SCENARIO ANALYSIS OF ALASKA’S POWER COST EQUALIZATION ENDOWMENT FUND FOR ELECTRICAL SUBSIDIES IN RURAL ALASKA

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Abstract
Energy management is important for the sustainable development. The policy of Power Cost Equalization (PCE) program subsidizes electrical power costs for rural residents in Alaska. This paper examines whether funding from the PCE endowment fund can provide for the future demand for subsidies when certain variables are changed. Sixteen scenarios were developed using variables that affect the supply of funding, demand for subsidies, a potential market change, and potential policy changes. Economic self-sufficiency for each scenario was measured by the endowment’s ability to provide funds for subsidies by the number the years that subsidies are completely funded, the percent of subsidies funded, and net present value. This evaluation found that the endowment will not provide adequate funding to meet the future demand for subsidies. It is recommended to “inflation proof” the PCE endowment fund to grow the principal in order to better meet the future demand for subsidies.

Keywords Sensitivity, Endorsement fund, Electrical Subsidies

1. Introduction
The State of Alaska has established the Power Cost Equalization (PCE) program to grow the principal in order to better meet the future demand for subsidies, similar to how the Alaska Mental Health Trust and University of Alaska endowment funds are currently managed. Allowing commercial enterprises to be eligible for PCE subsidies is not recommended. Subsidize electrical power costs for rural residents that do not have access to the lower electrical rates available in urban areas (Alaska Energy Authority, 2009). Communities eligible for PCE are typically small, remote, isolated, not interconnected by roads or power grid, economically disadvantaged, and produce electricity using diesel delivered infrequently and stored in large tanks (Kohler & Schutt, 2012). Shown below is a comparison of electrical rates between the three major urban communities of Anchorage, Fairbanks, and Juneau, and all other communities in Alaska.
Of note, electricity consumption in PCE communities is highly price inelastic, thus for every change in price a very small change in consumption is expected (Fay & Meléndez, 2012). Residents (households) of PCE eligible communities can be subsidized for their first 500 kWh of monthly power usage, with no subsidy after the 500 kWh limit (Alaska Energy Authority, 2009). Commonly, per capita power usage in these rural communities is half of the per capita power usage in urban communities in Alaska, even with the PCE subsidy (Kohler & Schutt, 2012). Communities are eligible for a monthly 70 kWh per capita subsidy for common facilities such as laundry, washrooms, and street lights. Commercial enterprises are not eligible for the PCE subsidy (Alaska Energy Authority, 2009).

This paper examines whether the PCE Endowment Fund can provide for future needs of the recipients when certain variables are changed. Variables affecting the supply of funding from the endowment are return on investment, percent disbursement, and discount rate. Variables that affect the demand for subsidies are population, climate change, per capita demand, inflation, and differential inflation for fuel. A market change that could affect the calculation for subsidies is the importation of liquefied natural gas into Southcentral Alaska. Policy changes that may affect the demand for subsidies are residential, commercial, and community limits, House Bill No. 39, a large hydro project in the Railbelt, a change in conservation, and the use of more renewables.

All PCE communities are aggregated into a single unit for analysis. Certain variables are approximated to have a uniform rate of change. Scenarios will be run to test the endowment fund to determine when it succeeds and fails to provide sufficient earnings to fund subsidies provided by the PCE program.

This topic should be of interest to policy makers and members of the public who are concerned about energy issues in Alaska. Alaska in the near term may have the financial resources to adjust the PCE program and/or the endowment to obtain economic self-sufficiency, while in future there may be less financial resources available to make adjustments. Attention should be given to any necessary policy changes that can be made now to ensure that the endowment fund provides benefits in the future.

