owned Snettisham project near Juneau, includes a "lake tap" near the bottom of the lake that supplies water to a powerhouse at sea level through a 1.5 mile tunnel.

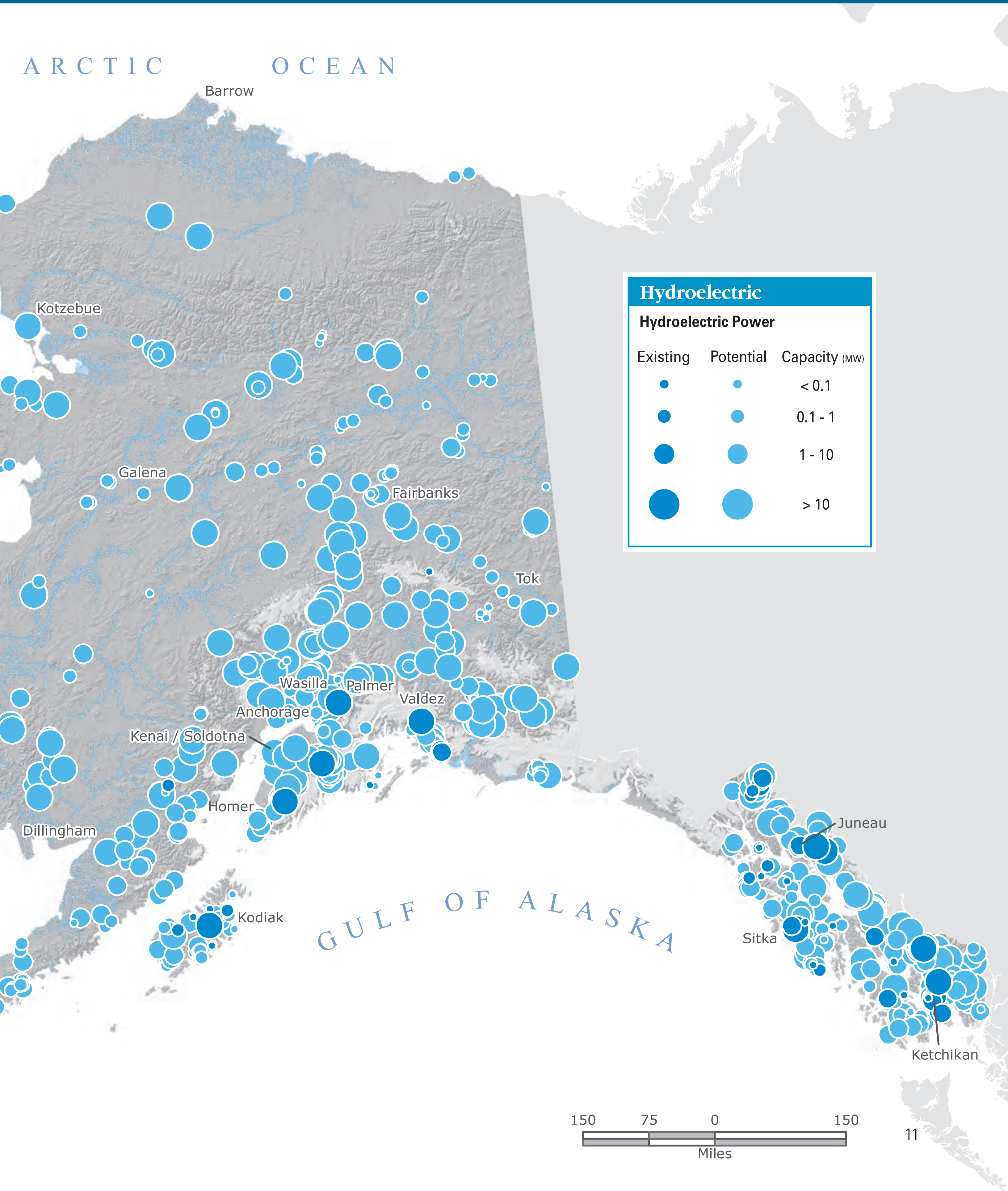
In contrast to projects providing storage, smaller "run-of-river" projects use more modest structures to divert a portion of the natural river flow through penstocks to turbines to make power. An example is the 824 kW Tazimina project near Iliamna where water is diverted into an intake 250 feet upstream from a 100-foot waterfall through a steel penstock to an underground powerhouse and then released back into the river near the base of the falls.

Two major projects first proposed in the 1980's are again under consideration: the Susitna and Chakachamna hydroelectric projects. The Susitna project would consist of one or two dams on the upper Susitna River about 45-80 miles northeast of Talkeetna. The ultimate capacity of these schemes ranges from 600 to 1880 MW of electricity. The 330 MW Lake Chakachamna project, located 85 miles west of Anchorage, would use a lake tap and a 10-mile tunnel to supply power to the Railbelt grid near Beluga.

Many rural communities located on the Yukon and other large rivers are interested in using river currents for generating power. This technology is referred to as river hydrokinetic or in-stream power. In the summer of 2008, the community of Ruby and the Yukon River Intertribal Watershed Council installed a 5 kW experimental river current turbine, the first in the world, to test feasibility of in-stream power generation on the Yukon River. This project team plans to continue testing a 5kW and eventually a 25kW turbine at Ruby. Alaska Power and Telephone has issued an RFP for a hydrokinetic device they plan to deploy at Eagle in 2010. The communities of Whitestone and Igiugig are also pursuing hydrokinetic projects. The Alaska Center for Energy and Power is developing a test center for hydrokinetic technology at Nenana on the Tanana River.



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Kenai / Soldotna
Homer
Dillingham
Kodiak
GULF OF ALASKA
Juneau
Sitka
Ketchikan
Hydroelectric
Hydroelectric Power
Existing
Potential
Capacity (MW)
< 0.1
0.1 - 1
1 - 10
> 10
150
75
0
150
Miles

Ocean

Alaska has 44,000 miles of coastline, more than all other states combined. This enormous resource gives Alaska great potential to develop energy from the ocean.

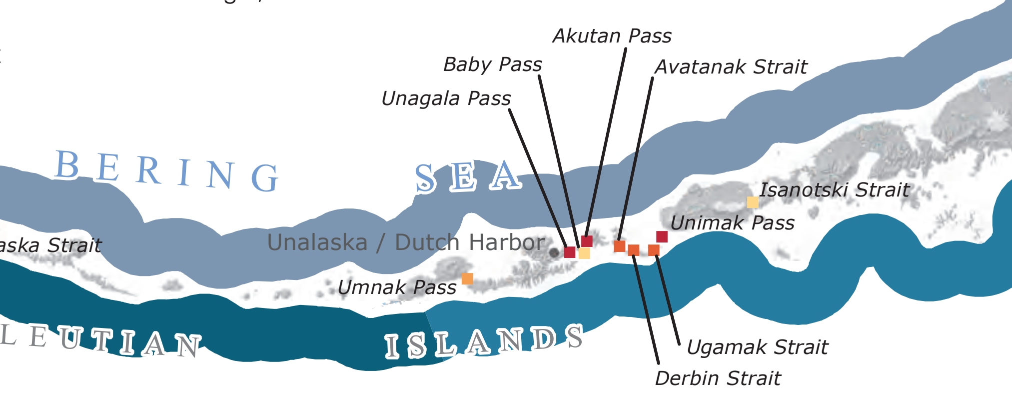
Ocean energy falls into three general categories: ocean thermal energy conversion (OTEC), tidal energy, and wave energy. OTEC applications are limited to tropical areas such as Hawaii and the southern Atlantic Coast. However, both tidal and wave energy have the potential to meet some of Alaska's energy needs. Some tidal energy technologies may also be used in river applications (*see Hydroelectric, page 10*).

