

SCOMM

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Alaska State Legislature

UTILITIES RESTRUCTURING COMMITTEE

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AGENDA

March 8, 2000 * 8 a.m. * Capitol 120

1. **"State of Alaska Alternative Energy Development"**
Percy Frisby, Manager, Rural Energy Programs
Department Community & Economic Development
2. **"Fuel Cell Technology and More"**
Ron Johnson, Director, Energy Center
University of Alaska - Fairbanks
3. **"AVEC'S Alternative Energy R& D"**
Charlie Walls, President
Alaska Village Electric Cooperative, Inc.(AVEC)
4. **"North Slope Borough Energy Profile"**
Richard Glenn, Director of Energy Management
North Slope Borough
5. **"Kotzebue's Wind Energy Development"**
Brad Reeve, General Manager
Kotzebue Electric Association
6. **"Yakutat Salt Chuck Tidal Project"**
Scott Newlun, Administrator
Yakutat Power, Inc.
7. **"Current Disposition of Healy Clean Coal Project"**
Michael Kelly, Pres. And CEO
Golden Valley Electric Assn.
and
Randy Simmons, Executive Director
AIDEA, Department Community & Economic Development

NOTE TO FILE

5/8/00

Regarding March 8, 2000:

Entire back-up material for this meeting is available in Rep. Hudson's office, Red Notebook, in March 8, 2000 URC pentaflex file. This is in file drawer labeled "Utilities Restructuring Committee".

Shp

Biomass

Alternative Energy Development

The purpose of the Alaska Energy Authority's alternative energy programs is to develop projects that reduce the cost of energy in predominantly rural locations and use locally available energy resources. Current efforts include:

Biomass Fuels. The Alaska Bioenergy Program provides financial and technical assistance for using wood and waste to produce power, heat, and processed fuels. The program is funded in part by the U.S. Department of Energy. Recent projects include waste wood-to-ethanol production in Southeast Alaska, wood-fired district heating in rural Interior Alaska, biomass resource assessment, and analysis of small waste-to-energy feasibility.

Coal and Natural Gas. This program seeks to develop small coal and natural gas-fueled energy systems suitable for rural locations. Recent projects include the preparation of a computer screening model for small coal-fired thermal energy stations and assessment of the economics of developing local natural gas resources for rural energy production. Work is conducted in cooperation with the University of North Dakota Energy and Environmental Research Center.

Conservation. The AEA's energy conservation program promotes energy efficiency in schools and other large facilities. The program includes the Rural Alaskans Conserve Energy (RACE) initiative, which provides energy audits and training in rural communities, technical support for energy saving retrofits, and funding for energy efficiency demonstrations. The program is supported in part by the U.S. Department of Energy. Please see Energy Savings Initiatives for more information.

Fuel Cells and Energy Storage. The AEA provides funding and technical support for fuel cell and energy storage development in Alaska. Partners include Chugach Electric Association, Copper Valley Electric Association, the University of Alaska Energy Center, Sandia National Laboratory, and the U.S. Department of Energy.

Hydroelectric and Tidal Energy. The AEA provides funding assistance for assessment and development of small hydroelectric and tidal power facilities. Recent efforts include state and federal pass-through funding for hydro projects in Atka, Cordova, Iliamna, King Cove, Old Harbor, and Unalaska, as well as support for an assessment of tidal power feasibility.

Wind. The Wind Energy Program provides assistance for the evaluation and development of wind energy systems for rural communities. Currently AEA is participating in the Kotzebue Wind Turbine Test, the Wales High Penetration Wind-Diesel System project, and installations being considered in Unalaska and Nome. AEA coordinates the state's Wind Resource Assessment Program. Partners in the wind program include Kotzebue Electric Association, Alaska Science and Technology Foundation, National Renewable Energy Laboratory, and the U.S. D.O.E.

Tuesday, February 29, 2000



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Yakutat Ankau Salt Chuck Tidal Project

- Energy from the Oceans

Yakutat Power, Inc., and the people of Yakutat propose to make pioneering advances in developing a new and environmentally clean technology for generating electricity from Salt Water Estuary (Chucks), marine currents.

- Power From Ocean Currents

The tidal movements of the oceans represent an enormous source of energy. On a small scale, tidal watermills have been used for centuries, trapping the water that flows into estuaries on high tides and releasing it back through waterwheels with the ebbing tide. This principle has been used on a larger scale in barrage schemes, the best known of which is the 240 MW French scheme the river Rance in Brittany. However, the majority of the world's tidal power simply flows around the edges of the continents, unused.

It is, nevertheless, possible to use the energy of a current, just as windmills use the power of the wind. Wind farms, using the wind to produce electricity, are now a common sight in many areas. There is no reason why tidal power cannot be caught in a similar way.

Yakutat Power has identified a potential site in our own back yard, we are estimating that the tide could generate around 2 MW of electricity, from a small generation unit. This is a considerable resource, which could go a long way towards reducing reliance on fossil fuels, and meeting government commitments to cut the emissions of greenhouse gases. Other studies have shown that known tidal resources around the UK coastline could supply about 20% of the total electricity requirement of the country. It should be noted that there is very little good information available on marine currents, and further surveys may reveal an even greater potential.

The best sites are those with strong currents, which tend to be around headlands, between islands, or in channels, where the tidal flow is concentrated. Yakutat's Ankau tidal flow area is particularly well placed for tidal power, with many good potential sites around the coast, we feel that this natural containment area is a perfect placement to develop this technology. High currents tend to be found near land, so bringing the electricity ashore to where it is needed is not too expensive. Tidal electricity will be particularly useful for isolated, and island communities that cannot be connected to a national grid.

Tuesday, February 29, 2000

One of the main barriers to the use of tidal power has been the difficulty of making turbines that survive in the harsh marine environment, but work on offshore installations by the oil industry has shown that these problems can be solved. Another difficulty was that it was predicted to be too expensive to make and install reliable marine turbines. Work on wind turbines, particularly for offshore windfarms, has indicated that these costs can be kept down. In the long term, it looks quite possible to generate electricity from tidal flows at cost comparable with power from wind and hydro even from first generation machines.

- Marine Tidal Current Turbines

Yakutat Power has been researching current turbines for a number of years. Back in the late 1970's this emerging technology was involved in a project in Sudan using river current to pump water for irrigation. Since that time several Companies, Governments, and Universities have been performing extensive research on this type of power generation. We at Yakutat Power have been in contact with several of the leaders of this field of development and believe that the technology is advancing at such a fast pace at this time, we could be instrumental in the development of a viable unit. Along with various Government, and Private agencies we feel that the United States should be the leader in developing this Low Impact Alternate Energy Source.

It now seems time to implement tidal turbines on a commercial scale. Now is the time for the various government agencies to fund a consortium headed by Yakutat Power to design and install a tidal turbine at the Ankau Tidal Estuary near the town of Yakutat. This R&D project will adapt equipment and designs from offshore, marine and wind generator technology to prove that current turbines can be made and installed at reasonable cost. It is planned to install the turbine in the year 2000, and it will supply electricity to the grid over a period of at least a year to give operating experience.

- Environmental impact.

Despite their benefits, renewable energy projects have often attracted criticism for their effects on the environment. Land is flooded for hydroelectric dams, wind farms are noisy and a blot on the landscape. A positive feature of marine turbines is that they have minimal environmental impact. They could be placed underwater and be completely invisible from the surface, but it is most likely that there will need to be some marker for their presence sticking above the water so warn boats and fishermen of their presence. Being underwater, and away from land, there will be no noise problems. The rotors are slow-moving, and fish, seals and other marine life will easily be able to avoid the moving blades.

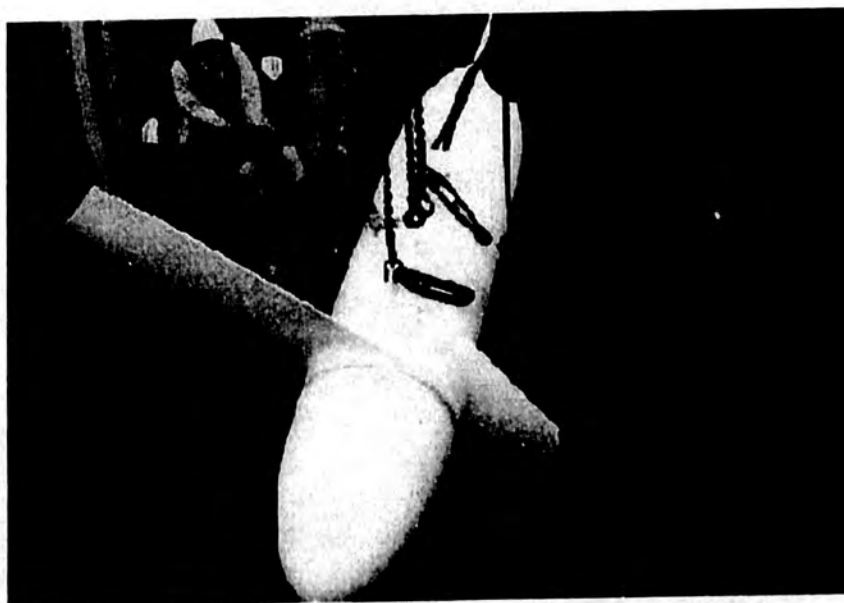
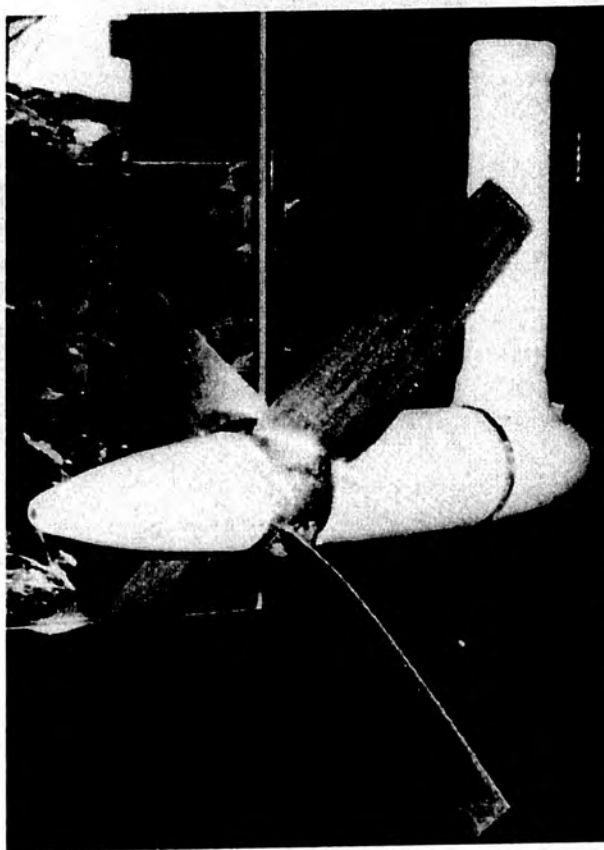
- Future Development

Following the Ankau marine current turbine project, Yakutat Power plans to progress to an implementation plan using an array of turbines in a given locations. This would be the pattern for future commercial development, encompassing both on the components and the installation to give a cheaper unit cost. Further work will be called for to make the turbines reliable. Servicing turbines in seawater will be an expensive operation, and the units must be developed to run for extended periods without needing to be visited. A implementation plan will be a large capital undertaking, funding will have to be identified, we suggest that a new company be formed to allow interested partners to invest in the project.

The widespread tidal resource, the minimal environmental impact of the technology, and the growing need for clean, inexhaustible power, make it inevitable that marine current energy will become a major new industry in the 21st Century.

Tuesday, February 29, 2000

Two Different Turbine Designs



DRAFT
Alaska Energy Plan — Rural
Phase I

Alaska Industrial Development
and Export Authority



Denali Commission



U.S. Department
of Agriculture



Prepared by
CH2MHILL

October 1999

Contents

Section	Page
1 Introduction	1-1
2 Executive Summary – Rural	2-1
Electric Utility Service	2-1
Bulk Fuel Storage	2-3
Space and Water Heating	2-4
3 Rural Alaska Region	3-1
Demographic and Economic Characteristics	3-2
Electric Utility Service	3-3
Description	3-3
Issues and Possible Solutions	3-9
Bulk Fuel Storage	3-14
Description	3-14
Issues and Possible Solutions	3-20
Heating	3-24
Description	3-24
Issues and Possible Solutions	3-26

Tables

3-1	Rural Alaska Utility Size and Type of Ownership.....	3-7
3-2	Bulk Fuel Storage Capacity in 161 Rural Alaska Communities, 1999	3-16
3-3	Bulk Fuel Storage Deficiency Rankings.....	3-18

Figures

2-1	Estimated Annual Personal Income per Capita in Selected Alaska Regions and the United States, 1997	2-1
2-2	Average Delivered Power Cost: Selected Alaska Regions and United States	2-2
3-1	Rural Alaska Communities	3-1
3-2	Annual Personal Income and Average Electric Rate (All Customers) in Alaska Regions and United States, 1997	3-2
3-3	Rural Alaska Generation Capacity by Source of Power, 1997.....	3-4
3-4	Total Cost of Electric Service by Item for Alaska Village Electric Cooperative 1998.....	3-5
3-5	Fuel Efficiency for Power Cost Equalization Utilities	3-6
3-6	Average Residential Electric Rate (500-kWh usage) in Alaska Regions and United States, 1997	3-9
3-7	Primary Fuel for Space Heating in Rural Alaska Households (1990 Census) ...	3-25

SECTION 1

Introduction

State and federal officials express continuing concern that government energy policy in Alaska lacks focus, that funding decisions are not guided by consistent policy, and that the efforts of government agencies involved in the energy sector are not adequately coordinated. As a result:

- Governor Knowles asked the Alaska Industrial Development and Export Authority (AIDEA) to oversee the development of a statewide energy plan that will recommend a set of clear and consistent energy policies.
- The federal co-chair of the Denali Commission has also called for an energy plan that will help guide the Commission's funding decisions, and has contributed both funds and staff time to the planning effort.
- The Alaska office of the U.S. Department of Agriculture Rural Development (USDA), which continues to finance energy projects and other infrastructure in rural Alaska, had already initiated a study of the management, operations, and maintenance capabilities of village utilities, including water, wastewater, solid waste, and bulk fuel storage as well as electric power. USDA is now joining with AIDEA and the Denali Commission in the preparation of an energy plan by integrating their village utility O&M study into the overall planning effort.¹

Because the key energy issues vary considerably from one region of the state to another, the energy plan will be prepared separately for each of three regions:

- Rural Alaska. For purposes of this plan, rural Alaska is defined to include primarily those communities that are eligible for the Power Cost Equalization (PCE) program — about 14 percent of the state's population.
- Southeast / Four Dam Pool. This includes the six communities served by the Four Dam Pool plus Juneau and Sitka — also about 14 percent of the state's population.
- Railbelt. The Kenai Peninsula / Anchorage / Fairbanks corridor — 72 percent of the state's population.