### 1.1 Conditions in Rural Alaska

The increase in energy prices over the last several years has put Rural Alaska under substantial strain. As described in a recent report by Commonwealth North:

“Twenty percent of Alaska’s 710,000 residents live in almost 300 communities spread across 500,000 square miles. While some rural communities are larger - Ketchikan, Kodiak, etc. – most are small. Hub communities such as Barrow, Bethel, Kotzebue, Nome, Dillingham and others are home to 2,500-
5,000 people while some 250 communities have populations of 50-1,100. Per capita income is extremely low while costs of goods and services are extremely high. Low income and high costs are among the drivers causing many community members to move to hubs, urban communities, and outside destinations in search of gainful employment and affordable cost of living.” (Kohler & Schutt, 2012)

Electrical rates in Rural Alaska can be 3 to 5 times higher than in urban Alaska (Alaska Energy Authority, 2013b). Currently, 183 communities are eligible for PCE subsidies (Alaska Energy Authority, 2012), which is about 80% of all rural communities in Alaska (Alaska Energy Authority, 2009). About 30% of all electrical energy sold in PCE eligible communities receive PCE subsidies, and the total PCE program cost represents 18% of the total cost electricity in those communities (Kohler & Schutt, 2012).

Typically, residential customers participating in the PCE program consume 40% less electricity per month than customers in urban areas of Alaska (Fay, Meléndez & Schwörer, 2012). Households in rural Alaska with the lowest incomes can spend up to 47% of their total income for heating and electricity, more than five times than in urban areas (Kohler & Schutt, 2012). Clearly, the PCE program is beneficial to many Alaskans, especially those with limited income.

1.2. Power Cost Equalization
The PCE program was established to subsidize electrical power costs for rural residents that do not have access to the lower electrical rates available in urban areas. Specifically, “PCE was established in 1984 as a parity program to lower the end cost of electricity in rural Alaska while projects were built to lower costs in more urban areas – Bradley Lake Hydro to serve the Railbelt, the Northern Intertie to bring low cost gas-fired power to Fairbanks, and hydro projects to serve Valdez, Kodiak, Ketchikan, Petersburg and Wrangell.” (Kohler & Schutt, 2012)

Residents of PCE eligible communities can be subsidized for their first 500 kWh of monthly power usage; there are no subsidies after the 500 kWh limit. Communities eligible for PCE can also receive a monthly 70 kWh per capita subsidy for common facilities such as laundry, washrooms, and street lights. State and Federal facilities, and commercial enterprises are not eligible to participate in the PCE program (Alaska Energy Authority, 2013b).

Of note, rural utility costs increased by 170% in the last 20 years and PCE disbursements have only risen by 56% in the last 20 years (Kohler & Schutt, 2012). The following exhibit shows cost differences that certain communities would experience with and without PCE subsidies.

The formula to determine how much subsidy is available to PCE eligible communities is based upon the weighted average cost of power generation in Alaska’s three largest urban communities: Anchorage, Fairbanks, and Juneau, determined by tariff filings submitted by the utilities to the Regulatory Commission of Alaska (Alaska Energy Authority, 2009). The current weighted average cost of urban power generation is $0.1430/kWh. The subsidized electrical power rate for residential users is 95% of the difference between the calculated urban base rate and the electrical power rate for that particular PCE community (Alaska Energy Authority, 2009). The subsidized electrical power rate for each community is determined by the Regulatory Commission of Alaska and currently cannot exceed $0.8142/kWh (Alaska Energy Authority, 2013b).
Exhibit 2 Cost With and Without PCE Subsidies (Meléndez & Fay, 2012)

The Exhibit below summarizes the current values from the PCE Funding Formula (Alaska Energy Authority, 2013b).

Exhibit 3 Current Values from the PCE Funding Formula

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Eligible Utility Cost</td>
<td>$1.00/kWh</td>
</tr>
<tr>
<td>Maximum Residential Subsidy</td>
<td>$0.81/42/kWh</td>
</tr>
<tr>
<td>Current Average Residential Rate</td>
<td>$0.53/kWh</td>
</tr>
<tr>
<td>Current Average Eligible Utility Cost</td>
<td>$0.47/kWh</td>
</tr>
<tr>
<td>Current Average Effective Residential Rate</td>
<td>$0.22/kWh</td>
</tr>
<tr>
<td>Weighted Average Urban Cost</td>
<td>$0.1430/kWh</td>
</tr>
</tbody>
</table>

In fiscal year 2012, the PCE program made payments totaling $39.5 million. These payments were funded at 100% of the level determined by the formula (Alaska Energy Authority, 2013b). It should be noted that the payments can be, and in the past have been, made at less than 100% level when there is insufficient funding (Alaska Energy Authority, 2009).