Tidal energy is a concentrated form of the gravitational energy exerted by the moon and, to a lesser extent, the sun. This energy can be converted into electricity in two ways: by dams or impoundments that cause water to flow through turbines at high and low tidal stages, and by underwater turbines that are turned by kinetic tidal flow. Although tidal impoundments were studied in Alaska in the 1990s, as of 2009 only kinetic tidal projects are being investigated. One of the significant benefits of tidal energy is that the tides are predictable for centuries in advance.

Since 2006, the Alaska Energy Authority (AEA) has partnered with the Electric Power Research Institute (EPRI) to study wave and tidal energy potential in Alaska. The resulting reports are available on AEA's and EPRI's websites. This map gives estimates of average tidal flow electrical generation potential for 35 sites based on the assumption that 15% of the available energy is available for power generation. Cook Inlet, with North America's second largest tidal range, has attracted interest as an energy source for the Railbelt. Ocean Renewable Power Company, LLC obtained a FERC permit in 2008 to begin development of a demonstration tidal project, with plans to begin the construction of a commercial power plant in 2012. The world's first commercial-scale tidal generator, a 1.2 MW underwater turbine called SeaGen, was installed in Northern Ireland in 2008.

Wave energy is the result of wind acting on the ocean surface. Alaska has one of the best wave resources in the world, with parts of the Aleutian Islands coast averaging more than 50 kW per meter of wave front. The total wave power flux on southern Alaska's coast alone is estimated at 1,250 TWh per year, but the challenge to using wave energy is the lack of energy demand near the resource. Much of Alaska's wave energy is dissipated on remote, undeveloped shorelines. The greatest wave energy resources are at the western end of the Aleutian Chain, while substantial resources are found on the southern side of the Alaska Peninsula and the coastlines of Kodiak and southeast Alaska. The City of Yakutat has funded a wave energy feasibility study.

The world's first commercial wave energy farm, the Agucadora Wave Farm in Portugal, opened in September of 2008 with 2.5 MW generation capacity produced by three Pelamis Wave Energy Converters. Portugal plans to order 28 more Pelamis machines to complete the project with a total of 22.5 MW of generation capacity. The site is 5 kilometers off the coast of northern Portugal, near Povao de Varzim.

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Knik Arm
Fire Island
Palmer
Upper Cook Inlet
Wasilla
Pt Possession
Anchorage
Valdez
Creek
North Foreland
The Forelands
Kenai / Soldotna
Harriet Point
East of Kalgin Island
Cape Ninilchik
Bainbridge Passage
Homer
Dillingham
Clarks Point
Chugach Passage
Cape Current Narrows
Whale Passage
Kodiak
GULF OF ALASKA
North Inian Pass
North Passage (Icy Strait)
Juneau
South Passage (Icy Strait)
South Inian Pass
Kootzhanoo Inlet
Sergius Narrows
Turn Point
Sitka
South Ledge
Spike Rock
Tonowek Narrows
Ketchikan
Tlevak Narrows
Ocean
Tidal Electric Generation Potential
MW
1.3 - 25
75 - 100
25 - 50
100 - 220
50 - 75
Wave Power Potential
kW/m
26 - 30
40 - 50
30 - 40
50 - 56
150 75 0 150
Miles

Solar

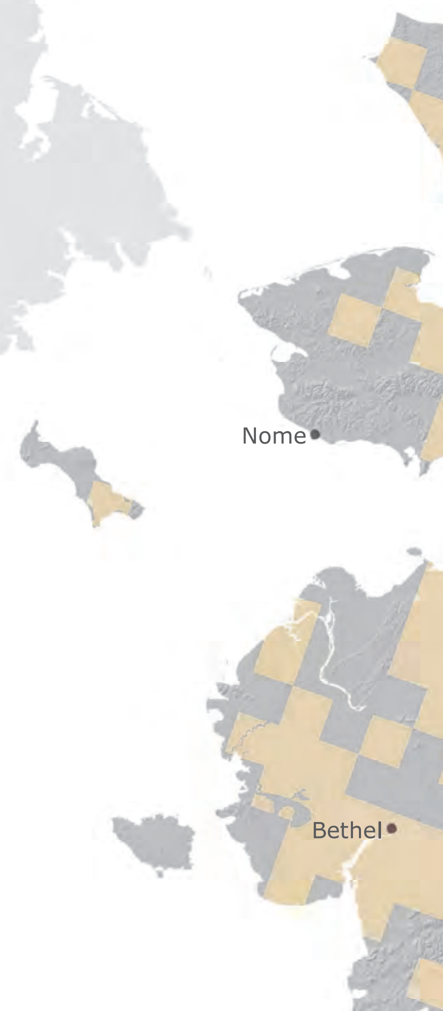
Although Alaska's high latitude presents the challenge of minimal solar energy during the long winter when energy demand is greatest, solar energy fulfills an important role in off-grid power generation and low power applications such as communications at remote sites.

In Alaska, careful house design and construction can minimize the use of heating fuel. "Passive solar" design includes proper southern orientation and the use of south facing windows that transfer the sun's energy into the house through the natural processes of conduction, convection, and radiation. Passive solar design employs windows, thermal mass, and proper insulation to enable the building itself to function as a solar collector.

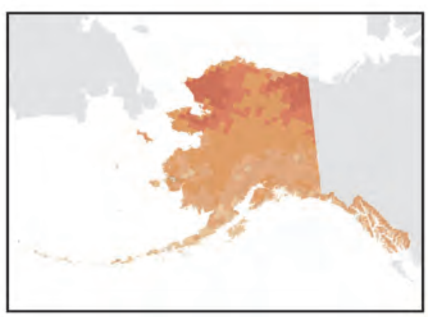
"Active solar" heating systems use pumps or fans to move energy to a point of use, such as a domestic hot water tank. A typical home demands a large amount of fuel year-round for domestic hot water, so using the sun to heat water for even seven or eight months a year saves significant amounts of energy. A larger role for active solar hot water systems may emerge as advances in heating systems allow solar heated fluid to supply in-floor systems currently heated by conventional fuel boilers.

A $600,000 grant from the Alaska Energy Authority will allow the Alaska Village Electric Cooperative to assess performance of utility-scale PV systems in villages. The proposed PV-diesel hybrid systems would provide solar-powered energy for much of the summer and some days during winter, with a diesel generator as backup to provide a stable energy supply.