¹ USDA describes their study as follows:

"As part of the statewide energy plan, a companion document will be prepared which includes an in-depth examination of management, maintenance and operations issues. These issues currently are critical to the long term sustainability and effectiveness of all utility services in rural Alaska. Rural utilities are intensely interrelated and share significant opportunities in co-management, maintenance and operations.

This document will present the examination of total life cycle costs, including operation, maintenance and management of water, sanitation, solid waste disposal, electric power and bulk fuel storage utilities in rural Alaska. It will include the exploration of socially and culturally appropriate and cost efficient policy incentives which encourage reliable and cost efficient utility service. Finally, it will present a menu of policy options, utility operational models and best service practices useful to village residents, policy makers, and service providers."

For each region, the plan will be developed in two phases. **Phase 1** will be accomplished quickly and includes the following:

- Brief background description of energy systems and usage
- Identification of major problems and issues
- Listing of all previously identified plausible approaches and possible solutions to each specified problem

Phase 2, the heart of the energy plan, will take considerably longer to prepare and will include the following:

- Identification of any new potential approaches and solutions to identified problems
- An initial screening analysis to reduce the list of plausible approaches and solutions to manageable size
- In-depth evaluation of each measure remaining on the short list following the initial screening process
- Recommendation of government policies that will advance the most promising measures most effectively

This document presents the Phase 1 results for the rural Alaska region and covers three distinct energy sectors:

- Electric power
- Bulk fuel storage
- Space and water heating

The information in this report was developed by CH2M HILL and AIDEA with input from the Department of Community and Economic Development and the Institute of Social and Economic Research, University of Alaska Anchorage.

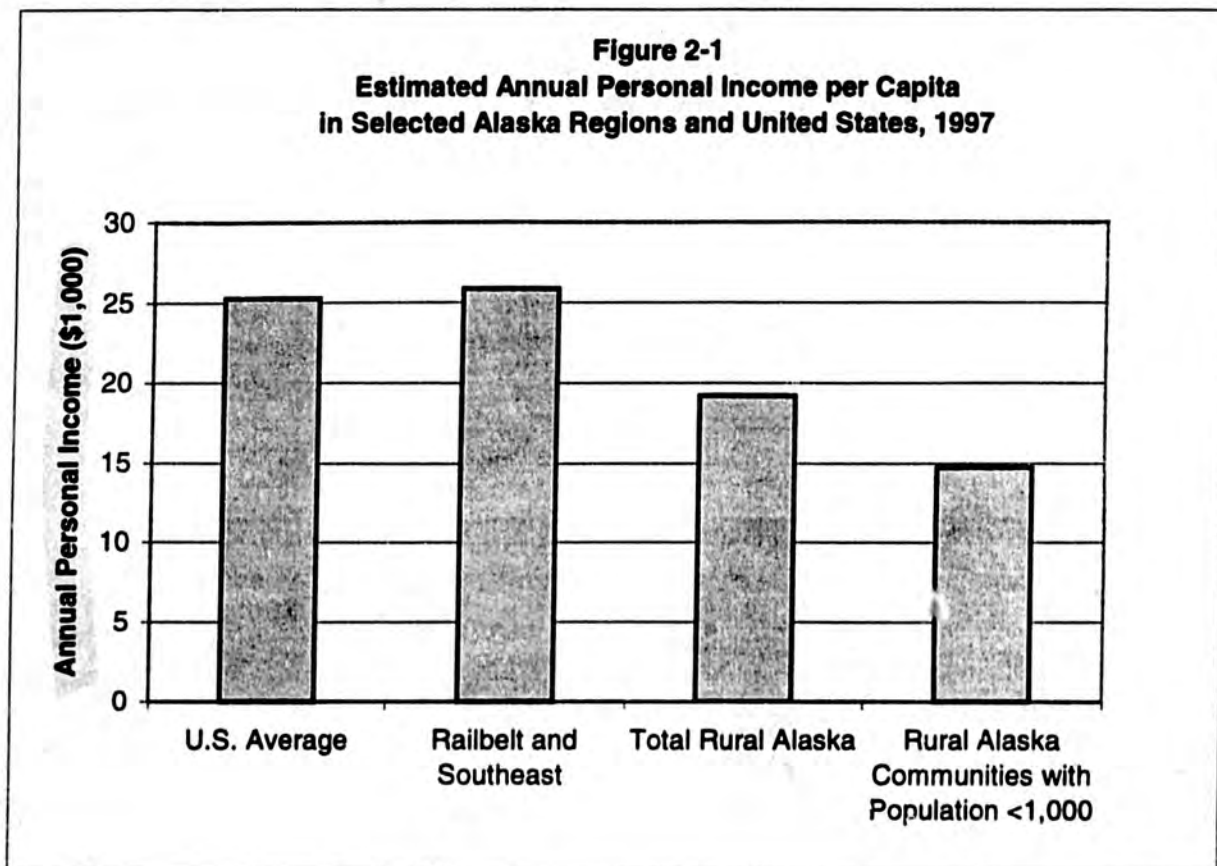
SECTION 2

Executive Summary—Rural

For this study, rural Alaska is defined to include primarily those communities that are eligible for the State of Alaska's Power Cost Equalization (PCE) program. This includes about 87,000 people living in 195 communities, most of which are isolated villages of less than 1,000 population.

The economy of rural Alaska is a mixture of cash employment and subsistence hunting and fishing. The cash economy is exceptionally dependent on government employment and transfer payments, although commercial fishing and fish processing, mining, timber, and tourism contribute greatly, though in varying degrees, to the economic base.

As shown in Figure 2-1, average per capita income in Alaska's villages of under 1,000 population is about 40 percent less than the national average.

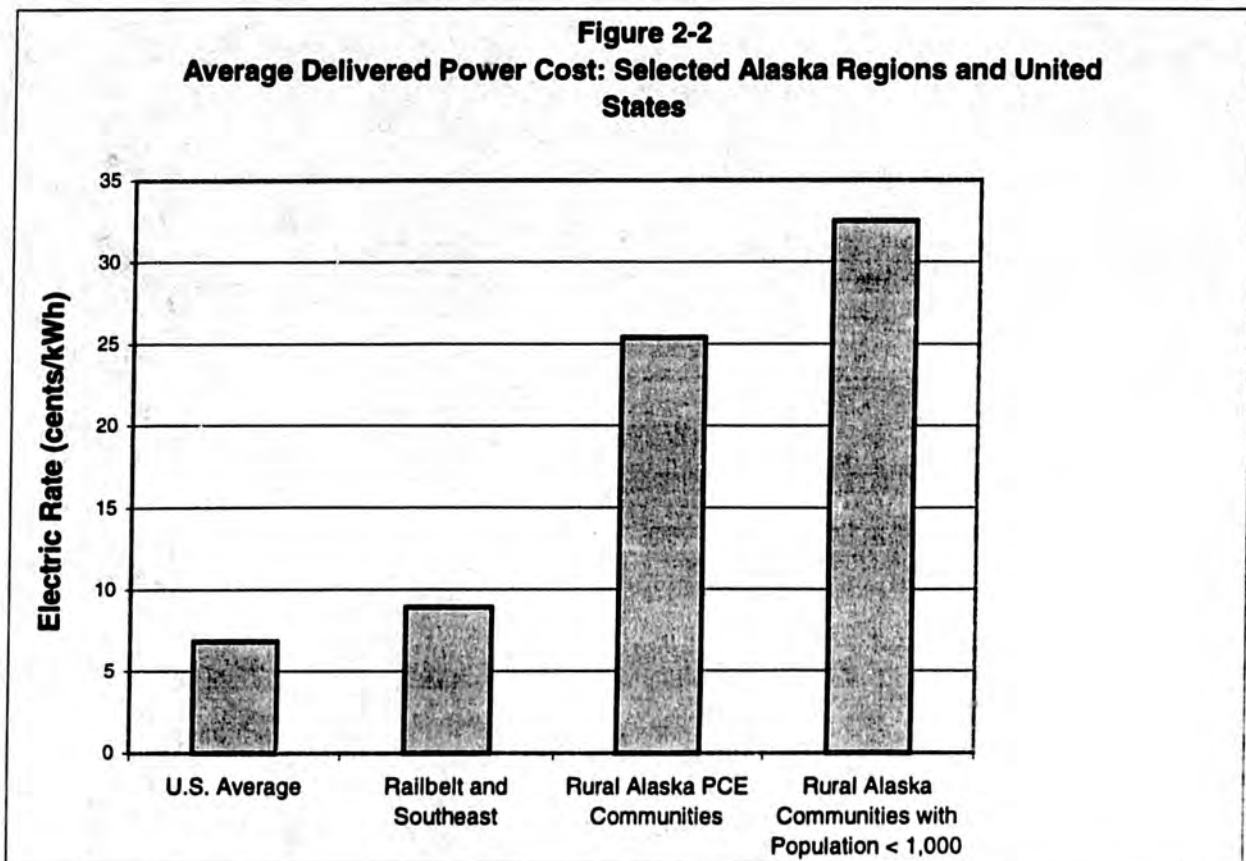


Electric Utility Service

There are 99 utilities providing electricity to the 195 communities. Most of these utilities serve only one small village, and most of the village electrical systems operate in isolation with no transmission connection to another community. The four largest utilities serve over

55 percent of the population. The remaining 95 utilities serve less than 45 percent of the population.

As shown in Figure 2-2, the average cost of power in rural Alaska PCE communities is 25.4 cents per kWh, 3.7 times the national average. The cost of power in the communities of less than 1,000 population is even higher at 32.5 cents per kWh, 4.7 times the national average. These figures represent utility rates without adjustment for PCE or any other subsidy.



Almost all of the electricity sold by rural Alaska utilities is produced with diesel generators. The largest cost component of providing electricity is operation and maintenance (O&M), followed by fuel cost. The average fuel efficiency of diesel generation has been improving over the years. For all rural utilities, average efficiency is about 12.1 kWh sold per gallon of fuel consumed, resulting in an average fuel cost of about 8.8 cents per kWh.

The condition of the physical plant at many rural utilities is poor. In 1998, the State updated its condition assessment of 52 single-village electric utilities and found that 34 had power plants or distribution systems considered unserviceable, while 20 had extensive fuel contamination in or around the powerhouse. "Unserviceable" means that the facility is unsafe, not operational, or cannot be repaired for less than replacement cost. The focus of the USDA study, as briefly described in the introduction to this document, is based on the premise that deficiencies in management and O&M practices are largely responsible for the poor condition of these facilities.

To help make power more affordable in rural communities, the State established the PCE program in 1985. Last year, however, the State reduced PCE funding and was unable to find a long-term solution. This effort continues, and, given the level of attention and analysis focused on PCE during the last year, further consideration of PCE or alternative rate subsidy programs is not included within the scope of this energy plan.

The main issues identified for the electric utility sector in rural Alaska are:

- High cost of power
- Utility management, operation, and maintenance
- Reliability of electric service

There are many potential approaches and solutions, most of which can be grouped as follows:

- Continue to increase the efficiency of diesel power plants and distribution systems
- Reduce fuel prices through consolidated purchasing strategies or alternative delivery methods
- Expand the use of waste heat recaptured from diesel generators
- Develop energy conservation strategies to reduce cost
- Increase power sales to reduce rates
- Implement alternatives to diesel generation
- Consolidate utilities
- Increase competition
- Privatize utility ownership
- Change in regulatory practices
- Establish and enforce financial and technical standards
- Improve operator and management training
- Increase efforts at preventive maintenance
- Standardize parts and equipment
- Ensure adequate reserve capacity

Bulk Fuel Storage

The State of Alaska studied 161 rural communities over the last 3 years to establish a comprehensive database on rural tank farm conditions. The new database includes information on 844 tank farms. If the rest of the 195 communities in rural Alaska are similar to those currently included in the database, there are an estimated 1,020 tank farms in small

rural communities in Alaska with a total bulk fuel storage volume of about 51 million gallons.

A 1992 State study of tank farm conditions in 44 communities found that over 98 percent of these facilities had significant code violations posing a threat to public safety and the environment. Common deficiencies include no secondary containment dikes, poor piping systems, no security fencing, and active leaks. In view of the consistency of the conditions encountered and the geographic spread of the sites surveyed, the study concluded that the results were representative of typical conditions in rural communities throughout Alaska.

Funds to upgrade and replace these systems are currently being supplied by the Denali Commission, EPA, the Coast Guard, and the State of Alaska. The State manages tank farm design and construction, while EPA and the Coast Guard provide technical assistance and help ensure compliance with environmental regulations.

The main issues for the bulk fuel storage sector in rural Alaska are:

- Poor condition of existing bulk fuel storage facilities
- Inadequate maintenance and improper operation
- Environmental remediation

Most of the potential solutions can be grouped as follows:

- Continue State management of design and construction of consolidated tank farms
- Solicit proposals for design, construction, and possibly ownership and financing of new tank farms
- Establish or encourage alternatives for tank farm ownership and O&M responsibility
- Consolidate multiple tank farms into fewer facilities
- Improve operator and management training
- Enhance regulatory enforcement
- Increase efforts at preventive maintenance
- Develop remediation plans and funding sources

Space and Water Heating

At least two-thirds of rural Alaska households use fuel oil as their primary heating source. About one in five households use wood either as a primary fuel or to supplement oil heat.

The retail price of fuel oil in rural Alaska ranges from \$1.50 to \$3.20 per gallon, which is two to four times the national average. The main issue for the heating sector in rural Alaska is high cost.