The following excerpt from the PCE Funding Formula Review (Fay, Meléndez & Schwörer, 2012) describes the effects of the program:

“While residents in PCE communities may be consuming more electricity than they would if they were paying market prices, their consumption is in the realm of “lifeline” levels barely powering what would be considered essential modern household functions such as lights and refrigeration. It appears that the
primary effect of the PCE program is increasing the quality of life of rural residents rather than encouraging “excessive” use of electricity.”

### 1.3. PCE Endowment Fund

Funding for the PCE program is available from the PCE endowment fund, appropriations from the General Fund, and the PCE Fund and Rural Electric Capitalization Fund (Alaska Energy Authority, 2013b). The PCE endowment fund was established with the intent of providing sufficient earnings to the PCE program so that it would be economically self-sufficient, and not require general fund appropriations (Kohler & Schutt, 2012). The PCE Fund and Rural Electric Capitalization Fund are no longer being used (Legislative Finance Division, 2013). The endowment was valued at $751.8M as of June 30, 2012 (Legislative Finance Division, 2013).

The endowment fund was created and capitalized in 2001 with funds from the Constitutional Budget Reserve and proceeds from the Four Dam Pool (Alaska Energy Authority, 2013b). The endowment is invested to produce at least a per annum return of 7%, the proceeds of which are used to fund the electrical power subsidies and grants to improve the power systems (Alaska Energy Authority, 2009). Specifically, 7% of the PCE Endowment Fund’s previous three year monthly average market values may be appropriated for annual PCE program costs (Alaska Energy Authority, 2009).

#### Exhibit 4 Significant Funding Changes to the Endowment Fund (Kohler & Schutt, 2012)

<table>
<thead>
<tr>
<th>Amount</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>$182.7M</td>
<td>Added in October 2006</td>
</tr>
<tr>
<td>$400.0M</td>
<td>Added in July 2011</td>
</tr>
<tr>
<td>$681.6M</td>
<td>Balance as of September 30, 2011</td>
</tr>
<tr>
<td>($74M)</td>
<td>Fund posted a loss in 2011</td>
</tr>
<tr>
<td>$751.8M</td>
<td>Balance as of June 30, 2012</td>
</tr>
</tbody>
</table>

The financial performance for the endowment fund was examined for the fiscal years 2003 through 2012 (Treasury Division, 2013). A summary of the relevant statistics for the rate of return for those 10 years is shown below:

#### Exhibit 5 Endowment Fund Rate of Return Statistics for the 10 Years

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Return</td>
<td>7.57%</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>11.24%</td>
</tr>
<tr>
<td>Maximum Return</td>
<td>24.33%</td>
</tr>
<tr>
<td>Minimum Return</td>
<td>-13.32%</td>
</tr>
</tbody>
</table>

The mean value for the return on investment is 7.57%, just above the target return of 7%. The standard deviation is quite large and reflects a broad range of potential results for the return on investment. It should be noted that this 10 year period included a significant recession in the United States economy, which could explain the wide range in values for the return on investment. The future is uncertain and a broad range of results for the return on investment could also occur in the next 10 years, thus the 7% appears to be a reasonable target.

### 1.4. Hypothesis

The endowment fund had a balance of $751.8M as of June 30, 2012 (Kohler & Schutt, 2012), which is a large amount of money by any measure. My hypothesis is that Alaska’s PCE endowment fund will provide adequate
funding in the future for the rural electrical subsidies and utility improvement grants under a variety of policy changes and economic conditions.

1.5. Following Chapters
The following chapters discuss the results of the literature survey, definition of the variables selected, methods used for evaluation, analysis and interpretation the results, suggested changes, and recommendations for future work.

2. Literature Survey
Electrical rates and subsidies in rural Alaska have been the subject of very few journal articles, but have been described in many technical reports developed by the Alaska Energy Authority (AEA) and the Institute of Social and Economic Research (ISER) at the University of Alaska Anchorage. Noteworthy sources of information as shown below.