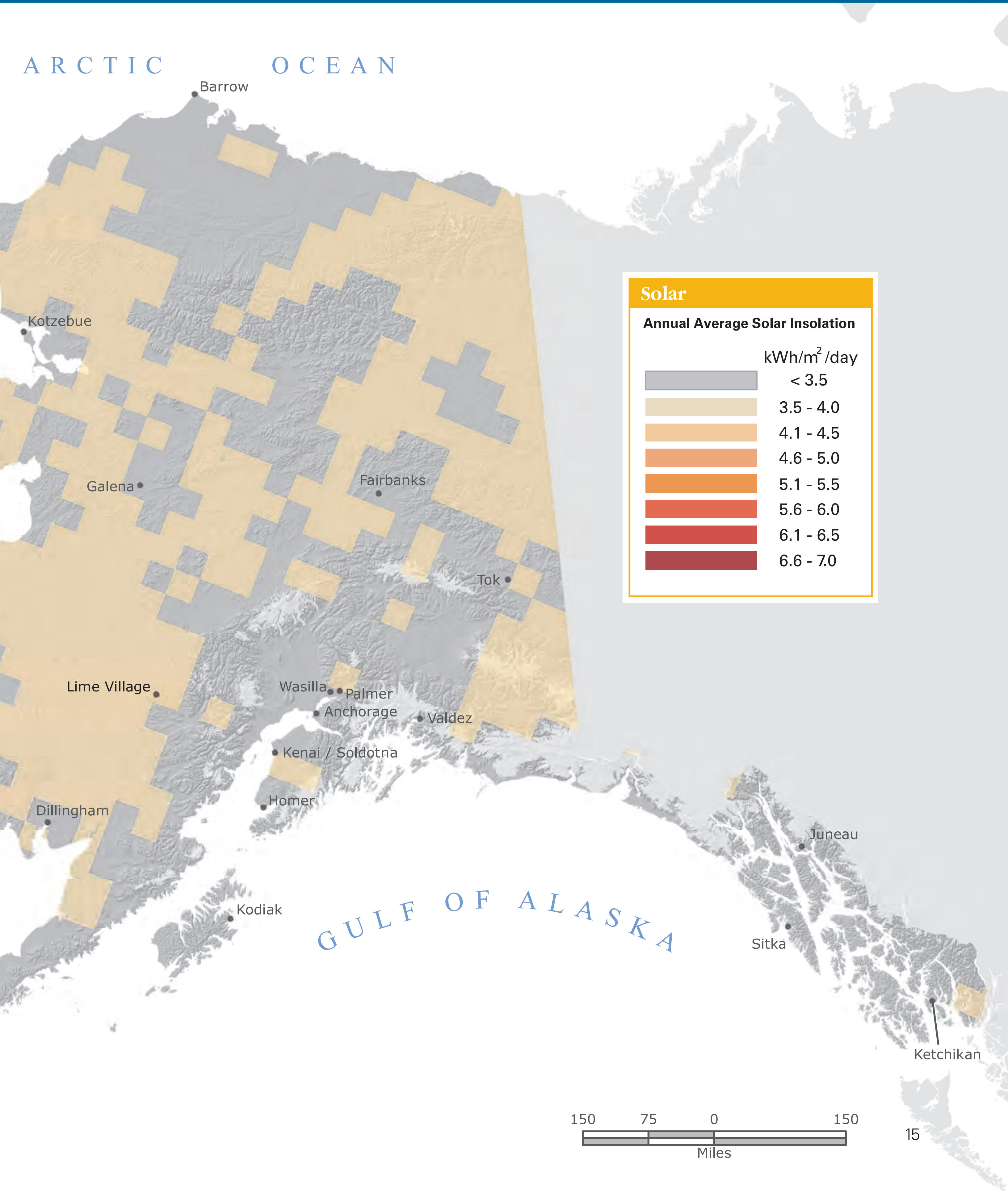
Although large utility-scale solar electric projects such as a 64 MW solar thermal plant in Nevada are being built in the Lower 48, significant utility-scale solar generation is unlikely in Alaska due to high capital costs and low yearly solar power output. For off-grid cabin owners, remote government installations, and other places where a relatively small amount of electricity is needed only during summer months and proven generation options are limited, solar photovoltaics remain a choice worth exploring. Currently photovoltaic is one of the most expensive electricity options for Alaska. However, as the price of solar panels continue to drop, more people are likely to consider solar electricity economical, especially if the cost of fossil-fueled electricity continues to rise.



December Average Insolation



June Average Insolation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GULF OF ALASKA
Sitka
Ketchikan
Solar
Annual Average Solar Insolation
kWh/m2/day
< 3.5
3.5 - 4.0
4.1 - 4.5
4.6 - 5.0
5.1 - 5.5
5.6 - 6.0
6.1 - 6.5
6.6 - 7.0
150
75
0
150
Miles

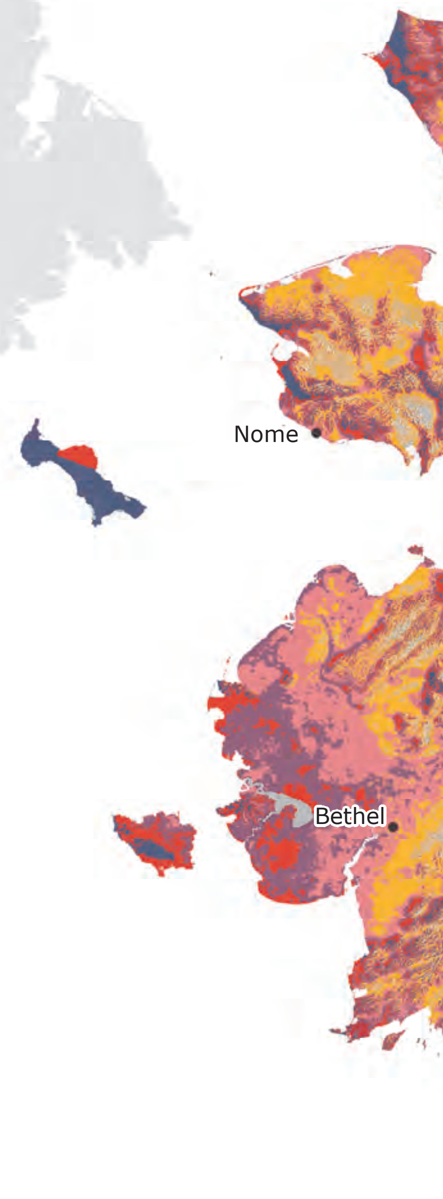
Wind

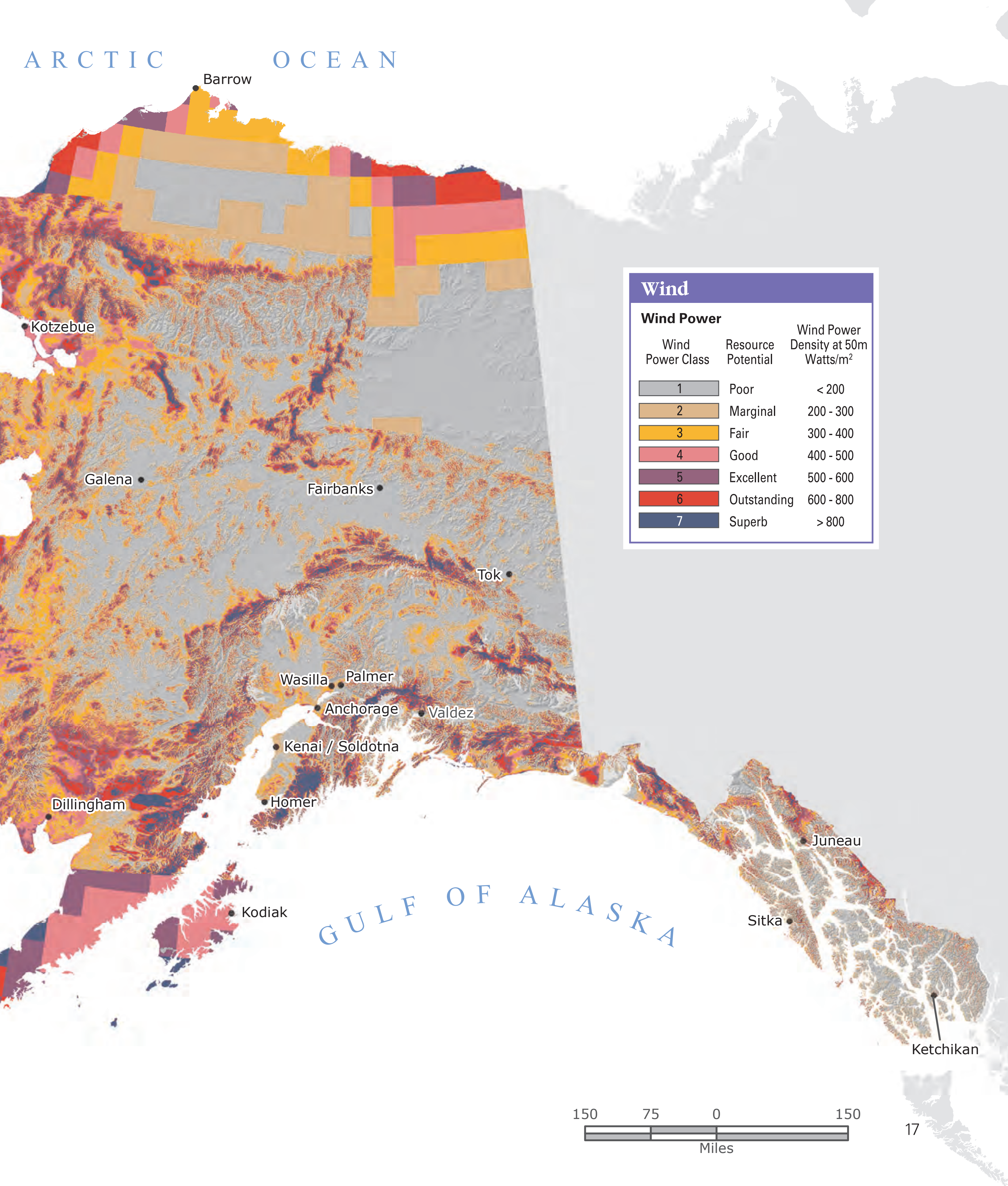
Alaska has abundant wind resources available for energy development. Costs associated with fossil fuels and improvements in wind power technology make this clean, renewable energy source attractive to many Alaskans. The wind map on these pages provides an initial indication of the potential for wind energy development. Wind power density, represented as watts per square meter, is divided into seven power classes. Wind energy feasibility depends on the size of electrical load, price of displaced fuel such as diesel or natural gas, foundation costs, and other site-specific variables.