Most of the potential solutions can be grouped as follows:

- Reduce wholesale fuel prices through consolidated purchasing strategies
- Increase fuel efficiency through weatherization and advances in furnace efficiency
- Expand use of wood or other alternative sources of heat where cost-effective
- Exploit opportunities to use waste heat from diesel powerplants

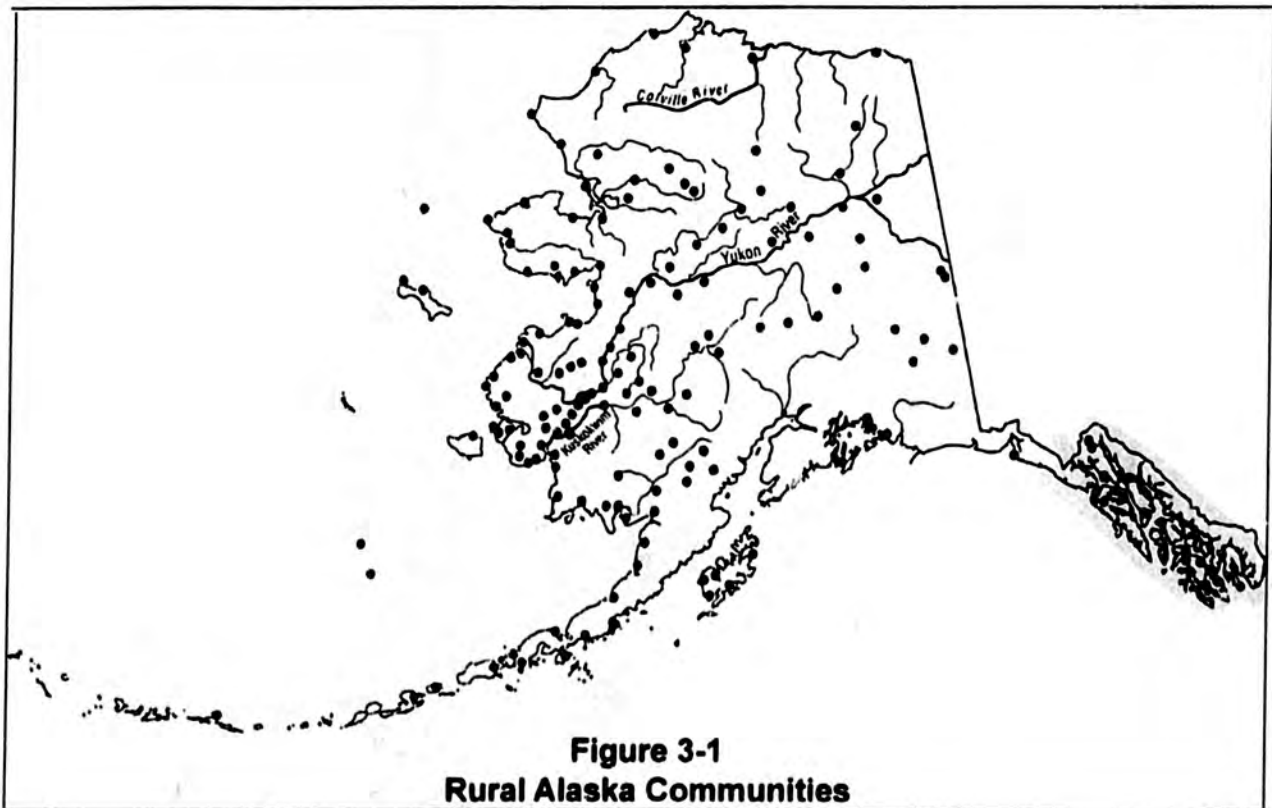
SECTION 3

Rural Alaska Region

For this study, the rural Alaska region is defined to include primarily those communities that are eligible for Alaska's Power Cost Equalization (PCE) program. This excludes the Railbelt as well as Juneau, Sitka, and the communities served by the Four Dam Pool.²

There were 86,900 people living in Rural Alaska in 1997, representing 14 percent of the total Alaska population. Almost all of the rural Alaska population lives in 195 established communities that are distributed throughout the state as shown in Figure 3-1.

Most rural Alaska communities are remote and isolated. They are not interconnected to any power grids or fuel pipelines. As a result, with few exceptions, each community's power requirements are supplied by stand-alone diesel power plants.



² The Denali Commission is empowered to provide assistance to rural Alaska but, to date, has not determined precisely what "rural Alaska" includes. In the future, the Commission may adopt a broader definition of the term.

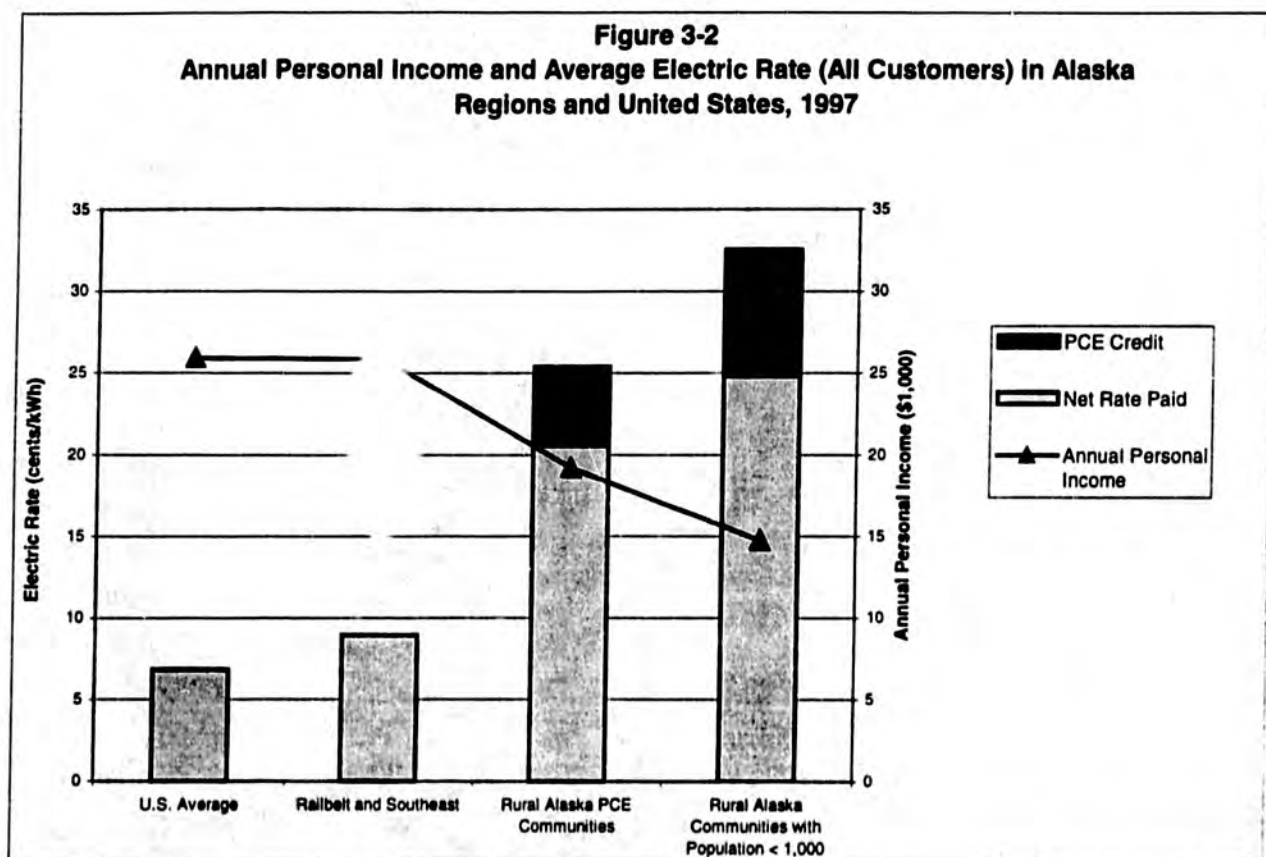
Demographic and Economic Characteristics

Rural Alaska communities have populations ranging from 32 to 5,277. All but 13 communities have populations less than 1,000, and half have populations less than 265. The largest communities, in order of size, are Bethel, Unalaska, Nome, Barrow, Kotzebue, Dillingham, and Cordova. In the 10 years between 1988 and 1998, the population of rural Alaska increased by 18 percent.

The economy of rural Alaska is a mixture of cash employment and subsistence hunting and fishing. The cash economy is exceptionally dependent on government employment and transfer payments while commercial fishing and fish processing, mining, timber, and tourism contribute greatly, though in varying degrees, to the economic base.

In 1997, the average income per capita in rural Alaska of \$19,220 was 26 percent below the rest of the state and 24 percent below the national average. Per capita personal income varies widely from community to community, ranging from an estimated 1997 income of \$3,300 in Birch Creek to several communities between \$45,000 and \$50,000.

In the 182 rural communities with populations under 1,000, 1997 personal income per capita averaged \$14,760, only 58 percent of the national average (Figure 3-2).



Electric Utility Service

Description

General Characteristics

There are 99 utilities providing electricity to the 195 communities in rural Alaska. These utilities had 1997 sales of 446 million kWh, or 9 percent of statewide electric energy sales, and vary in size from annual sales of 100,000 to 50 million kWh. As noted above, most of these 195 communities have generation facilities that are operated only to meet the community needs. This is true even for the 13 utilities in rural Alaska that serve more than a single community. Only a few communities have electric utilities physically connected to one another.

The largest utility in rural Alaska is the Alaska Village Electric Cooperative (AVEC). AVEC provides service to 51 communities with about 20,100 residents, or 23 percent of the rural Alaska population. However, because AVEC does not have any large industrial loads, its electricity sales were only about 11 percent of 1997 rural Alaska electricity sales. Nonetheless, AVEC has the most sales of utilities serving rural Alaska. The Barrow Utilities and Electric Cooperative is almost as large as AVEC. The next largest utilities are Alaska Power and Telephone and Bethel Utilities Corporation.

Generation Mix

Almost all electricity generated in Rural Alaska is powered by diesel fuel. As shown in Figure 3-3, power generated is:

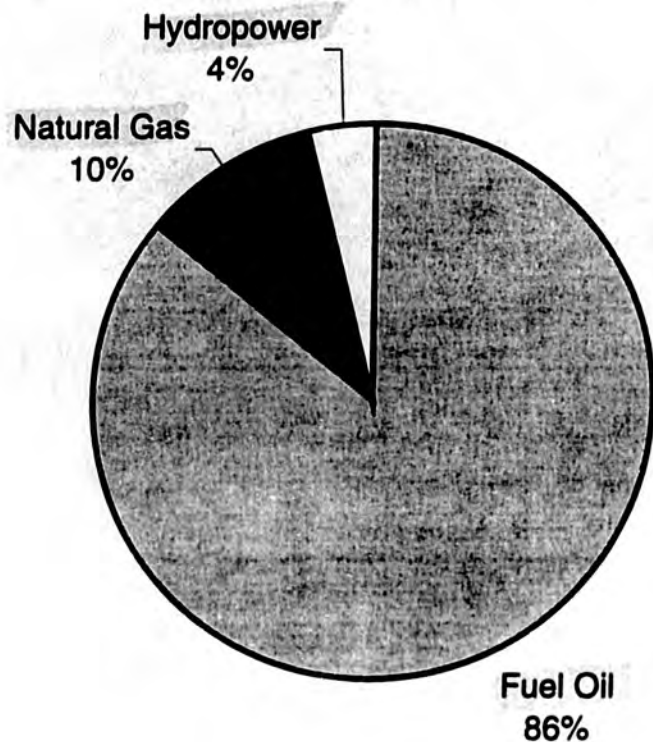
Diesel fired	86 %
Natural gas fired	10 %
Hydropower	4 %

All of the natural gas-fired electricity in rural Alaska is produced by Barrow Utilities and Electric Cooperative, where natural gas is available in abundance as a byproduct of North Slope oil production.

Hydroelectric power is generated by eight utilities:

Utility	Communities Served with Hydropower
Alaska Power and Telephone	Haines, Skagway, Craig
Cordova Electric Cooperative	Cordova
Pelican Utility Company	Pelican
Akutan Electric Utility	Akutan
City of King Cove	King Cove
Larsen Bay Utility Company	Larsen Bay
City of Ouzinkie	Ouzinkie
I-N-N Electric Cooperative	Iliamna, Nondalton, Newhalen

Figure 3-3
Rural Alaska Generation Capacity by Source of Power, 1997



All generate with hydropower to meet a portion of their power requirements.

Cost of Delivered Power

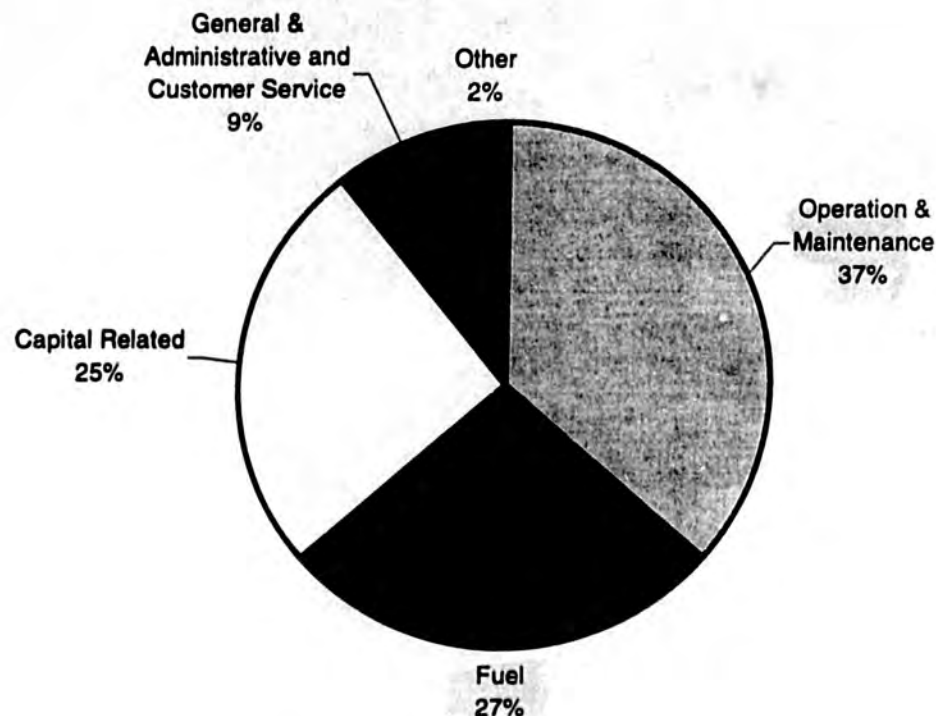
Primarily as a result of the small size of rural Alaska communities and their remote, isolated locations, the cost of power generated and distributed in rural Alaska is substantially higher than national standards. The average cost of power in rural Alaska PCE communities is 25.4 cents per kWh, 3.7 times the national average of 6.85 cents per kWh. There is a wide range in average costs of power among communities.³ The cost of power to the communities of less than 1,000 population is even higher. As shown in Figure 3-2, the average for these communities is 32.5 cents per kWh, 4.7 times the national average.