2.1. PCE Data and Statistics
The Alaska Energy Authority publishes annual statistics for the PCE program, the latest of which is for fiscal year 2011 (Alaska Energy Authority, 2012), and periodically publishes reports on overall energy use in Alaska, the latest of which covers the period from 1960 through 2011 (Fay, Meléndez & West, 2012). Additional information for the PCE program includes State Statutes, Regulations, and an informational guide published by the Alaska Energy Authority (Alaska Energy Authority, 2009). Information from these sources was useful in establishing the context for the PCE program and deriving data used in the subsequent calculations.

2.2. Comparable Endowment Funds
Other large funds also managed by the State of Alaska were examined as they are indicators of the potential performance of the PCE endowment fund. The assumption is that, since all the funds are managed by the State of Alaska, there would be similar approaches to managing the funds. The primary sources for this examination were the review of the proposed fiscal year 2014 by the Alaska Legislative Finance Division (Legislative Finance Division, 2013), the revenue sources book produced by the Alaska Tax Division (Tax Division, 2012), the Public Employees’ Retirement System Annual Report (Division of Retirement and Benefits, 2012), and the financial history and projections from the Alaska Permanent Fund (Alaska Permanent Fund Corporation, 2012). The Exhibit below compares large funds managed by the State of Alaska.

**Exhibit 6 Comparison of Large Funds Managed by the State of Alaska**

<table>
<thead>
<tr>
<th>Fund</th>
<th>Target Return</th>
<th>Distributions</th>
<th>Inflation Proofing</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCE Endowment</td>
<td>7%</td>
<td>7% of the past 36 month average balance</td>
<td>No</td>
</tr>
<tr>
<td>Alaska Permanent Fund</td>
<td>5.3%</td>
<td>10.5% of past 5 years realized income</td>
<td>Yes</td>
</tr>
<tr>
<td>Mental Health Trust</td>
<td>Managed by the Alaska Permanent Fund</td>
<td>4.25% of moving 4 year average</td>
<td>Yes</td>
</tr>
<tr>
<td>University of Alaska Endowment</td>
<td>8%</td>
<td>4.5% of moving 5 year average</td>
<td>Yes</td>
</tr>
<tr>
<td>Public Employees Retirement System</td>
<td>8%</td>
<td>-</td>
<td>No</td>
</tr>
</tbody>
</table>

Also examined was summary information for University endowments in the United States (Brown, Garlappi & Tiu, 2010). The Exhibit below shows the results of averaging those yearly means and standard deviations for returns and disbursements.
The generally accepted target for university endowment disbursements is 5%, which agrees with the mean shown in the exhibit above. Simulations have shown that 5.5% is generally the upper limit for disbursement while still preserving the principal of the fund (Bowman, Tuckman & Young, 2012).

2.3. Current Legislation
In January 2013 House Bill No. 39 was introduced to revise the PCE program (Edgmon, Herron, & Kreiss-Tomkins, 2013). This act would raise the residential limit to 600 kwh per month, and include small businesses up to 600 kwh per month as long as the business uses less than 2,400 kwh per month. The sponsor statement stressed that the residential limits were currently minimal to support basic functions, and that small businesses also needed relief to safeguard the economy in rural Alaska. The Fiscal Note included projections of funding requirement with and without HB39 through SFY 2019 (Alaska Energy Authority, 2013a).

Exhibit 7 Summary Information for University Endowments in the United States

<table>
<thead>
<tr>
<th>University Endowments</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Years</th>
<th>Number of Endowments Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns</td>
<td>10.11%</td>
<td>7.27%</td>
<td>1989 to 2005</td>
<td>281 to 709</td>
</tr>
<tr>
<td>Disbursements</td>
<td>4.96%</td>
<td>0.20%</td>
<td>1994 to 2005</td>
<td>375 to 709</td>
</tr>
</tbody>
</table>

2.4. Population
The Alaska Department of Commerce and Workforce Development periodically produces a report with low, baseline, and high projections for future population in Alaska. The methodology separates the current population into five year “cohorts” and applies fertility, mortality, in-migration, out-migration factors based upon the particular cohorts demographics. The report summarizes the findings by demographic groups, region, census area, and statewide basis. Information was extracted using the census areas that contain the PCE communities. The timeframe for the projections is 2010 through 2035 (Hunsinger, Howell & Whitney, 2012). The exhibit below shows the past and projected population trends for economic regions in Alaska.