Much of the best winds are located in the western and coastal portions of the state. In parts of southwest Alaska, turbines may actually need to be sited away from some of the best winds to avoid extreme gusts and turbulence. In the interior, average wind speeds tend to be much lower, although localized wind resources can be found near Healy and Delta. Katabatic winds, created by variation in air mass temperatures, are found in places like the upper Matanuska Valley and near Seward and Juneau. Site-specific wind resource data has been collected through the Alaska Energy Authority's anemometer loan program.

Wind power technologies currently being used or planned for use in Alaska range from small wind chargers at off-grid homes or remote camps, to medium-sized machines displacing diesel fuel in isolated village wind-diesel hybrid power systems, to large industrial turbines larger than 1 MW. On the Railbelt, several of the major utilities are examining wind power as a way to diversify future sources of energy and hedge against rising natural gas prices. Wind Energy Alaska's roughly 50 MW Fire Island project, located in a class 4 to 5 site west of Anchorage, is in the initial stages of permitting with hopes that power will be generated by mid-2011. Golden Valley Electric Association has also made substantial progress towards developing the roughly 25 MW Eva Creek wind project located near existing transmission lines north of Healy. Together these projects could provide approximately 5% of the Railbelt's electrical energy.

Alaska's first wind farm, located in Kotzebue in a Class 4 to 5 wind resource, has been displacing a portion of the utility's diesel fuel with wind power since 1997. On St. Paul Island in the Bering Sea, the Tanadgusix Corporation (TDX) takes advantage of a Class 7 wind resource to provide electricity, as well as heat produced from excess wind energy, to a large industrial facility. In the communities of Selawik, Hooper Bay, Toksook Bay, Savoonga, and Kasigluk, the Alaska Village Electrical Cooperative (AVEC) currently operates 15 turbines with a total installed capacity of 1,364 kW. An intertie from Toksook Bay also provides electricity to Nightmute and Tununak. AVEC plans to install a total of 1,200 kW of additional generating capacity in the villages of Toksook Bay, Chevak, Mekoryuk, Quinhagak and Gambell by 2010. The Chaninik Wind Group is working to install 450 kW in each of the villages of Kongiganak, Kwigillingok, Tuntutuliak, and Kipnuk in 2009. And in Kodiak the Kodiak Electrical Association is installing three 1.5 MW turbines at Pillar Mountain, with generation expected to begin in the fall of 2009.




ARCTIC OCEAN
Barrow
Kotzebue
Galena
Fairbanks
Tok
Wasilla
Palmer
Anchorage
Valdez
Kenai / Soldotna
Homer
Dillingham
Kodiak
Juneau
Sitka
Ketchikan
GULF OF ALASKA
Wind
Wind Power
Wind Power Class
Resource Potential
Wind Power Density at 50m Watts/m²
1 Poor < 200
2 Marginal 200 - 300
3 Fair 300 - 400
4 Good 400 - 500
5 Excellent 500 - 600
6 Outstanding 600 - 800
7 Superb > 800
150 75 0 150
Miles

Renewable Energy Policies

State and federal policies that encourage renewable energy projects play an important role in their development.

At the federal level, the production tax credit (PTC) is the primary incentive tool. The PTC was passed by Congress to even the playing field between the renewable energy industry and the heavily subsidized fossil fuel and nuclear industries. The PTC currently allows the owners of qualifying renewable energy projects to take 2.1 cents off their tax bill for every kilowatt-hour of renewable energy generated during the first ten years of the project. Though the tax credit is an important part of renewable energy project financing, one criticism of the PTC has been its short-term duration. Congress has typically reauthorized the tax credit for only one or two years at a time, making it difficult for investors to plan development of renewable energy resources far into the future. The current PTC expires December 31, 2012. Alternatively, wind and solar projects can choose to take advantage of a 30% federal investment tax credit (ITC) for facilities placed in service by 2013 if construction begins in 2009 or 2010.

Historically, individual state policies have been the primary drivers of renewable energy development in the United States. The three primary policies used across the country are net metering, renewable portfolio standards, and renewable energy funds. A fourth policy area focuses on state set electrical tariffs being used in countries like Canada, Germany, and Spain.

Net Metering

State net metering rules provide an incentive for individuals and businesses to invest in their own small renewable energy systems by allowing them to sell any excess power they produce back into the grid. Forty states now offer some form of net metering. Different rules in each state determine the maximum amount of power an individual can sell back to the utility, the price at which the utility must purchase the power, and the length of time an individual producer can "bank" the power they produce before a "net" bill must be calculated.

Rich Seifert

Home near Fairbanks that uses a combination of photovoltaic cells for power, an active solar water heater, and passive solar design.

Although it is possible for individuals to sell power back in some Alaska utility districts, Alaska does not have a statewide net metering law that would make it much easier to do so.