The largest cost category for rural Alaska utilities is operation and maintenance (O&M). Fuel cost is next largest. Detailed breakdown of costs is generally not available for these electric utilities. AVEC data are generally representative for rural Alaska utilities that operate according to industry standards and that finance most of their physical plant

³ Excluding Barrow, these average costs range among communities from 14 cents to 64 cents per kWh.

through low-interest federal loans. As shown in Figure 3-4, O&M accounts for 37 percent of AVEC's costs, fuel accounts for 27 percent, and capital requirements (depreciation and interest expense) account for 25 percent. Phase 2 of the energy plan will include an expanded focus specifically on the O&M challenge for rural utilities.

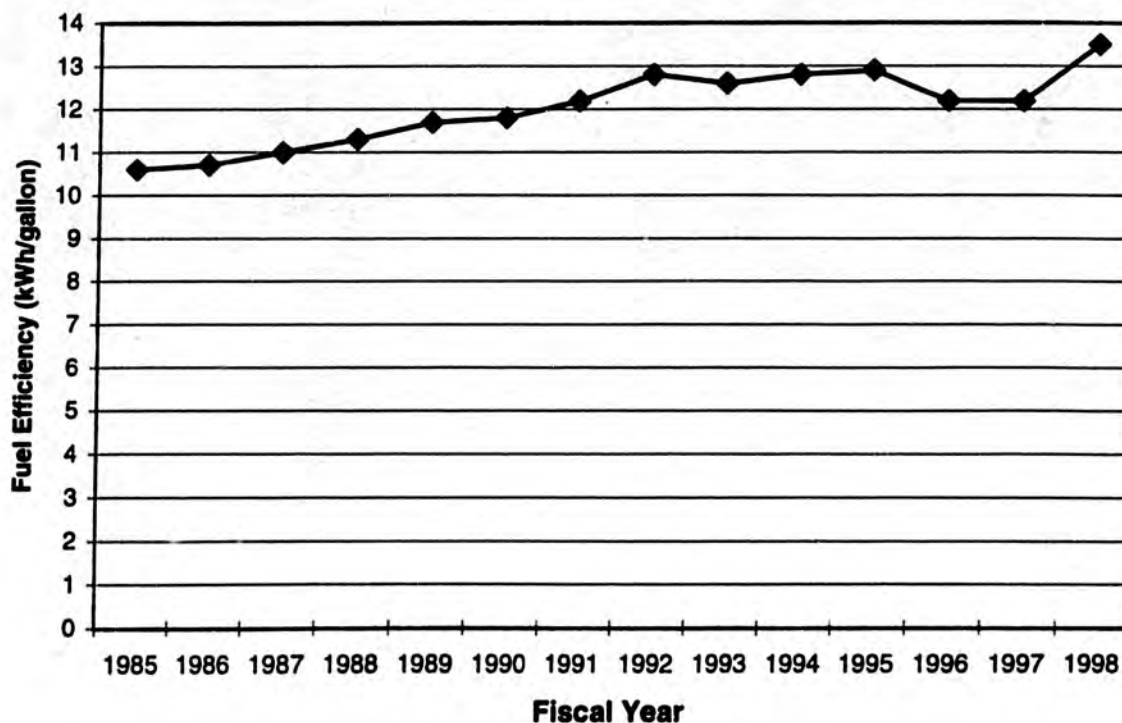
Figure 3-4
Total Cost of Electric Service by Item for
Alaska Village Electric Cooperative, 1998



Fuel costs vary primarily because of the price of fuel delivered to the community and the efficiency of power generation at the community. The fuel price varies primarily based on the cost of delivery. Utilities in coastal communities, particularly those in Southeast Alaska, generally pay low prices (as low as \$0.75 per gallon), whereas interior communities pay higher prices (as high as \$2.20 per gallon).

Even with the high cost of electric service in rural Alaska, real costs have actually decreased over the course of the last two decades. This is due in part to decreases in the real cost of fuel oil and increases in the fuel efficiency of generation. As shown in Figure 3-5, the average number of kWh generated per gallon of fuel oil in rural Alaska has steadily increased. AVEC's generation efficiency doubled between 1975 and 1998.

Figure 3-5
Fuel Efficiency for Power Cost Equalization Utilities



Utility Ownership and Management

Most rural Alaska utilities are publicly owned. As shown in Table 3-1, only 24 of the 99 utilities serving rural Alaska are privately owned. Publicly owned utilities, including cooperatives, municipalities, and tribal councils, provide service to 77 percent of the communities and 78 percent of the population served by utilities in rural Alaska.⁴

Thirteen utilities serve more than one community and a total population of 42,000, or about half of the rural Alaska population. The larger, multi-community utilities benefit from economies of scale by spreading some fixed utility costs over the greater volume of sales. They also might have access to skilled personnel in both operations and management on a more consistent basis. Although the smaller single-village utilities do not enjoy similar economies of scale and might not have consistent access to skilled workers, they do offer the potential for greater local control and, in some cases, lower overhead.

As a result of these differences, rural Alaska utilities are managed with varying structures and commitment to standard utility practices. Typically, the larger utilities must conform to standard utility practices to meet their financial requirements. Cooperatives like AVEC obtain capital financing from the United States Rural Utility Service (RUS). RUS has financial and operating requirements to which its borrowers must conform. Private utilities,

⁴ An estimated 97 percent of the population in rural Alaska is served by electric utilities.

TABLE 3-1
Rural Alaska Utility Size and Type of Ownership

Type of Ownership	Number of Utilities	Communities Served	Population Served	Total Sales (Thousand kWh)
Cooperatives				
Serving Multiple Communities	7	75	30,576	125,001
Serving a Single Community	<u>11</u>	<u>11</u>	<u>9,478</u>	<u>73,101</u>
Subtotal	18	86	40,054	198,102
Municipalities	33	39	19,254	113,037
Tribal Councils	26	26	6,249	27,961
Private ^a				
Serving Multiple Communities	6	28	13,091	91,455
Serving a Single Community	<u>16</u>	<u>16</u>	<u>5,496</u>	<u>23,362</u>
Subtotal	22	44	18,587	114,818
Rural Alaska Total	99	195	84,144	448,779

^a Includes investor-owned companies and native corporations.

like Alaska Power and Telephone in rural Southeast Alaska, are regulated by the Regulatory Commission of Alaska (RCA). The RCA requires that the utility conform to certain accounting, financial, and operating standards. The larger municipal systems, like the City of Barrow, obtain financing through sale of municipal bonds. In order to sell these bonds, the city must demonstrate that its utility systems are operated properly and in conformance with industry standards.

On the other hand, smaller, single-village utilities in rural Alaska are typically not required to demonstrate compliance with standard utility practices. Where standards are not enforced, equipment maintenance is more likely to be inadequate. In 1998, the State updated its condition assessment of 52 single-village electric utilities in rural Alaska.⁵ Of these utilities, 29 had powerhouses that were "unserviceable,"⁶ 20 had extensive fuel contamination in or around the powerhouse, and 34 had "unserviceable" components in their distribution systems.

Service Reliability

Normally, electric utilities maintain careful records on service outages. However, because the utility systems in rural Alaska are so small, reliable data are not available. Interviews with utility representatives and community leaders indicate that the service outage rates are high by national standards. Outages are numerous and last from only a few minutes to several days. Outage rates and duration vary from utility to utility, largely based on the

⁵ This update was reported in the *Rural Energy Plan*, State of Alaska, February 1999.

⁶ Unserviceable was defined as an unsafe condition or as having a repair cost that was greater than a replacement cost.

availability of operating expertise, system conditions, and the availability of adequate backup systems.

Electric Service Affordability and the Power Cost Equalization Program

To help make power more affordable in rural communities, the State of Alaska established the Power Cost Equalization (PCE) Program in 1985. PCE was designed as a rate subsidy program through which the State pays a portion of the consumer's electric bill in nearly all of the 195 rural communities. Not all electrical consumption is eligible for PCE; about 39 percent of total consumption was eligible in FY 1998. The other 61 percent was purchased at the full unsubsidized rate.

For PCE-eligible consumption, the utility's cost of power determines the amount of subsidy. In FY 1998, PCE paid an average of 12.4 cents for each kWh that was eligible for PCE subsidy. These payments ranged from a high of nearly 35 cents to a low of less than 2 cents, with the smaller communities typically having a greater dependence on the PCE program.

In FY 1998, PCE paid about 19 percent of the total revenues realized by Alaska's eligible rural electric utilities. This reduced the FY 1998 cost of power to the average customer from 25.4 to 20.6 cents per kWh. The resulting average rates are still high by both state and national standards, as demonstrated in Figure 3-2. For communities of less than 1,000 population, the net rates after PCE payments are higher than the overall rural average.

In 1999, the legislature reduced the level of PCE benefits by enacting several revisions to the program, including:

- Commercial customers were removed from PCE eligibility. *and schools*
- The maximum number of kWh per month for which residential customers can receive PCE was reduced from 700 to 500.

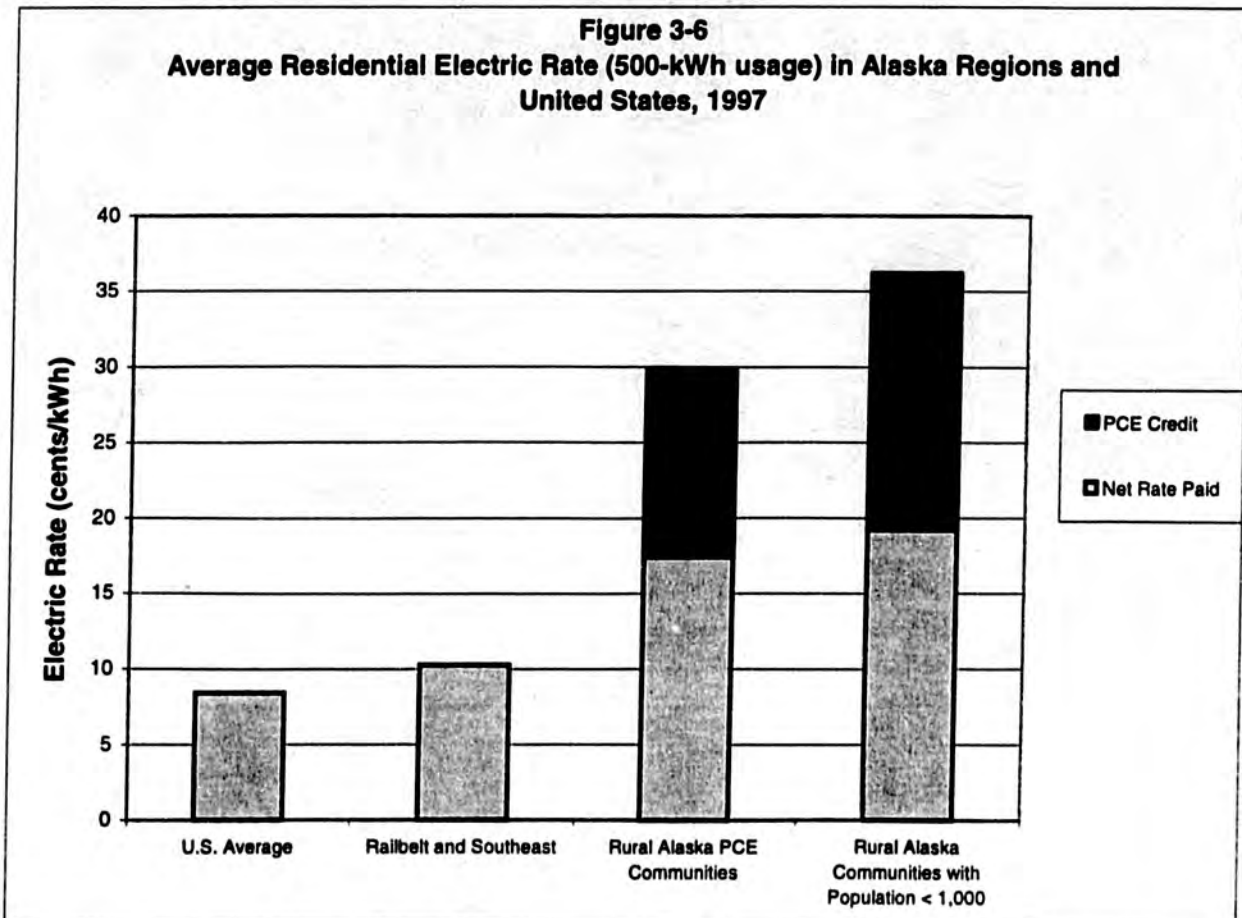
With these changes, the total share of electrical consumption that will be eligible for PCE subsidies is projected to decline from 39 percent to about 30 percent. Consistent with these changes, the aggregate level of program funding was reduced from \$18.0 million to \$15.7 million. Further, the State now projects that about 75 percent of program funding will go to residential customers and the other 25 percent will reduce electric bills for community facilities. As a result, PCE will pay about 16.5 percent of the total costs to be realized by PCE-eligible utilities. The net rate paid by customers is projected to increase from 20.6 cents to 21.2 cents per kWh, or 3.1 times the national average.

The primary beneficiary of PCE is the residential customer. Without PCE, the average residential customer in rural Alaska would pay about \$1,500 per year for electricity. Given the recent program changes, PCE is now projected to pay about \$450 of this amount, leaving the average residential customer to pay the remaining \$1,050.