Exhibit 8 Alaska Population by Economic Region (Hunsinger, Howell & Whitney, 2012)

2.5. Electrical Use in Rural Alaska
A journal paper entitled “Population, climate, and electricity use in the Arctic, integrated analysis of Alaska community data” examined relationships between weather, population, and electricity consumption in 42 communities in rural Alaska. That paper found that population is the dominate variable in electrical use, and that there is an upward trend in per capita electricity use (Hamilton et al, 2011). This paper provided information on changes in electrical use due to per capita demand and climate change.

2.6. Fuel Prices
Electrical generation in PCE eligible communities is mostly dependent upon diesel fuel. ISER periodically produces for AEA a report with low, baseline, and high projections for diesel fuel prices for PCE eligible communities. The timeframe for the fuel price projections is 2012 through 2035 (Fay, Meléndez & Pathan, 2012).

2.7. Programs in Other Countries
Surprisingly, journal articles were not found for rural electrical rate subsidies in the United States, Northern Europe and Canada. Journal articles were found for rural electrical rate subsidies in Brazil, China, India, and Nepal, all countries with rural regions undergoing development. However, in those cases the electrical subsidies either applied to user rates in centralized systems, user rates for specific industries such as agriculture, or effects to user rates from funding infrastructure improvements. Those programs are not applicable because the Alaska PCE program serves only residential customers in communities with decentralized utility systems (isolated, not interconnected to a widespread power grid).

There are similar electrical subsidies being provided in the Canadian territories of Northwest (Northwest, 2010), Yukon (Yukon 2011), and Nunavut (Nunavut, 2005). These territories have small remote isolated communities that use diesel to generate electricity. Each territory is served by a single utility (Wikipedia, 2013) and the government of each territory provides the funding for the subsidies to relieve the burden of high prices in those communities. Funding for each territorial government is provided by the federal Canadian government (Department of Finance Canada, 2013). The Canadian subsidies are similar to the Alaskan PCE program in that each territory uses a large community with relatively lower electrical rates to determine the base rate. The Canadian subsidies differ in that there does not appear to be a large endowment to fund the electrical subsidies in the Canadian territories. The exhibit below shows the comparative differences of the electrical subsidies between the territories. From the literature survey it appears that the PCE program in Alaska is a mature and refined policy, however it provides lower levels of subsidies than provided in Canada.

![Exhibit 9 Electrical Subsidies in Canadian Territories](Northwest, 2010) (Yukon 2011) (Nunavut, 2005)

<table>
<thead>
<tr>
<th>Territory</th>
<th>Energy Levels for Residential Rates (kWh per month)</th>
<th>Energy Levels for Commercial Rates (kWh per month)</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northwest</td>
<td>First 600 in summer, First 1.000 in winter</td>
<td>N/A</td>
<td>Northwest Territories Power Corporation</td>
</tr>
<tr>
<td>Territories</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yukon</td>
<td>First 1,000, then 1.001 to 2,500, then over 2,500</td>
<td>First 2,000, Then 2,001 to 15,000, Then 15,001 to 20,000, then over 20,000</td>
<td>Yukon Electrical Company Limited &amp; Yukon Energy</td>
</tr>
<tr>
<td>Nunavut</td>
<td>First 700 in summer, First 1,000 in winter</td>
<td>First 1,000</td>
<td>Qulliq Energy Corporation</td>
</tr>
</tbody>
</table>

3 Definition of Variables Used in the Economic Analysis
Data has been obtained from multiple sources and reduced to a usable form, either an annual percent change or a one-time percent step increase or decrease. All PCE eligible communities are aggregated into a single unit for analysis. Certain variables are approximated to have a uniform rate of change. Care was taken in the calculations to ensure that the initial values were expressed in current year dollars. The exhibit 10 shows the sixteen variables used in the scenarios, and are described further in subsequent sections.