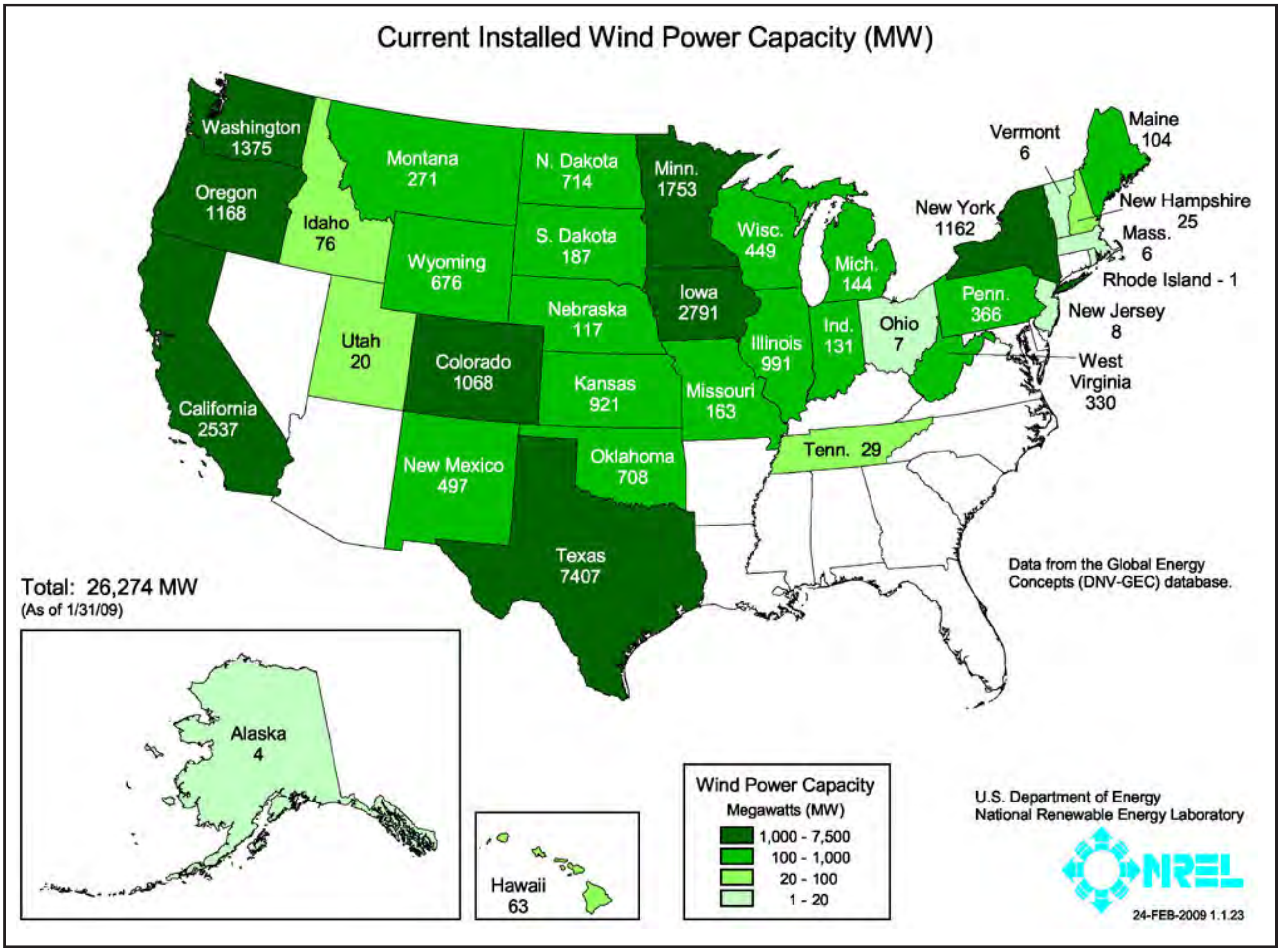
Alaska Energy Authority

Renewable energy creates jobs for Alaskans

The Homer Electric Association (HEA) and Fairbanks' Golden Valley Electric Association (GVEA) have developed Sustainable Natural Alternative Power (SNAP) programs. SNAPs allow customers who wish to support renewable energy development to do so by contributing to a fund that is held in escrow by the utility company. Individuals in the GVEA and HEA service areas who want to produce up to 25 kW of renewable electricity for the grid are paid from the escrow fund in proportion to the amount of power they produce, plus the utilities avoided fuel cost. Other cooperatives in Alaska are also considering starting their own SNAP programs.

Renewable Portfolio Standards

Twenty-eight states and the District of Columbia now have a policy known as a renewable portfolio standard (RPS), and an additional 5 states have set a less binding renewable energy goal. An RPS is a state law that requires utility companies to generate a specified percentage of their electricity from renewable resources by a certain date. For example, Nevada law mandates that investor owned utilities in that state produce 20% of their electricity from renewables by the year 2015. The percentage and the end date range widely across the various states that have an RPS. Utilities are typically given interim milestones, and must pay a fine if they do not reach those milestones. Most states allow utilities to purchase renewable energy credits (RECs)



National Renewable Energy Laboratory

Wind is the fastest growing energy sector in the world. The U.S. moved to 1st place in total installed wind generation capacity, passing Germany in 2008, though the U.S. only generates around 1% of its electricity from wind. Denmark already generates over 20% of its electricity from wind, followed by Spain at 12% and Portugal at 9%.

to meet the RPS standard and avoid paying fines. The RPS approach makes different entities and renewable energy resources compete to meet the standard.

Currently, there are several bills being heard in Congress to create a mandatory national Renewable Electricity Standard (RES).

Renewable Energy Funds / System Benefit Charges

Eighteen states, including Alaska, have renewable energy funds (sometimes called clean energy funds), most of which are supported by small, mill-rated surcharges on energy sold to consumers. These surcharges are sometimes referred to as system benefit charges. Renewable energy funds provide support for the development of renewable energy by helping to remove market barriers, lowering financing costs, developing infrastructure, and educating the public. For example, the system benefit charges in Oregon are deposited into an independent trust that funds eligible wind, solar electric, biomass, small-scale hydro, tidal, geothermal, and fuel cell projects. These projects are supported by grants, loans, rebates, equity investments, and other financing mechanisms used by the fund.

Terms of the various funds vary from state to state. Some states have scheduled funds to last only five years. Other states have open-ended funds. Longer-term funds provide greater stability for renewable energy developers. It's estimated that over the next 10 years the combined renewable energy funds of the 18 states will invest about $3.5 billion in renewable energy generation.

Kotzebue Electric Association

Four 66 kW Integrity wind turbines that make up part of Kotzebue Electric Association's 1,155 kW wind farm. In a typical year, the 17-turbine wind farm displaces over 100,000 gallons of diesel fuel.

In the states that have both an RPS and a renewable energy fund, the two policies work together to stimulate the renewable energy market. RPS standards "pull" renewable energy technologies into a state by providing a long-term market that reduces investment risk and provides a level playing field for developers. On the other hand, renewable energy funds "push" clean energy technologies by lowering market barriers through direct investment incentives and supporting the infrastructure needed to develop renewable energy. For example, in California, the fund is used to buy down the above-market costs of renewable energy. And of course, the development that takes place as a result of renewable energy funds helps states meet their RPS requirements.

Renewable Energy Credits (RECs)

Utilities recognized years ago that there was a market demand for clean, renewable energy when customers agreed to pay more for resources like wind. Today, rather than charging a premium for renewable source power, most utilities sell the social and environmental attributes of renewable energy separately from the actual electrons in the form of certificates. Also known as "green tags," renewable energy certificates (RECs) are essentially the bragging rights that are created when renewable energy is produced. Each REC represents the production of one megawatt hour of renewable energy and the displacement of approximately 1,400 pounds of CO_2 emissions. Buyers of RECs include utilities trying to meet state RPS requirements, as well as a growing number of federal agencies and corporations committed to supporting increased renewable energy production. For example, the Fortune 500 company Whole Foods is buying RECs from wind farms to offset 100% of the electricity used in all of its facilities in the United States and Canada.

The Bonneville Environmental Foundation (BEF) offers RECs containing renewable energy from Alaska. Carbon offsets are available through the BEF website, and businesses and individuals can contact BEF to discuss the purchase of RECs containing the social and environmental attributes from small village wind projects in rural Alaska.

Alaska Volcano Observatory

Steam vent on Kiska Volcano in the Aleutian Islands. Several communities in the Aleutians are considering developing their geothermal resources.

Electricity Feed Laws and Advanced Renewable Tariffs

Electricity feed laws and advanced renewable tariffs (ARTs) are used in a number of European countries and are considered by many to be the world's most successful policy mechanism for stimulating rapid renewable energy development. They give renewable energy producers guaranteed access to the electric grid at a price set by the regulatory authority, giving producers the contractual certainty needed to finance renewable energy projects. They also enable homeowners, farmers, cooperatives and others to participate on an equal footing with large commercial developers of renewable energy. Currently 16 countries in the European Union use some form of feed law.

ARTs are the modern version of Feed Laws. They differ from the simpler feed laws in several important ways. Tariffs are differentiated by technology , project size or, in the case of wind energy, by the productivity of the resource. Tariffs for new projects are also subject to periodic review to determine if the program is sufficiently robust. For example, programs are reviewed every two years in France, and every three years in Germany.