As shown in Figure 3-6, PCE reduces the average residential rate paid for 500 kWh by 42 percent, from 29.9 to 17.5 cents per kWh. Despite this substantial subsidy, the average residential rate is still 2.1 times the national average. Figure 3-6 also shows that the smaller rural Alaska communities are more dependent on PCE subsidies, and their net rates remain higher than those for the overall region.

While most of the PCE subsidy goes to residential ratepayers, the program also makes a substantial difference in the operating costs of community facilities. For example, PCE is estimated to pay about two-thirds of the cost of electricity for many of the water and sewer systems that are now being installed in rural villages.

Declining State oil revenues were a major factor leading to the recent PCE program cuts. Because oil revenues are projected to continue their decline as North Slope production declines, long-term funding of the program is uncertain.



Issues and Possible Solutions

Issue: High Cost of Power

Discussion

Largely because of the isolation and low population base of rural Alaska, the cost of generating and distributing power there is nearly four times the national average. At the same time, residents of this region are least able to afford high power costs. Personal income per capita in rural Alaska is 28 percent lower than the national average. To help make power affordable, the State of Alaska implemented the PCE program in 1985 to reduce power costs to consumers in rural Alaska. In FY 1998, the program reduced electricity costs paid in the region by 20 percent. Nonetheless, rates paid for power delivered to communities in rural Alaska remain high. On average, rural Alaska communities pay rates

that are 3.1 times higher than the national average. Further, given State budget constraints, the long-term future of PCE funding is uncertain.

Possible Solutions/Approaches

- I. Opportunities aimed primarily at fuel cost reductions
 - Install more efficient diesel generators
 - Install automated switchgear to better match generator size with load
 - Create additional fuel purchasing cooperatives that, through higher volume purchases, can negotiate lower prices with bulk fuel suppliers
 - Reduce distribution line losses with more efficient distribution equipment
 - A. Expand use of waste heat from diesel generators
 - B. Investigate opportunities to for fuel deliveries by air (e.g., lengthen runways to allow large quantities to be delivered by air)
 - G. Energy efficient end-use equipment
 - H. Capitalize on alternative energy, including:
 1. Wind
 2. Small hydro
 3. Natural gas / coal bed methane
 4. Fuel cells
 5. Biomass / wood
 6. Energy storage systems
- II. Opportunities for efficiencies from technological improvements
 - A. Automate system operations, including remote operation of facilities
 - B. Reduce need for distribution system upgrades through distributed generation capacity at individual facilities
 - C. Reduce peak demands to induce lower system peak demands/improved equipment utilization
 1. Revise rate structures (e.g., time-of-day demand charges)
 2. Load management
 - D. Improved inter-agency planning and coordination, including coordination with affected local utilities (e.g., the inappropriate installation of electric hot water heaters in new construction)
 - E. In designing new community infrastructure, use life-cycle cost analysis in selecting equipment that uses electricity.

III. Opportunities for greater efficiency incentives

- A. Eliminate direct subsidies for replacing equipment that fails due to poor maintenance. For example, require that any such emergency subsidies be tied to an enforceable commitment to standard maintenance of all plant and equipment (e.g. joining a regional utility or privatizing).
- B. Change regulatory structures to provide greater incentives to improve operations and lower costs. For example, increase PCE disallowance for generator inefficiency.
- C. Privatize utilities that are currently publicly owned.
- D. Through RCA regulation, provide profit margin incentives for improved operations.
- E. Find ways to introduce elements of competition into rural utility management and operations.
- F. Change regulatory practices or requirements that result in increased costs without an offsetting benefit.

IV. Opportunities for greater economies of scale

Consolidate ownership and operation of single-community electric utilities into regional utilities to spread fixed costs over more sales, share resources among utilities, and increase purchasing power

- A. Consolidate ownership and operation of electric utilities with other utilities (e.g., water and wastewater) on a regional basis
- B. Standardize parts, equipment, and operations across utilities to reduce needed inventories and labor through inter-utility sharing on inventories and expertise
- C. Build interties
- D. Require schools to purchase their electricity needs from the local utility rather than self-generate
- E. Identify opportunities to increase power sales for the purpose of long-term rate reduction.

V. Opportunities for efficiencies from modernized administrative practices

- A. Automated meter reading
- B. Prepaid metering
- C. Central billing
- D. Separate accounting for municipal electric systems from other municipal accounts
- E. Standard accounting practices

- F. Increased operator training
- G. Development of methods to reduce operator turnover
- Expanded circuit rider maintenance

Issue: Reliability of Utility Service

Discussion

As would be expected for small, isolated utilities, average outage rates among rural Alaska communities are well above national standards. Outages are numerous and last from only a few minutes to several days.

Possible Solutions/Approaches

- I. Improved information (given that very little information presently exists on service reliability in rural Alaska)
 - A. Prepare an evaluation of service reliability in rural Alaska. Develop data on reliability in terms of frequency, length, impacts, and causes of service interruptions. Consider cost-effectiveness given community priorities for reliability improvements.
- II. Improved reserve capability
 - A. Install adequate (double contingency) standby in all communities.
 - B. Allow for simple, single unit operation to meet community needs for the smaller communities. When a single unit fails, simply replace generation by starting the next unit (also adequately sized to meet full requirements).
 - C. Provide for distributed generation with central backup.
 - D. Provide for interties between/among communities where opportunities exist.
- III. Improved O&M
 - A. Standardize parts, equipment, and operations across utilities to reduce needed inventories and labor through inter-utility sharing on inventories and expertise.
 - B. Eliminate direct subsidies for replacement of plant and equipment that fail due to poor maintenance. For example, require that any such emergency subsidies be tied to an enforceable commitment to standard maintenance of all plant and equipment (e.g. joining a regional utility or privatizing).
 - C. Link PCE or other incentives with service reliability performance.
 - D. Provide for automated operations.
 - E. Expanded circuit rider maintenance.

Issue: Utility Operations, Maintenance, and Management

Discussion

There is a substantial range in the operation and management capability of electric utilities in rural Alaska. These capabilities range from levels consistent with national standards to substantially less than national standards. Typically, small, single-village communities have lower levels of expertise available to run the utility efficiently. This is demonstrated by the State's 1998 updated condition assessment of 52 single-village utilities in rural Alaska. Of these utilities, 29 had powerhouses that were "unserviceable,"⁷ 20 had extensive fuel contamination in or around the powerhouse, and 34 had "unserviceable" components in their distribution systems.

Possible Solutions/Approaches

- I. Establish and enforce standards for management, maintenance, and operations.
 - A. Create a statewide agency or organization that will establish standards for rural electric utilities with respect to financial management, physical plant, and system maintenance and operations.
 - B. Require that receipt of capital project grants be tied to an enforceable commitment to standard maintenance of all plant and equipment.
 - C. Encourage or require single-village utilities that do not meet O&M standards to join a multi-village utility.
 - D. Encourage or require single-village utilities that do not meet O&M standards to contract with a capable firm or organization for long-term maintenance and management services.
 - E. Establish mechanism to determine if operation and maintenance is being performed as required.
 - F. Standardize parts, equipment, and operations across utilities.
- II. Other options to reorganize utility ownership.
 - A. Privatize utilities that are publicly owned.
 - B. Consolidate ownership and operation of electric utilities with other utilities (e.g. water and wastewater) on a regional basis.
- III. Increase State payment of utility O&M costs.
 - A. Include prepayment of long-term maintenance costs with capital project grants.
 - B. Expand the State's circuit rider maintenance program.
- IV. Regulatory options.
 - A. Improved scrutiny of utility costs by regulatory agency.

⁷ Unserviceable was defined as an unsafe condition or as having a repair cost that was greater than a replacement cost.

- B. Change regulatory structures to provide greater incentives to improve operations and lower costs. For example, increase PCE disallowance for generator inefficiency.
- V. Improve utility operator skills.
 - A. Increase operator training.
 - B. Develop methods to reduce operator turnover.
- VI. Other alternatives.
 - A. Eliminate direct subsidies for replacement of plant and equipment that fail due to poor maintenance.
 - B. Prepare a systematic survey of maintenance and management to assess specific practices and identify areas where opportunities exist for improvement.
 - C. Improve collections through automated meter reading, pre-paid metering, or central billing. Improve accounting through increased training and separate books for electric utility.

Bulk Fuel Storage

Description

Storage Volume

The State of Alaska studied 161 rural communities over the last 3 years to establish a comprehensive database on rural tank farm conditions. The database excludes some communities that are often considered rural but that are well developed compared to the typical village. Excluded communities are:

Bethel	Barrow	Haines
Dillingham	Kodiak	Petersburg
Unalaska	Cordova	Wrangell
Nome	Yakutat	Sitka
Kotzebue	Skagway	

The new database includes information on 844 tank farms with a total storage volume of approximately 42 million gallons (Table 3-2). If the rest of the 195 communities in rural Alaska are similar to those currently included in the database, there would be about 1,020 tank farms in small rural communities in Alaska with a total bulk fuel storage volume estimated at 51 million gallons.

An earlier study of tank farm conditions in 44 communities conducted by the Alaska Energy Authority in 1992 found that over 98 percent of these facilities had significant code

violations. These conditions pose a threat to public safety and the environment. Common deficiencies observed include no secondary containment dikes, poor piping systems, no security fencing, and active leaks. In view of the consistency of the conditions encountered

and the geographic spread of the sites surveyed, the study concluded that the results were representative of typical conditions in rural communities throughout Alaska.

EPA has only one full-time inspector to cover the tank farms in rural Alaska and has inspected about 500 facilities in the last 5 years. An estimated 90 percent of the tank farms inspected were out of compliance with environmental regulations.

The new tank farm database created over the last 3 years assesses the condition of each tank farm by assigning deficiency points in seven categories: suitability of site location, secondary containment, tank foundations, tanks, piping, electrical systems, and overall safety. Each community is then characterized with a weighted average number of points per tank farm. This is used by the State as a starting point for determining which communities will have priority for upgrade or replacement of their tank farm facilities.

Deficiency rankings for 141 communities are shown in Table 3-3, with higher totals corresponding to greater deficiencies. The State plans to visit each rural village at least once every 3 years to update this information. The condition assessments and community rankings in the State's bulk fuel storage database provide an initial prioritization for improvement projects. Additional factors that are considered before projects are selected include the following:

- Tank farm ownership. Private industry can often bring facilities into compliance without public subsidy.
- Critical conditions of individual tank farms, distinct from average conditions.
- Other funding opportunities available to a specific village.
- Cost savings from siting projects in communities located near each other.
- Community income level and size, and corresponding cost per resident.
- Community contribution and commitment.
- Community administrative and maintenance capability.
- Federal tax compliance of tank farm owners.
- Experience obtained from any earlier work with the community.

TABLE 3-2
Bulk Fuel Storage Capacity in 161 Rural Alaska Communities, 1999

Community	No. of Tank Farms	Storage Capacity (gallons)	Community	No. of Tank Farms	Storage Capacity (gallons)
Akutan	3	1,860,090	Hughes	3	48,000
Alakanuk	5	417,029	Huslia	4	167,607
Alatna	1	10,500	Hydaburg	3	122,000
Aleknagik	3	73,000	Igiugig	3	68,900
Allakaket	5	42,252	Iliamna	18	172,355
Ambler	5	370,053	Ivanof Bay	3	48,100
Angoon	3	160,468	Kake	7	258,033
Aniak	12	1,144,730	Kaltag	8	264,500
Anvik	7	137,163	Karluk	3	50,000
Arctic Village	5	54,660	Kasaan	3	40,200
Atka	3	150,300	Kiana	8	385,900
Beaver	3	91,000	King Cove	5	663,415
Bettles	5	119,700	Kipnuk	5	559,800
Birch Creek	4	63,600	Kivalina	6	304,700
Brevig Mission	8	260,900	Klawock	3	140,984
Buckland	7	297,300	Kobuk	3	37,300
Chalkyitsik	5	76,125	Kokhanok	4	66,300
Chefornak	6	256,400	Koliganek	3	140,000
Chevak	10	580,540	Kongiganak	8	225,670
Chignik Bay	6	244,900	Kotlik	5	352,055
Chignik Lagoon	12	138,400	Koyuk	8	261,050
Chignik Lake	4	104,200	Koyukuk	5	99,000
Chuathbaluk	4	79,900	Kwigillingok	6	283,700
Clark's Point	7	152,900	Larsen Bay	3	204,300
Coffman Cove	3	59,942	Levelock	4	188,300
Cold Bay	19	657,859	Lime Village	3	14,800
Craig	7	339,906	Lower Kalskag	3	194,270
Crooked Creek	5	106,800	Manokotak	8	163,150
Deering	6	209,900	Marshall	5	261,560
Diomedea	3	165,500	McGrath	17	606,800
Eek	8	215,100	Mekoryuk	10	324,030
Egegik	7	280,800	Metlakatla	5	628,248
Ekwok	3	135,320	Mountain Village	8	653,354
Elfin Cove	1	102,465	Naknek	8	1,781,400
Elim	8	278,190	New Stuyahok	3	183,250
Emmonak	11	1,045,895	Newhalen	4	365,200
False Pass	4	356,668	Newtok	8	238,850
Fort Yukon	10	225,600	Nightmute	8	165,150
Galena	7	2,155,250	Nikolai	2	87,500
Gambell	9	640,900	Noatak	7	268,600
Golovin	2	156,400	Nondalton	11	153,900
Goodnews Bay	6	252,700	Noorvik	6	461,000
Grayling	4	222,361	Nulato	9	401,300
Gustavus	6	137,230	Old Harbor	3	122,900
Hollis	1	4,000	Ouzinkie	3	78,200
Holy Cross	6	290,746	Pedro Bay	4	116,400
Hoonah	10	434,077	Pelican	2	147,185
Hooper Bay	8	562,222	Perryville	3	103,400