3.1. Supply of Funding
The exhibit 11 summarizes the values chosen for the variables that affect the supply of funding available from the endowment for subsidies.

The supply variables are described in detail below.

3.1.1. Return on Investment
By Statute, the target return on investment for the endowment fund is 7% (Alaska Energy Authority, 2009). The actual return will be a result of the management decisions to select the investments and the variability inherent to most investments. The low, baseline, and high values chosen are, respectively, 5.3%, the current target of the Alaska Permanent Fund which is based upon blend of current market performance indicators (Alaska Permanent Fund Corporation, 2012), 7%, the mandated target minimum return on PCE endowment investments (Alaska Energy Authority, 2009), and 10.11%, the average return derived from a study of university endowment funds in the United States (Brown, Garlappi & Tiu, 2010).

<table>
<thead>
<tr>
<th>Exhibit 10 Variables for Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply Variables</strong></td>
</tr>
<tr>
<td><strong>Annual Percent Change</strong></td>
</tr>
<tr>
<td><strong>Low</strong></td>
</tr>
<tr>
<td>Return on Investment</td>
</tr>
<tr>
<td>Statutory Disbursement</td>
</tr>
<tr>
<td>Discount Rate (Nominal)</td>
</tr>
<tr>
<td><strong>Demand Variables</strong></td>
</tr>
<tr>
<td>Population Change</td>
</tr>
<tr>
<td>Climate Change</td>
</tr>
<tr>
<td>Per Capita/Customer Demand</td>
</tr>
<tr>
<td>Inflation Rate</td>
</tr>
<tr>
<td>Differential Inflation for Fuel</td>
</tr>
<tr>
<td>Compounded Demand Factor</td>
</tr>
<tr>
<td><strong>Market Event Variables</strong></td>
</tr>
<tr>
<td><strong>One Time Step Increase/Decrease</strong></td>
</tr>
<tr>
<td>Imported LNG</td>
</tr>
<tr>
<td><strong>Policy Variables</strong></td>
</tr>
<tr>
<td><strong>One Time Step Increase/Decrease</strong></td>
</tr>
<tr>
<td>Residential Limits</td>
</tr>
<tr>
<td>Commercial Limits</td>
</tr>
<tr>
<td>Community Facilities</td>
</tr>
<tr>
<td>HB 39</td>
</tr>
<tr>
<td>Large Hydro</td>
</tr>
<tr>
<td>Change in Conservation</td>
</tr>
<tr>
<td>More Renewable Energy</td>
</tr>
</tbody>
</table>
3.1.2. Disbursement
The annual disbursement from the PCE endowment fund is set by Statute, whereas the disbursements from other endowment funds are typically determined by policy of the organization managing those funds. The low, baseline, and high values chosen are, respectively, 4.5%, the policy of the University of Alaska endowment fund (Tax Division, 2012), 5.5%, the projected upper limit of disbursements that will still preserve the principal (Bowman, Tuckman & Young, 2012), and 7%, the target disbursement of the PCE endowment (Alaska Energy Authority, 2009).

3.1.3. Discount Rate
The discount rate used in this evaluation is to calculate constant year dollars to evaluate alternatives relative to each other. The nominal low, baseline, and high values chosen are, respectively, 4.41%, which is the result of combining the current 20 year treasury bond (2.89%) (U.S. Treasury, 2013) with the low inflation rate estimated by the Federal Reserve Bank of Cleveland (1.52%), 7%, the guidance given for evaluating investments in the OMB Circular A-94 (U.S. Office of Management and Budget, 1992), and 8%, the rate adopted by the Public Employees Retirement System Board (Division of Retirement and Benefits, 2012).

3.2. Demand for Subsidies
These variables represent the change in consumption and subsequent demand for subsidies. These variables are due to external factors, such as prior economic conditions, generally outside the control of policy makers. The exhibit below summarizes the values chosen for the variables that affect the demand for subsidies.