In 2006, the Canadian province of Ontario enacted a type of Advanced Renewable Tariff called a Standard Offer Contract, which offers 20-year contracts at 11 cents/kWh (Canadian) to producers of wind, biomass and small hydro energy and 42 cents/kWh for solar photovoltaic energy. The contracts are available to anyone with a project under 10 MW, including homeowners, businesses and commercial energy producers.

Many commentators are looking to Ontario's policy to become a model that other North America jurisdictions will follow. Recently the State of Washington passed a modest version of a feed law for small solar projects. It gives businesses and homes with solar photovoltaics a credit of 15 cents/kWh for electricity generated by the PV system. The credit is capped at $2,000 annually and runs until 2015. The law also combines economic multipliers to increase the system owner's credit up to 54 cents/kWh if the project's components are manufactured in Washington. In 2008, California enacted the United States' first ART, which allows for 10, 15, or 20 year contracts between utility companies and small (less than 1.5 MW) renewable energy producers. The price paid for renewable energy varies depending on the California Public Utilities Commission's determined market price and the time of day, with higher prices paid during times of peak demand. Legislation for feed-in tariffs is also being drafted in several other states.

Chris Rose, REAP

Hydrogen filling station in Reykjavik, Iceland. Iceland gets 99% of its electricity and over 90% of heat for buildings from its geothermal and hydroelectric resources. The government's goal is to be the first nation in the world to replace its use of fossil fuels in autos and boats with hydrogen fuel.

Alaska

2008 was a landmark year for renewable energy and energy efficiency in Alaska. The Cold Climate Housing Research Center published a report outlining recommended state programs, initiatives, and goals to reduce end-use energy demand and save up to $840 million over the next 5 years, and the State Legislature appropriated $360 million for home weatherization and rebate programs. 2008 also saw the passage of H.B. 152, which established the Renewable Energy Grant Program administered by the Alaska Energy Authority. In the Fund's first two years the Legislature has appropriated $125 million for grants for qualifying projects, with the most weight given to projects that serve communities with the highest energy costs.

In 2009, the Alaska Energy Authority and the Alaska Center for Energy and Power completed a comprehensive survey of energy resources in Alaska entitled "Alaska Energy: A First Step Towards Energy Independence." This survey will act as a tool by which state and local leaders can educate and engage the public in building a new comprehensive and diversified energy policy for Alaska.

Glossary

Absorption Chiller – A device that uses heat energy rather than mechanical energy to cool an interior space through the evaporation of a volatile fluid.

Active Solar – A solar water or space-heating system that uses pumps or fans to circulate the fluid (water or heat-transfer fluid like diluted antifreeze) from the solar collectors to a storage tank subsystem.

Alternative Fuels – A term for "non-conventional" transportation fuels derived from natural gas (propane, compressed natural gas, methanol, etc.) or biomass materials (ethanol, methanol, or biodiesel).

Anemometer – An instrument for measuring the velocity of wind; a wind gauge.

ASTM – Abbreviation for the American Society for Testing and Materials, which is responsible for the issue of many standard methods used in the energy industry.

Availability – Describes the reliability of power plants. It refers to the number of hours that a power plant is available to produce power divided by the total hours in a set time period, usually a year.

Avoided Cost – The incremental cost to an electric power producer to generate or purchase a unit of electricity or capacity or both.

Biodiesel – A domestic, renewable fuel for diesel engines derived from natural oils like fish and vegetable oil; produced by a chemical process which removes the glycerin from the oil and meets a national specification (ASTM D 6751)

Biomass – Organic matter that is available on a renewable basis, including agricultural crops and agricultural wastes and residues, wood and wood wastes and residues, animal wastes, municipal wastes, and aquatic plants.

Bioenergy – Electrical, mechanical, or thermal energy or fuels derived from biomass.

Capacity Factor – The ratio of the average power output of a generating unit to the capacity rating of the unit over a specified period of time, usually a year.

Co-firing – Using more than one fuel source to produce electricity in a power plant. Common combinations include biomass and coal, biomass and natural gas, or natural gas and coal.

Cogeneration – The generation of electricity and the concurrent use of rejected thermal energy from the conversion system as an auxiliary energy source.

Conduction – The transfer of heat through a material by the transfer of kinetic energy from particle to particle; the flow of heat between two materials of different temperatures that are in direct physical contact.

Convection – The transfer of heat by means of air currents.

Dam – A structure for impeding and controlling the flow of water in a watercourse that increases the water elevation to create hydraulic head. The reservoir creates, in effect, stored energy.

District Heating System – Local system that provides thermal energy through steam or hot water piped to buildings within a specific geographic area. Used for space heating, water heating, cooling, and industrial processes. A common application of geothermal resources.

Distributed Generation – Localized or on-site power generation, which can be used to reduce the burden on a transmission system by generating electricity close to areas of customer need.

Distribution Line – One or more circuits of an electrical distribution system on the same line or poles or supporting structures, usually operating at a lower voltage relative to a transmission line.

Domestic Hot Water – Water heated for residential washing, bathing, etc.

Electrical Energy – The amount of work accomplished by electrical power, usually measured in kilowatt-hours (kWh). One kWh is 1,000 Watts generated for one hour and is equal to 3,413 Btu.

Energy – The capability of doing work; different forms of energy can be converted to other forms, but the total amount of energy remains the same.

Energy Crop – A plant grown with the express purpose to be used in biomass electricity or thermal generation.

Energy Storage – the process of storing, or converting energy from one form to another, for later use. Storage devices and systems include batteries, conventional and pumped storage hydroelectric, flywheels, compressed gas, hydrogen, and thermal mass.

Ethanol – A colorless liquid that is the product of fermentation used in alcoholic beverages, in industrial processes, and as a fuel.

Feedstock – A raw material that can be converted to one or more products.

Fossil Fuels – Fuels formed in the ground from the remains of dead plants and animals, including oil, natural gas, and coal. It takes millions of years to form fossil fuels.

Fuel – Any material that can be burned to make energy.

Fuel Oil – Any liquid petroleum product burned for the generation of heat in a furnace or firebox, or for the generation of power in an engine. Domestic (residential) heating fuels are classed as Nos. 1, 2, 3; Industrial fuels as Nos. 4, 5, 6.

Generator – A device for converting mechanical energy to electrical energy.

Geothermal Energy – Energy produced by the internal heat of the earth; geothermal heat sources include hydrothermal convective systems; pressurized water reservoirs; hot dry rocks; manual gradients; and magma. Geothermal energy can be used directly for heating and cooling or to produce electric power.

Head – A measure of fluid pressure, commonly used in water pumping and hydro power to express height that a pump must lift water, or the distance water falls. Total head accounts for friction and other head losses.

Heat Pump – An electricity powered device that extracts available heat from one area (the heat source) and transfers it to another (the heat sink) to either heat or cool an interior space or to extract heat energy from a fluid.

Hybrid System - An energy system that includes two different types of technologies that produce the same type of energy; for example, a wind turbine and a solar photovoltaic array combined to meet electric power demand.

Hydroelectric Power Plant – A power plant that produces electricity by the force of water falling through a hydro turbine that spins a generator.

Hydrogen – A chemical element (H_2) that can be used as a fuel since it has a very high energy content.

Landfill Gas – Naturally occurring methane produced in landfills that can be burned in a boiler to produce heat or in a gas turbine or engine-generator to produce electricity.

Large-scale or Utility-scale – A power generating facility designed to output enough electricity for purchase by a utility.

Load – Amount of electricity required to meet customer demand at any given time.

Meteorological (Met) Tower – A structure instrumented with anemometers, wind vanes, and other sensors to measure the wind resource at a site.

Ocean Energy Systems – Energy conversion technologies that harness the energy in tides, waves, and thermal gradients in the ocean.

Ocean Thermal Energy Conversion (OTEC) – The process or technologies for producing energy by harnessing the temperature differences between ocean surface waters and that of ocean depths.