TABLE 3-2
Bulk Fuel Storage Capacity in 161 Rural Alaska Communities, 1999

Community	No. of Tank Farms	Storage Capacity (gallons)	Community	No. of Tank Farms	Storage Capacity (gallons)
Pilot Point	4	135,900	Shishmaref	10	504,300
Pilot Station	6	257,125	Shungnak	8	272,600
Pitka's Point	2	37,320	Sleetmute	6	91,800
Platinum	4	79,700	South Naknek	5	267,100
Point Baker	1	20,180	Stebbins	7	361,000
Port Alexander	3	39,212	Stevens Village	3	75,200
Port Alsworth	8	65,755	Stony River	4	75,600
Port Heiden	8	591,100	Takotna	2	173,400
Port Lions	2	91,700	Tanana	4	249,600
Port Protection	1	24,094	Tatitlek	4	35,000
Quinhagak	13	391,700	Telida	1	5,000
Rampart	1	47,500	Teller	13	374,700
Red Devil	5	102,600	Tenakee Springs	2	72,569
Ruby	4	276,410	Thorne Bay	6	313,455
Russian Mission	6	175,184	Togiak	11	444,600
Saint Mary's	29	1,063,900	Toksook Bay	7	332,955
Saint Michael	9	1,766,500	Tuntutuliak	4	233,000
Sand Point	7	687,850	Tununak	7	292,400
Savoonga	9	421,390	Twin Hills	4	188,200
Scammon Bay	6	288,900	Unalakleet	13	1,168,200
Selawik	7	536,700	Upper Kalskag	6	126,680
Shageluk	4	143,709	Venetie	3	65,000
Shaktolik	2	278,660	Wales	7	308,700
Sheldon Point	3	165,663	White Mountain	5	185,000
TOTAL				844	42,499,368

TABLE 3-3
Bulk Fuel Storage Deficiency Rankings

Community	Weighted Avg. Points per Tank Farm ^a	Community	Weighted Avg. Points per Tank Farm ^a	Community	Weighted Avg. Points per Tank Farm ^a
Nikolai	127.5	Port Heiden	67.7	Holy Cross	43.0
Arctic Village	122.9	Shageluk	67.5	Ruby	42.5
Kotlik	121.7	Kiana	67.4	Ekwok	41.8
Chalkyitsik	119.4	Emmonak	67.3	Gustavus	41.7
Beaver	116.1	Deering	67.0	Port Lions	40.0
Venetie	115.1	Sheldon Point	67.0	Pelican	39.5
Rampart	115.0	Lower Kalskag	66.8	Pilot Station	39.4
Port Protection	110.0	Shishmaref	65.4	Levelock	37.6
Chignik Lagoon	108.2	Stony River	65.2	Aniak	37.5
Noorvik	107.4	Telida	65.0	Newhalen	37.3
Takotna	102.9	Alakanuk	64.9	Grayling	36.5
Red Devil	101.3	Brevig Mission	64.7	McGrath	35.1
Toksook Bay	101.1	Nightmute	64.3	Kasaan	35.0
Point Baker	100.0	Port Alsworth	64.0	Stevens Village	34.7
Larsen Bay	99.8	Russian Mission	63.7	Quinhagak	34.7
Diomedes	98.8	Newtok	63.3	Koliganek	33.6
Birch Creek	98.6	Shungnak	62.4	Metlakatla	33.4
Old Harbor	95.6	Hooper Bay	62.1	Scammon Bay	32.4
Chignik Lake	94.6	False Pass	61.0	Saint Mary's	32.1
Atka	94.3	Bettles	60.6	Teller	32.0
Kongiganak	93.2	Pilot Point	59.5	Chignik Bay	31.7
Crooked Creek	91.0	Coffman Cove	58.2	Shaktolik	31.5
Chevak	90.1	Ouzinkie	58.1	Wales	29.6
Aleknagik	85.1	Craig	57.5	Ambler	29.4
Tanana	84.3	South Naknek	57.3	Goodnews Bay	28.7
Togiak	83.7	Tuntutuliak	57.2	Klawock	28.5
Tununak	83.2	Unalakleet	57.2	Hughes	26.9
Upper Kalskag	82.6	Allakaket	57.0	Kwigillingok	25.0
Kokhanok	81.9	Kaltag	55.9	Twin Hills	24.6
Manokotak	81.5	New Stuyahok	54.9	Kivalina	23.3
Koyukuk	80.3	Mekoryuk	54.9	Perryville	20.9
Huslia	80.0	Pedro Bay	54.9	Selawik	20.1
Buckland	79.6	Elim	54.5	Alatna	20.0
Gambell	78.0	Thorne Bay	53.2	Hollis	20.0
Koyuk	77.8	Marshall	50.3	Pitka's Point	20.0
Chefornak	77.7	Ivanof Bay	50.1	Nondalton	16.0
Clarks Point	76.4	Elfin Cove	50.0	Galena	15.7
Chuathbaluk	75.9	Tenakee Springs	49.5	King Cove	10.4
Egegik	74.3	Kobuk	49.5	Hydaburg	8.2
Nulato	74.3	Fort Yukon	49.0	Cold Bay	7.3
Sleetmute	72.3	Iliamna	48.4	Port Alexander	6.2
Noatak	71.7	Tatitlek	48.0	Saint Michael	5.8
Anvik	71.3	Hoonah	47.4	Sand Point	5.3
Mountain Village	70.9	Savoogna	46.7	Karluk	5.0
White Mountain	70.0	Golovin	46.2	Akutan	4.7
Platinum	69.5	Kipnuk	45.6	Naknek	3.6
Stebbins	69.1	Kake	44.9	Angoon	0.4
Igiugig	69.0	Eek	43.9	Lime Village	0.0

TABLE 3-3
Bulk Fuel Storage Deficiency Rankings

Community	Weighted Avg. Points per Tank Farm ^a	Community	Weighted Avg. Points per Tank Farm ^a	Community	Weighted Avg. Points per Tank Farm ^a
^a Tank Farm Evaluation Criteria:					
Site Location					Points
Site suitable for tank farm					0
< 100 feet from public well					10
< 25 feet from an eroding bank or beach, or in a flood plain					10
Gasoline tanks < 25 feet from an important building					10
					30 max.
Secondary Containment					
*Liquid-tight, lined dike of proper volume and construction (not plywood, 12" min. freeboard)					0
*Liquid-tight, lined dike of improper volume or construction (plywood or < 12" min. freeboard)					10
*Fully diked but not liquid-tight (sand bag dike, permeable gravel, torn or missing liner)					20
*Partial or no dike					30
					30 max.
Foundations					
*Tanks on acceptable foundations (min. 6" timbers, no cribbing, stable)					0
*Tanks directly on gravel pad or light timbers (raised small timbers, on permeable gravel)					5
*Tanks directly on tundra or natural soils (no dike or liner, subject to erosion)					10
*Tanks leaning considerably or unstable foundations (seismic hazard)					10
					20 max.
Tanks					
*Tanks in fair to good condition (no dents, minimum rust, no major repairs needed)					0
*Immediate need of cleaning and painting					10
*Rusted or dented beyond repair or riveted, bolted or other					30
					30 max.
Piping (choose most likely to leak, i.e., victaulic, threaded or welded, only)					
*Welded piping above grade					0
*Welded piping below grade					5
*Threaded piping above grade					10
*Threaded piping below grade					20
*Victaulic piping above grade					30
*Victaulic piping below grade					40
Rubber hose					20
Additional for active leaks					20
					80 max.
Electrical					
Wiring appears appropriate					0
Exposed wiring, improper grounding, etc.					10
					10 max.
Life, Health & Safety					
*Code compliant					0
*Low risk					10
*Medium risk					20
*High risk					30
*Potential for loss of life					40
					40 max.

*Indicates that only one of the group should be chosen.

Source: Alaska Division of Energy, February 1999.

Following the 1992 tank farms study, the State began a program to repair and replace fuel piping systems. The emphasis of these initial efforts was on piping systems so that the limited resources available could be used to repair the facilities most commonly associated with leaks. When more funds became available, the program was expanded to include comprehensive upgrades of the piping systems and entire tank farms. Over the last several years, the emphasis of the facility improvements has been on consolidating the fuel storage requirements of multiple tank farm owners into a single new facility. The advantages of this approach include:

- The risk of fuel leaks and spills is minimized when a single entity is responsible for operation and maintenance.
- The entire bulk storage system can be brought into compliance at one time.
- Coordinated fuel purchases could result in lower fuel prices.

In the last 3 years the State has completed tank farm upgrade or replacement projects in 13 communities and will finish 11 more projects in 1999. As of February 1999, projects in an additional 17 communities were in the planning and design stage of project development. Sixteen projects already completed or scheduled to be completed in 1999 had a total cost of approximately \$15,805,000 for repair or replacement of about 1,892,000 gallons of storage volume.

This gives an average cost of \$8.35 per gallon for the current level of improvements. This value reflects the current approach of consolidating multiple tank farms into a single new facility. Based on the upgrades completed to date and assuming that future upgrades would be similar in scope and cost, the cost to upgrade or replace all of the remaining tank farms in rural Alaska would be approximately \$350 million dollars.

Most of the funding for these upgrades is being supplied under a memorandum of understanding among the Denali Commission, EPA, the Coast Guard, and the State of Alaska. The State manages the tank farm design and construction, while EPA and the Coast Guard provide technical assistance and help ensure compliance with environmental regulations.

The work completed to date has not included remediation of any oil spills. The costs to remediate would be over and above the costs to upgrade the tank farms. In some cases, The State has removed and disposed of tanks and other equipment at abandoned fuel storage sites but, due to lack of funding, has not attempted any additional cleanup.

At the current rate of progress, the State would be able to reach all the rural villages in 25 to 30 years. About 2 years are required to complete the planning, design, materials acquisition, and construction for each project.

Issues and Possible Solutions

Issue: Poor Condition of Existing Bulk Fuel Storage Facilities

Discussion

Over 98 percent of the rural bulk fuel storage facilities studied by the 1992 Alaska Energy Authority report had significant code or regulation violations, including no secondary

containment dikes, poor piping systems, no security fencing, and active leaks. The results were representative of conditions in rural communities throughout Alaska.

EPA has only one full-time inspector to cover the tank farms in rural Alaska and has inspected about 500 facilities in the last 5 years. An estimated 90 percent of the communities inspected were in noncompliance with environmental regulations.

A program to repair and replace fuel piping systems was begun, emphasizing piping systems so that the limited resources available could be used to repair the facilities most commonly associated with leaks. When more funds became available, comprehensive upgrades of the piping systems and entire tank farms were included. Over the last several years, the emphasis has been on consolidating the fuel storage requirements of multiple tank farm owners into a single new facility. The main obstacle to tank farm consolidation is obtaining agreement among the local institutions and tank farm owners about new facility ownership, operations, financial management, and configuration.

Various approaches have been used successfully by the State of Alaska during its upgrade projects. In one case, a new nonprofit corporation was formed to own and operate the consolidated tank farm. The corporation included all the concerned entities except the electric utility, which leased a dike and fenced enclosure within the tank farm. In another village, a nonprofit corporation was formed that only owned the tank farm enclosure and the piping system. Each participant maintains separate ownership and operating responsibility for its individual tanks.

The State of Alaska has used force account construction to maximize the use of local labor in tank farm construction. At the current rate of improvements, the Division expects to reach all the rural villages in 25 to 30 years (Alaska Division of Energy, February 1999). About 2 years are required to complete the planning, design, materials acquisition, and construction for each project.

Possible Solutions/Approaches

II. Construction Alternatives

- A. State manages construction and owner constructs with force account labor (current model).
- B. State manages design and contractor constructs; contractors selected through competitive process.
- C. Request proposals from private contractors to design and construct upgrades for selected groups of villages.
- D. Request proposals for qualified private or public entity to design, build, own, and manage new consolidated tank farm(s). Examples of potential respondents include wholesale fuel distributors, utility companies, regional or village corporations, local governments, and private businesses.
 1. Respondents could propose a plan for including salvageable existing tanks in the new facilities and removing tanks that are not salvageable.

2. Respondents could propose to develop and operate a single consolidated tank farm in one community or multiple tank farms in multiple communities.

- E. Existing tank farm owners manage design and construct their own upgrade or replacement projects.

III. Funding Alternatives for New or Upgraded Facilities

A. State and Federal Grants

1. Grants to existing owners with no conditions
2. Grants to existing owners with state supervision of design and construction
3. Grants to new or existing owners for construction of consolidated new facilities, with the grants based on statements of qualifications and proposals for constructing and maintaining facilities. (This alternative would be in conjunction with construction alternative ID, above.) Close existing facilities when new facilities are completed. Selection for grants based on previous performance, effective design, and business plan.
Examples of attractive components of business plan:
 - a) Consolidation with utility bulk fuel storage
 - b) Vertical integration with bulk fuel supply operations
 - c) Regional facility ownership
 - d) Economies of scale from single facilities sized to meet full community requirements
4. Prior to final grant award, commitments would be needed from major fuel users (e.g. schools, tribal counsels, electric utilities, fuel distributors) to either store their fuel in the proposed facility or purchase their fuel from the entity owning the facility.

B. State and Federal Loans

1. Loans to existing owners with no conditions.
2. Loans to existing owners with state supervision of design and construction.
3. Award of low-cost loans to new or existing owners for construction of consolidated new facilities, with the award based on statements of qualifications and proposals for constructing and maintaining facilities. (This alternative would be in conjunction with construction alternative ID, above.) Close existing facilities when new facilities are completed. Selection for grants based on previous performance, effective design, and business plan.

4. Owner Contributions—Require that local owners invest some meaningful amount of equity in the bulk fuel storage systems.

IV. Regulatory Alternative—Increased regulatory enforcement, including fines and closures following time-limited notice

Issue: Inadequate Maintenance and Improper Operation

Discussion

The poor condition of bulk fuel storage facilities in rural Alaska results in part from inadequate facility maintenance. Inadequate maintenance is a function of the relatively low priority of long-term maintenance expenditures in communities with low personal income, and low training levels needed to adequately maintain the storage facilities. Also reported are indications of owner apathy about maintaining the facilities in good condition. Interviews with affected parties indicate that this apathy results in part from a belief within rural Alaska communities that the State will make necessary repairs or upgrades when they are necessary.