Organic Rankine Cycle – A system that uses a hydrocarbon instead of water as a working fluid to spin a turbine, and therefore can operate at lower temperatures and pressures than a conventional steam process.

Panel (Solar) – A term generally applied to individual solar collectors, and typically to solar photovoltaic collectors or modules.

Passive Solar Design – Construction of a building to maximize solar heat gain in the winter and minimize it in the summer, thereby reducing the use of mechanical heating and cooling systems.

Peak Load – The amount of electricity required to meet customer demand at its highest.

Penstock – A component of a hydropower plant; a pipe that delivers water to the turbine.

Photovoltaics (PV) – Devices that convert sunlight directly into electricity using semiconductor materials. Most commonly found on a fixed or movable panel; also called solar panels.

Power – Energy that is capable of doing work; the time rate at which work is performed, measured in horsepower, Watts, or Btu per hour.

Production Tax Credit (PTC) – An incentive that allows the owner of a qualifying energy project to reduce their taxes by a specified amount. The federal PTC for wind, geothermal, and closed-loop biomass is 2.1 cents per kWh.

Radiation – The transfer of heat through matter or space by means of electromagnetic waves.

Railbelt – The portion of Alaska that is near the Alaska Railroad, generally including Fairbanks, Anchorage, and the Kenai Peninsula.

Renewable Resource – Energy sources which are continuously replenished by natural processes, such as wind, solar, biomass, hydroelectric, wave, tidal, and geothermal.

Run-of-River Hydroelectric – A type of hydroelectric facility that uses the river flow with very little alteration and little or no impoundment of the water.

Small-scale or Residential-scale – A generating facility designed to output enough electricity to offset the needs of a residence, farm or small group of farms, generally 250 kW or smaller.

Solar Energy – Electromagnetic energy transmitted from the sun (solar radiation).

Solar Radiation – A general term for the visible and near visible (ultraviolet and near-infrared) electromagnetic radiation that is emitted by the sun. It has a spectral, or wavelength, distribution that corresponds to different energy levels; short-wavelength radiation has a higher energy than long-wavelength radiation.

Tidal Power – The power available from either the rise and fall or flow associated with ocean tides.

Transmission Grid – The network of power lines and associated equipment required to deliver electricity from generating facilities to consumers through electric lines.

Turbine – A device for converting the flow of a fluid (air, steam, water, or hot gases) into mechanical motion.

Wave Energy – Energy derived from the motion of ocean waves.

Wind Energy – Energy derived from the movement of the wind across a landscape. Wind is caused by the sun differentially heating the atmosphere, earth, and oceans.

Wind Turbine – A device that converts energy in the wind to electrical energy, typically having two or three blades.

Windmill – A device that converts energy in the wind to mechanical energy that is used to grind grain or pump water.

Wind Power Class – A class based on wind power density ranging from 1 (worst) to 7 (best).

Wind Power Density – The amount of power per unit area of a free windstream.

Wind Resource Assessment – The process of characterizing the wind resource, and its energy potential, for a specific site or geographical area.

UNITS

Ampere – A unit of measure for an electrical current; the amount of current that flows in a circuit at an electromotive force of one Volt and at a resistance of one Ohm. Abbreviated as amp.

Amp-Hours – A measure of the flow of current (in amperes) over one hour.

Barrel (Petroleum) – Equivalent to 42 U.S. gallons (306 pounds of oil, or 5.78 million Btu).

British Thermal Unit (Btu) – The amount of heat required to raise the temperature of one pound of water one degree Fahrenheit; equal to 252 calories.

Cord (of Wood) – A stack of wood 4 feet by 4 feet by 8 feet.

Gigawatt (GW) – A unit of power equal to 1 billion Watts, 1 million kilowatts, or 1,000 megawatts.

Hertz – A measure of the number of cycles or wavelengths of electrical energy per second; U.S. electricity supply has a standard frequency of 60 hertz.

Horsepower (hp) – A measure of time rate of mechanical energy output, usually applied to electric motors as the maximum output; 1 electrical hp is equal to 0.746 kilowatts or 2,545 Btu per hour.

Kilowatt (kW) – A standard unit of electrical power equal to one thousand watts, or to the energy consumption at a rate of 1000 Joules per second.

Kilowatt-hour (kWh) – A common measurement of electricity equivalent to one kilowatt of power generated or consumed over the period of one hour; equivalent to 3,413 Btu.

Megawatt (MW) – One thousand kilowatts, or 1 million watts; standard measure of electric power plant generating capacity.

Megawatt-hour (MWh) – One thousand kilowatt-hours or 1 million watt-hours.

Mill – A common monetary measure equal to one-thousandth of a dollar or a tenth of a cent.

Quad – One quadrillion Btu. (1,000,000,000,000,000 Btu)

Therm – A unit of heat containing 100,000 British thermal units (Btu)

Terawatt (TW) – A unit of electrical power equal to one trillion watts or one million megawatts.

Tonne – A unit of mass equal to 1,000 kilograms or 2,204.6 pounds, also known as a metric ton.

Volt (V) – A unit of electrical force equal to that amount of electromotive force that will cause a steady current of one ampere to flow through a resistance of one ohm.

Watt (W) – Instantaneous measure of power, equivalent to one ampere under an electrical pressure of one volt. One watt equals 1.746 housepower, or one joule per second. It is the product of voltage and current (amperage)

Watt-hour – A unit of electricity consumption of one Watt over the period of one hour.

Watts per Square Meter (W/m^2) – Unit used to measure wind power density, measured in Watts per square meter of blade swept area.

Data Sources

References

Common Map Layers

(1) Communities: State of Alaska Department of Commerce, Community, and Economic Development. Community Database Online.
www.commerce.state.ak.us/dca/commdb/CF_COMDB.htm

(2) Lakes, Streams, and Glaciers: State of Alaska Department of Natural Resources (ADNR).
www.asgdc.state.ak.us/metadata/vector/physical/hydro/lk2mil.html

(3) Grayscale Elevation Hillshade Image: Resource Data Inc.
The elevation image was developed using a 300 meter digital elevation model from U.S. Geological Survey EROS Alaska Field Office.
www.asgdc.state.ak.us/metadata/raster/elev/elev300m.html

(4) Canada and Russia: State of Alaska Department of Natural Resources.
www.asgdc.state.ak.us/metadata/vector/physical/coast/canada.html
www.asgdc.state.ak.us/metadata/vector/physical/coast/russia.html

Infrastructure

Average generation from Alaska Electric Power Statistics (with Alaska Energy Balance) 1960-2001, University of Alaska Anchorage Institute of Social and Economic Research, 2003. www.iser.uaa.alaska.edu/Publications/akelectricpowerfinal.pdf

Pie chart from Alaska Electric Power Statistics 1960-2001, and AEA estimates for non-hydro renewables.

(5) Coal, Gas Turbine, and Diesel sites*: Institute of Social and Economic Research (ISER). Alaska Electric Power Statistics (with Alaska Energy Balance) 1960-2001.

(6) Existing Utility Hydroelectric sites: Alaska Energy Authority hydroelectric database. Spatial location and attribute data updated by HDR Alaska Inc. in 2006.

(7) Wind, Solar, Geothermal, and Biomass sites*: Alaska Energy Authority.

(8) Electrical Interties: Interties aggregated from data provided by Alaska Electric Light & Power Company, Alaska Power & Telephone Company, Alaska Village Electric Cooperative, Chugach Electric Association, City of Sitka Electric Department, Copper Valley Electric Association, Four Dam Pool Association, Golden Valley Electric Association, Homer Electric Association, Naknek Electric Association, and Nushagak Cooperative.

(9) Natural Gas Pipelines: ENSTAR Natural Gas Company.

(10) Electric Service Areas: Chugach Electric Association.

(11) Trans-Alaska Pipeline: State of Alaska Department of Natural Resources.
www.asgdc.state.ak.us/metadata/vector/trans/pipeline.html

(12) Railroad: State of Alaska Department of Natural Resources.
www.asgdc.state.ak.us/metadata/vector/trans/rail2mil.html

(13) Roads: State of Alaska Department of Natural Resources & State of Alaska Department of Transportation.
www.asgdc.state.ak.us/metadata/vector/trans/road2mil.html
www.asgdc.state.ak.us/metadata/vector/othermet/akhwysy.html

Biomass

(14) Forested Areas: U.S. Forest Service, U.S. Geological Survey, and State of Alaska Division of Forestry Forest Health Monitoring Clearinghouse.
http://agdc.usgs.gov/data/projects/fhm/index.html#G
http://agdcftp1.wr.usgs.gov/pub/projects/fhm/vegcls.txt

Vegetation classes for the map selected from source dataset classes as follows:
Open forest and tall shrub: Class 10, 15
Mixed spruce and broadleaf: Class 11, 12, 14, 16, 18
Closed spruce: Class 13, 17, 19

(15) Fish Processing Plants*: Alaska Energy Authority.
Plant locations are a subset of a fish biodiesel database.

(16) Class I Landfills*: State of Alaska Department of Environmental Conservation.

(17) Sawmills*: Alaska Wood Products Manufacturers Directory, September 2004. Juneau Economic Development Council Wood Products Development Service.
www.jedc.org/wood/index.htm

(18) Agricultural Lands: State of Alaska Department of Natural Resources, Division of Agriculture (ADNR). Agricultural lands classified by ADNR from land use plans and private land patented for agricultural use.

Geothermal

(19) Volcanoes: Alaska Volcano Observatory. The locations depicted represent volcanoes without regard to recency of activity.
http://www.avo.alaska.edu/volcanoes/latlong.php

(20) Wells and Springs by Temperature: Geo-Heat Center State Geothermal Database CD, Geo-Heat Center, Oregon Institute of Technology.
http://geoheat.oit.edu/database.htm

(21) Potential Geothermal Resources: Idaho National Laboratory.
The areas depicted represent regions favorable for the discovery (at shallow depth, less than 1000m) of thermal water of sufficient temperature for direct-heat applications. It is probable that only small areas of the regions are truly underlain by such thermal water; the regions represent that part of the state that deserves exploration for thermal areas. The regions are defined on the basis of various geothermal and tectonic phenomena such as locations of thermal wells and springs, above-normal heat flow, youthful volcanism, mineralization, and seismicity.
http://geothermal.id.doe.gov/maps/index.shtml
http://geothermal.id.doe.gov/maps/ak_metadata.htm

Hydroelectric

(22) Existing and Potential Hydroelectric sites: Alaska Energy Authority hydroelectric database. Spatial location and attribute data updated by HDR Alaska Inc. in 2006.

Ocean

(25) Tidal Electric Generation Potential: Brian Polagye, 2007. Tidal resource was quantified for 35 transects across tidal channels, perpendicular to the flow. The analysis used NOAA time series of currents and tidal range, as well as bathymetric data. Due to map scale each study site is depicted as a point location rather than a linear transect.

(26) Wave Power Potential: Mirko Previsic (re vision consulting LLC), 2007. Primary resource potential in average megawatts was derived from analysis of nine representative NOAA moored ocean buoys. The linear length of the approximate outer coast represented by each buoy was used to calculate the kilowatts per meter depicted on the map as a buffered area. Wave energy resource is not shown for the coastline north of the Yukon River delta due to seasonal pack ice and relatively low wave energy resources.

Solar

(23) Solar Insolation: U.S. Department of Energy, National Renewable Energy Laboratory, 1999. The data layer provides annual average daily total solar resource averaged over surface cells of approximately 40 km by 40 km in size.
www.nrel.gov/gis/data_analysis.html

Wind

(24) Wind Power: AWS Truewind, 2006 & U.S. Department of Energy, National Renewable Energy Laboratory (NREL), 1986.

Three separate datasets were merged to create the wind power layer. In order of display priority these were 1) AWS Truewind 2006 final data for the core of Alaska (200m resolution), 2) AWS Truewind 2006 final data for the Southeastern Panhandle (200m resolution), and 3) NREL 1987 data for the remaining locations. All datasets were clipped to the coastline to remove offshore locations.
www.nrel.gov/gis/data_analysis.html
www.awstruewind.com/inner/windmaps/UnitedStates.htm

*For data sources with descriptive point locations the spatial positions were derived by matching the descriptive location to the community location in (1), or were geocoded using the U.S. Geological Survey Geographic Names Information System database.

For More Information

Alaska

Alaska Energy Authority
www.akenergyauthority.org
Renewable energy resource maps, reports, programs, planning, and financing information.

Alaska Housing Finance Corporation
www.ajfc.state.ak.us
Residential energy efficiency and energy resources library, programs, and financing information.

Renewable Energy Alaska Project
www.realaska.org
A coalition of Alaska utilities, businesses, conservation and consumer groups, and Alaska Native organizations with a goal of increasing the production of renewable energy in Alaska.

Alaska Center for Energy and Power
www.uaf.edu/acep/
University of Alaska's research center for applied energy research to lower energy costs and develop economic opportunities throughout Alaska, based in Fairbanks.

Cooperative Extension Service
www.uaf.edu/coop-ext/faculty/seifert/energy.html
Provides housing technology information to Alaskan homeowners and builders.

Nationwide and Regional

National Renewable Energy Laboratory www.nrel.gov
USDOE's premier renewable energy research and development lab.

US Department of Energy's Office of Energy Efficiency and Renewable Energy www.eere.energy.gov/
Provides information on federal programs relating to renewable energy and energy efficiency

Western Governors Association
www.westgov.org/wga/initiatives/cdeac/index.htm
Maintains an advisory committee on clean and diversified energy.

Renewable Energy Policy Project
www.repp.org/index.html
Provides policy analysis and recommendations for increasing the use of renewable energy at the state and national level.

American Council on Renewable Energy
www.acore.org
National advocacy and research non-profit focused on facilitating and increasing the development of renewable energy resources in the United States.

Policies Supporting Renewable Energy

Database of State Incentives for Renewable Energy
www.dsireusa.org/ Information on tax incentives, rebate programs, portfolio standards, green power programs and other policies.

Clean Energy States Alliance
www.cleanenergystates.org/
Works with clean energy funds across the country to build and expand clean energy markets in the United States.

Biomass

National Biodiesel Board
www.biodiesel.org
National trade association represents the biodiesel industry.

National Biomass Energy Program
www1.eere.energy.gov/biomass
USDOE's Biomass energy program.

Pacific Regional Biomass Energy Partnership
www.pacificbiomass.org Promotes bioenergy development in Alaska, Hawaii, and the Northwest.

Geothermal

Geothermal Resources Council
www.geothermal.org
International association for geothermal education, including industry, researchers, and government.

National Geothermal Energy Program
www1.eere.energy.gov/geothermal
USDOE's geothermal energy program.

Hydroelectric

National Hydropower Association
www.hydro.org
Information on conventional hydro and tidal wave technologies.

Low Impact Hydropower Institute
www.lowimpacthydro.org
Low-impact hydro certification body with information about projects throughout the U.S.

Ocean

Electric Power Research Institute
www.epri.com/oceanenergy/
Ocean energy webpage for independent, nonprofit energy research center.

Solar

Alaska Sun
www.alaskasun.org Alaskans supporting solar energy with link to the Solar Design Manual for Alaska.

American Solar Energy Society
www.ases.org
National association dedicated to advancing the use of solar energy.

National Solar Energy Program
www1.eere.energy.gov/solar
USDOE's solar energy website.

Wind

Wind Powering America
www.windpoweringamerica.gov
USDOE's wind energy program

American Wind Energy Association
www.awea.org
National trade association promoting the development of wind power.

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