Possible Solutions/Approaches

I. Alternatives to Provide or Require Improved Maintenance

- A. Require adherence to maintenance and operation standards as a condition for State and federal financing of tank farm upgrade and replacement. Designate State and/or federal personnel to monitor compliance. Establish procedure to enforce compliance, repossess the tank farm, or transfer its ownership to a competent entity if O&M standards are not met.
- B. Require that owner of new or upgraded tank farm demonstrate acceptable O&M history or capability before approving grants or loans to finance upgrade or replacement. Requirement can be satisfied by executing long-term contract with competent entity for operation, maintenance, and management of tank farm prior to grant or loan approval.
- C. Establish a State bulk fuel storage agency or authority that would own and manage tank farms in rural Alaska, contracting for O&M services from competent local or regional entities.
 1. Performance incentives for the O&M contractor might include a 5-year rollover on the contract, subject to meeting maintenance criteria.
 2. Successful O&M contractors might
 - a) Create a regional bulk fuel storage O&M service
 - b) Vertically integrate bulk supply with O&M of bulk storage facilities
- D. Forgive payments on all or some portion of State or Federal low-cost loan subject to facility owner meeting O&M performance criteria

II. Alternatives for State Influence

C. Improve System Management

1. Provide for improved O&M training
2. Provide for higher salaries and other employee retention strategies

D. Enhanced Inspection of O&M Performance

1. EPA
2. Circuit rider inspector working for state or regional entity

Issue: Environmental Remediation

Discussion

EPA has only one full-time inspector to cover the tank farms in rural Alaska and has inspected about 500 facilities in the last 5 years. An estimated 90 percent of the inspected communities were found to be in noncompliance with environmental regulations. The poor condition of rural tank farms and piping systems has led to widespread site contamination. These leaks and spills pose a threat to both public health (groundwater contamination) and public safety (fire). Remediation, given the remote nature of the villages, will be difficult and expensive.

Possible Solutions/Approaches

- I. Assess individual sites and extent of contamination. Develop remediation plans.
- II. Focus first on system upgrades to stop the ongoing environmental damage from bulk storage operations; follow with site remediation.
- III. Set priorities for first accomplishing remediation at sites with the greatest benefit-to-cost ratios.
- IV. Provide cleanup grants and low-interest loans.
- V. Include site remediation as part of facility upgrades.

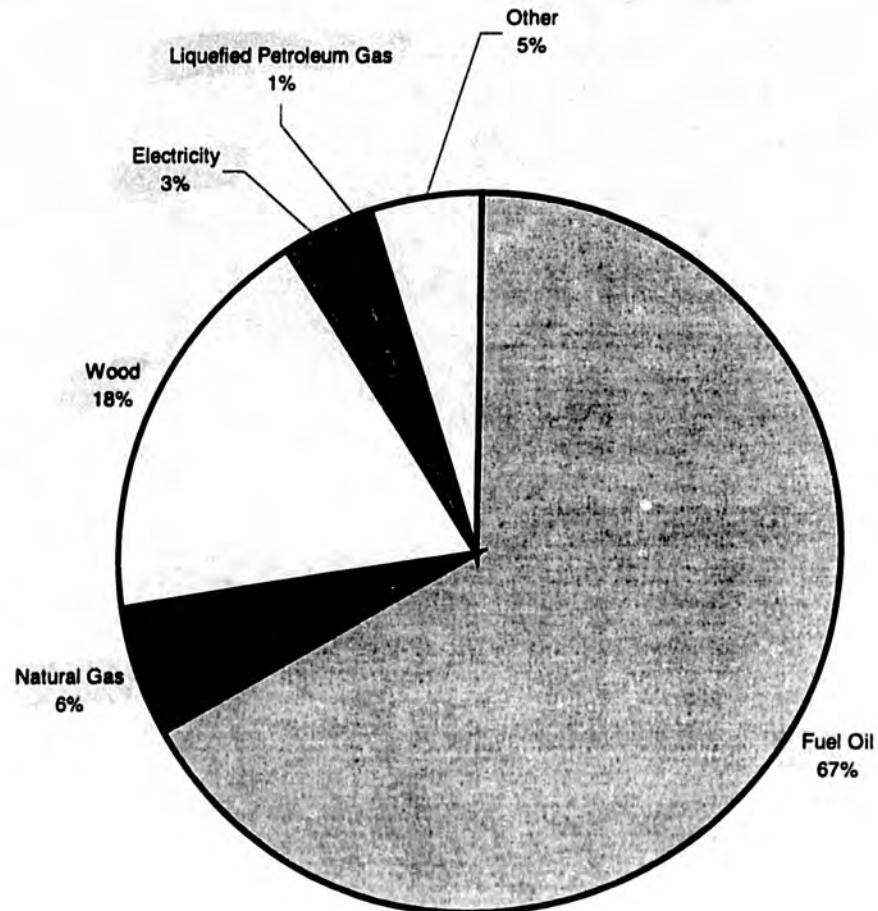
Heating

Description

Fuel oil provides the majority of space and water heating in rural Alaska. A prominent exception is in Barrow, where heating is almost entirely from natural gas available from the gas distribution utility attached to North Slope operations. Wood and, to a lesser extent, electricity are also used for heating purposes in various portions of rural Alaska.

Figure 3-7 shows the distribution of fuels reported by rural Alaska households as their primary heating source in the 1990 United States Census. As this figure shows, 67 percent of rural Alaska households use fuel oil as their primary heating source, 6 percent reported natural gas, and 18 percent reported wood. In interpreting these data, it is important to understand that these census data are self-reported information from limited census surveys.

Figure 3-7
Primary Fuel for Space Heating in Rural Alaska
Households (1990 Census)



Recent interviews with community representatives indicate that the ratio of households using fuel oil as their primary heating source is probably understated, and the ratio of households using natural gas and wood as the primary heating source is probably overstated.

Bulk fuel oil in rural Alaska generally is shipped from Washington state and from Alaska refineries. It is distributed primarily by barge to ports at coastal communities and inland communities that are accessible by river. When direct barge service is not available, bulk deliveries are normally completed by truck or by air transport. Deliveries are normally made once or twice a year to electric utilities and to commercial and municipal fuel storage operators. Within the various rural communities, fuel oil is distributed either by truck or, especially in small communities, by users obtaining fuel directly from bulk storage operators.

As discussed above for electric utility operations, the price of fuel oil varies within rural Alaska based on the cost of delivery. The cost of bulk fuel in coastal communities, particularly those in Southeast Alaska, is as low as \$0.75 per gallon, whereas the cost in more remote interior communities is as high as \$2.20 per gallon.

Generally, fuel distributors within communities add \$0.75 to \$1.00 to their cost per gallon. Thus, in broad terms, the price of fuel oil within rural Alaska ranges from \$1.50 to \$3.20 per gallon (\$10.80 to \$23.00 per million Btu). This is two to four times the average national cost.

Given the high cost of energy in rural Alaska, some communities have developed waste heat recovery systems at diesel power plants. Typically, waste heat is used to reduce heating costs at municipal and school facilities.

There is a wide range in the level of building weatherization. Buildings constructed prior to the mid-1980s typically are not energy efficient by today's standards. The Enhanced Weatherization Program of the Alaska Housing Finance Corporation (AHFC) is upgrading some of these buildings. Since 1991, the program has weatherized over 1,100 residential buildings in rural Alaska. This program is ongoing, with significant opportunity to weatherize additional buildings.

In the 1990s, much of the new construction in rural Alaska has been well insulated. One of the reasons is the success of the AHFC financing program. This program provides low-interest loans on new construction that obtains a rating of 4 Star Plus or better.

Issues and Possible Solutions

Issue: High Heating Costs

Discussion

Bulk fuel oil in rural Alaska generally is shipped from Washington state and from Alaska refineries. It is distributed within rural Alaska primarily by barge. Barges bring bulk fuel to ports at coastal communities and inland communities that are accessible by river. When direct barge service is not available, bulk deliveries are normally completed by truck or by air transport. Deliveries are normally made once or twice a year to bulk fuel storage operators. Within the various rural communities, fuel oil is distributed either by truck or, especially in small communities, by users obtaining fuel directly from bulk storage operators.

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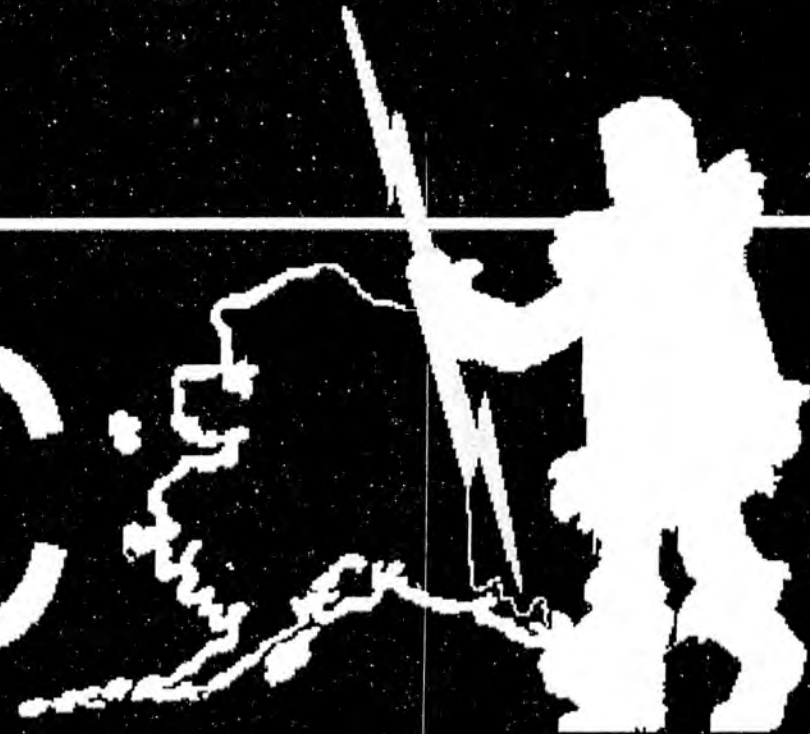
Possible Solutions/Approaches

- I. Opportunities to reduce fuel costs
 - A. Develop cooperative agreements among regional bulk fuel operators to increase the group's overall bargaining position in negotiating lower bulk fuel supply costs

- B. Develop cooperative ownership of fuel storage and distribution facilities
 - 1. Consolidate fuel oil storage and distribution responsibility into the electric utility operation for communities that have cooperative or municipal operations
 - 2. Establish independent fuel storage and distribution cooperatives
 - C. Exploit cost-effective opportunities to use waste heat from diesel power plants
 - D. Exploit cost-effective opportunities to use wood or other alternative energy sources in lieu of heating oil
 - E. Investigate the feasibility of bulk fuel deliveries by air through runway lengthening.
- II. Opportunities to improve efficiency of fuel use
- A. Improve building insulation/weatherization
 - B. Improve furnace efficiency
 - C. Include waste heat utilization considerations in the site selection and planning for community facilities.



AVEC



Alaska Village Electric Cooperative, Inc.

**AVEC's Development of Village Power Supply Options
House Special Committee on Utility Restructuring**

March 8, 2000

Presented by Charles Walls, President & CEO



The Challenge

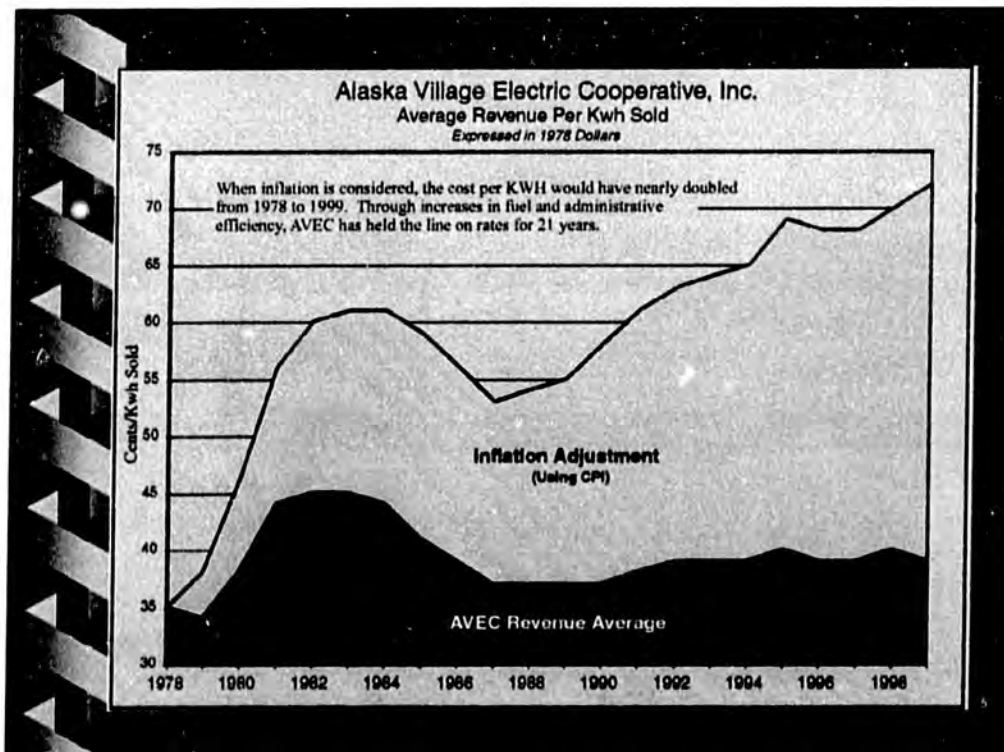
- **Generate reliable, high quality and economically affordable electric energy in the remote villages of rural Alaska.**

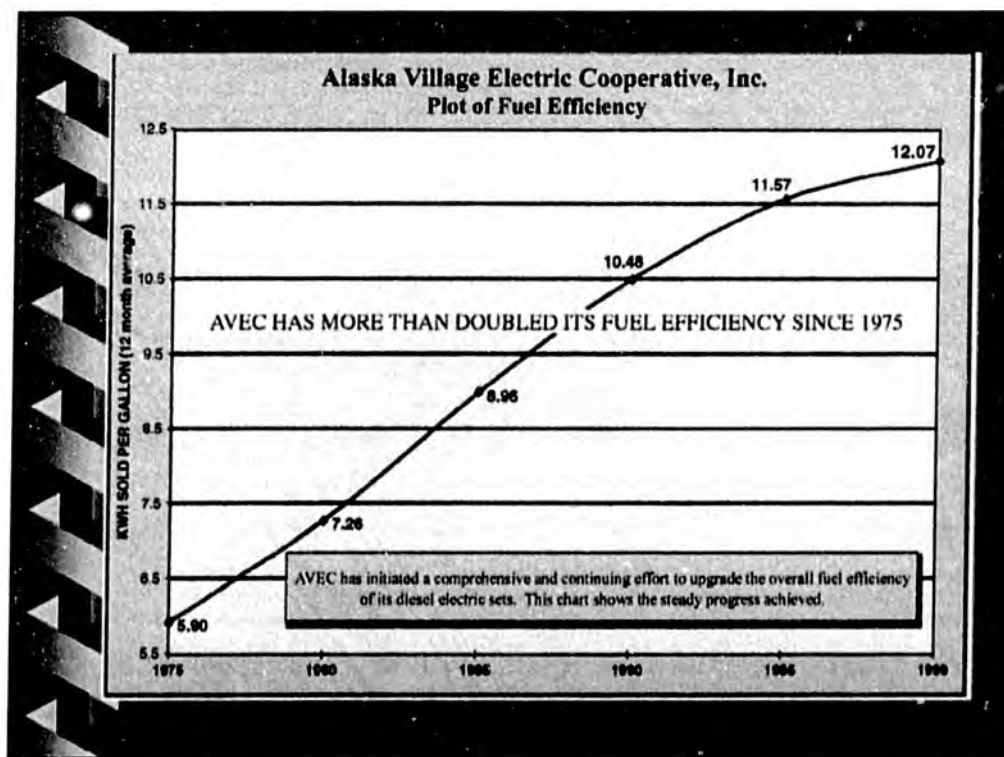
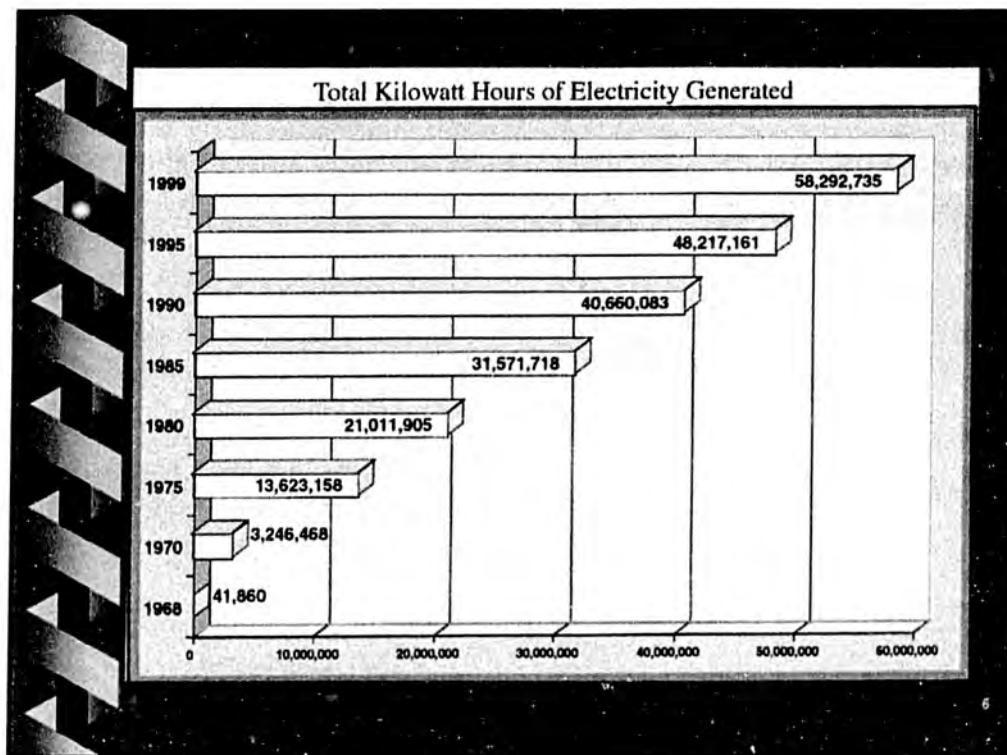


The Conditions: Great Distances

- **Tiny population centers are scattered over a vast geographical area.**
- **Roadway and electrical interties are generally not feasible.**

Alaska Vs. Lower Forty Eight

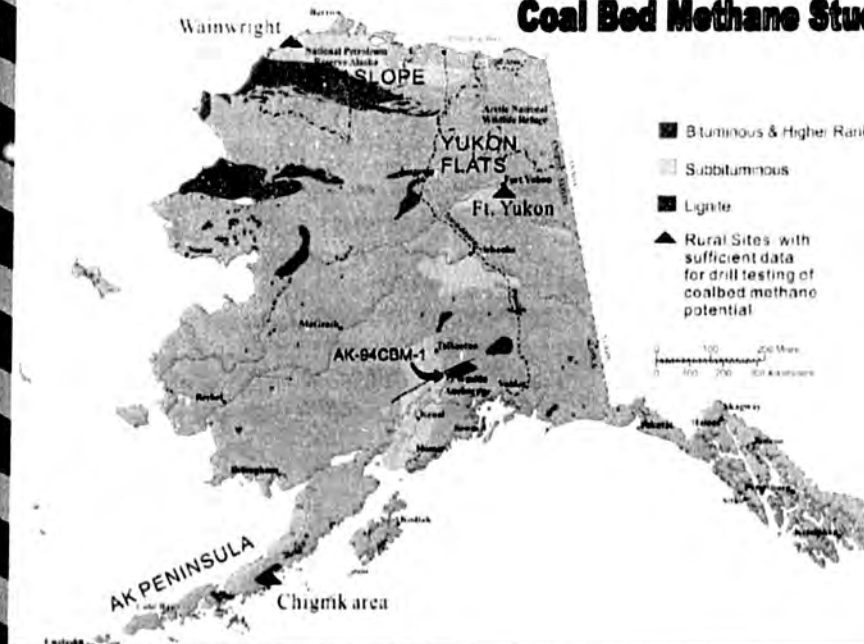


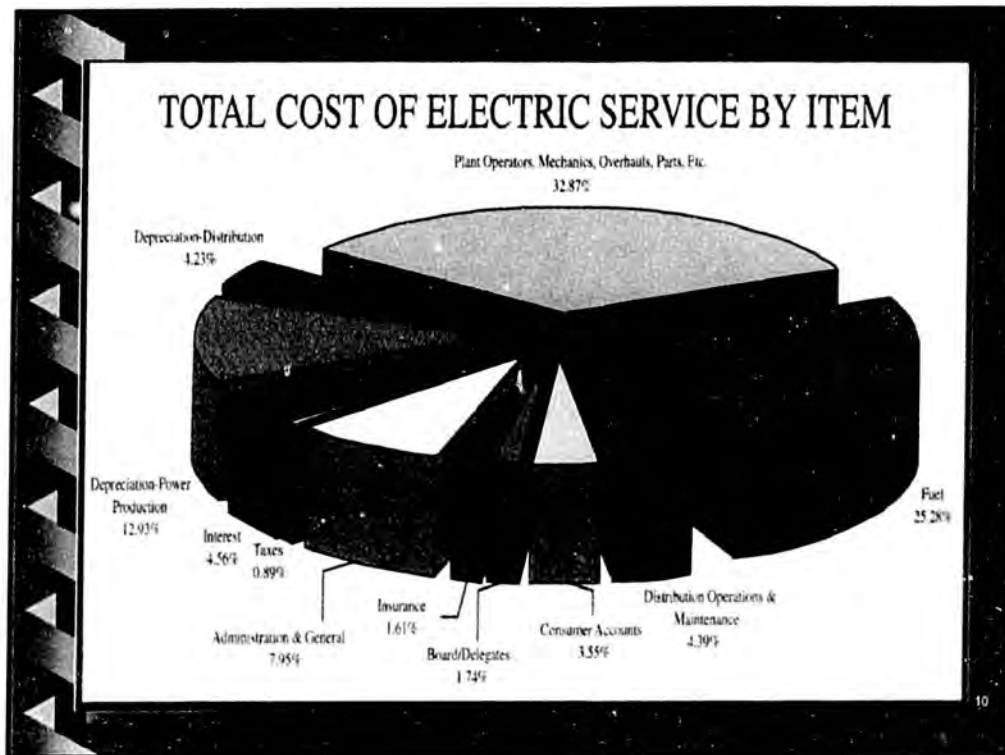


Fuel oil is the primary energy source for rural Alaska.



Coal Bed Methane Study





AVEC's R&D of Alternative Technologies

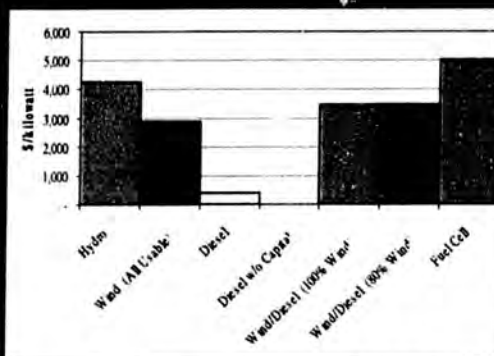
- High efficiency diesels.
- High penetration wind/diesel project at Wales.
- Micro hydroelectric project at Old Harbor.
- Microturbine project at Anchorage headquarters building.
- Advanced control systems & automation.
- Fuel Cells - Gas fuel not available in villages.

Installed Cost (\$/kW)

Hydro based on 600-kW unit with sufficient water for 2.6 million kWh per year.

Wind units do not provide firm capacity.

Diesel and fuel cell does not include fuel storage cost.



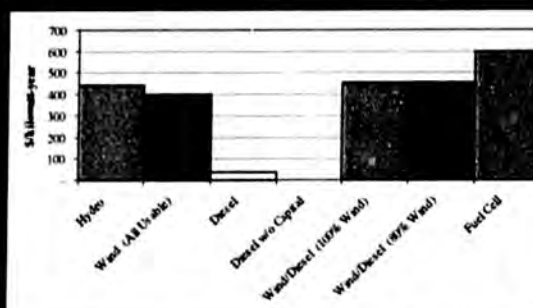
Technology	Installed Cost \$/kW
Hydro	\$4,200
Wind	\$2,900
Diesel	\$500
Wind/Diesel	\$3,200
Fuel Cell	\$5,000

12

Annual Fixed Costs Capital and O&M (\$/kW-yr)

Annual costs based on 7% cost of capital and 20-year amortization period (30 years for hydro).

All annual O&M costs for hydro and wind assumed to be fixed.

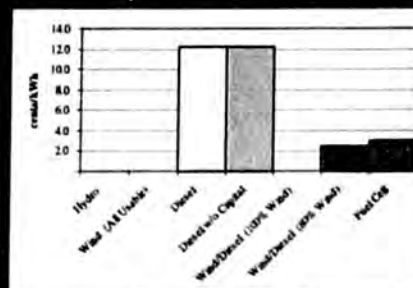


Hydro	\$420/kW-yr
Wind	\$400/kW-yr
Diesel	\$45/kW-yr
Wind/Diesel	\$450/kW-yr
Fuel Cell	\$600/kW-yr

13

Annual Variable Costs Fuel and O&M (cents/kWh)

- Diesel fuel based on 14.0 kWh/gallon and \$1.50/gallon. Variable diesel costs include provisions for overhauls and miscellaneous maintenance.
- Fuel cell based on \$3.00/MCF gas - Remote locations would be higher to include delivery and storage costs.
- Fuel storage facilities for Fuel Cell not in place in remote facilities.

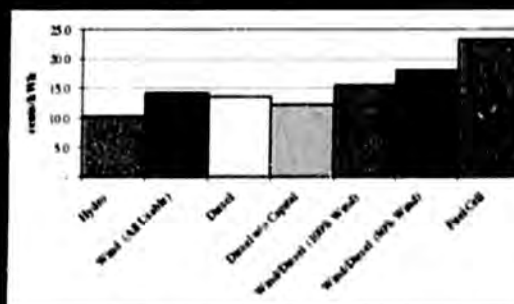


Diesel	12 cents/kWh
Wind/Diesel	2.2 cents/kWh
Fuel Cell	1.5 cents/kWh

14

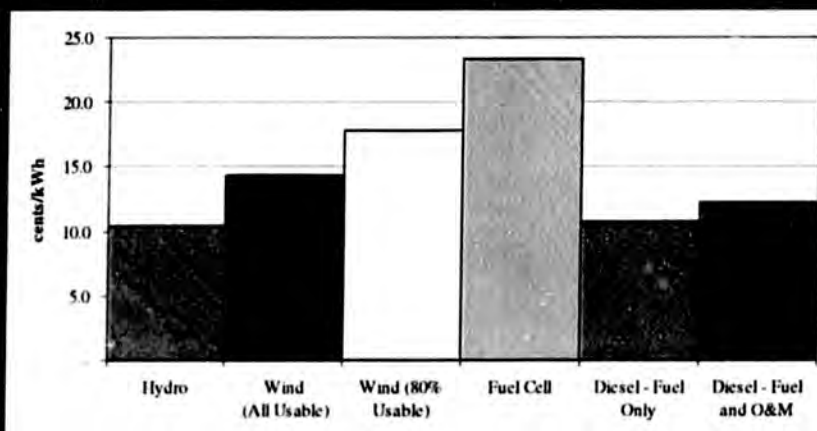
Total Costs (cents/kWh)

- All costs based on approximately 1.6 million kWh per year (except hydro at 2.6 million kWh).
- Diesel without capital is reflective of units already in place and no additional capacity required.
- Not all energy produced from wind turbines may be usable. The more generators, the more unusable energy.



15

Comparison to Avoided Costs (cents/kWh)



Economic Hurdles for Alternatives

- Capital costs of alternatives are much higher than diesel.
- O&M costs of alternatives is estimated, no track record.
- Non-firm alternatives such as hydro and wind compete directly with the avoided diesel fuel cost.
- High risk and cost of coal bed methane exploration and development.
- Alternative fuels compete directly with fuel oil.
- Fuel oil has economies of scale and an established infrastructure for transportation, storage, and utilization.

Conclusions to Date

- Diesel power production sets the benchmark to beat.
- Alternatives to diesel are capital intensive.
- No "silver bullet" technology on the horizon.
- High energy costs in rural Alaska is a long-term problem.



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