**Exhibit 12 Values for Demand Variables**

<table>
<thead>
<tr>
<th>Demand Variables</th>
<th>Annual Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population change</td>
<td>-0.24% 0.49% 1.40%</td>
</tr>
<tr>
<td>Climate Change</td>
<td>-1.09% -0.67% -0.24%</td>
</tr>
<tr>
<td>Per Capita/Customer Demand</td>
<td>0% 0.82% 2.03%</td>
</tr>
<tr>
<td>Inflation Rate</td>
<td>1.52% 2.20% 2.50%</td>
</tr>
<tr>
<td>Differential Inflation for Fuel</td>
<td>-0.72% 2.09% 3.40%</td>
</tr>
<tr>
<td>Compounded Demand Factor</td>
<td>5.01%</td>
</tr>
</tbody>
</table>

The combination of baseline values is used in the initial cash flow described later in this report. Low and high values are not combined as it is not plausible that conditions would occur to produce either all low or high values. The demand variables are further described below.

3.2.1. Population
Using the population projections from the Alaska Department of Labor and Workforce Development (ADLWD), information was extracted using the census areas that contain the PCE communities. Those projections are irregular gradients. To simplify the gradients the baseline value for average annual growth over the entire timeframe was computed for the areas containing PCE communities. Low and high variance of population growth for the areas containing PCE communities was extrapolated from the variance developed by
(ADLWD) for the statewide projections. This assumes that the statewide variance applies equally to the areas containing the PCE communities. The low, baseline, and high values chosen are, respectively, -0.24%, 0.49%, and 1.40% (Hunsinger, Howell & Whitney, 2012).

3.2.2. Climate Change
The paper that examined relationships between weather, population, and electricity consumption electrical to population and climate in rural Alaska found that a 1 degree C increase in climate temperature is equivalent to 7 people leaving an average size community of 800 people (Hamilton et al, 2011). Projected temperature changes were interpolated from a U.S. government document retrieved from the website for U.S. Global Change Research Program (U.S. Global Research Program, 2009). The annual percent change in electrical usage due to climate change was calculated using information from these two sources. The low, baseline, and high values chosen are, respectively, -1.09%, -0.67%, and -0.24%.

3.2.3. Per Capita Demand
The baseline, and high values chosen are, respectively, 0.82%, calculated from the 2011 PCE Statistics using the years 2000 through 2011 (Alaska Energy Authority, 2012), and 2.03%, calculated from the 114 kWh/person per year increase reported in the paper that examined relationships between weather, population, and electricity consumption electrical to population and climate in rural Alaska (Hamilton et al, 2011).

3.2.4. Inflation
The low, baseline, and high values chosen are, respectively, 1.52%, (Federal Reserve Bank of Cleveland, 2012), 2.20%, the CBO’s estimate of future inflation for the Core CPI (Congressional Budget Office, 2012), and 2.50%, used by the financial consultant for the State of Alaska (Tax Division, 2012).

3.2.5. Differential Inflation for Fuel
In recent history the price of diesel fuel has escalated annually at a rate greater than the general inflation rate. Low, baseline, and high fuel price projections for the timeframe 2012 through 2035 were developed by ISER; those projections are irregular gradients. To simplify the gradients the average annual rate of increase/decrease were calculated for the low, baseline, and high projections. The low, baseline, and high values chosen are, respectively, -0.72%, 2.09%, and 3.40% (Fay, Meléndez & Pathan, 2012).

3.3. Market Change
A market change that could affect the calculation of subsidies in the PCE formula is, beginning in 2015, the potential importation of liquefied natural gas into Southcentral Alaska. According to Joe Griffith, general manager of Matanuska Electric Association, importing liquefied natural gas into Southcentral Alaska could raise electrical rates 30% to 40% (Anchorage Daily News, 2012), resulting in an increase to the base rate used in the PCE subsidy formula. Most of the electrical generation for the Railbelt area of the Alaska is from thermal plants using natural gas in Southcentral Alaska. Specifically, 87.00% of the weighted average used for the base rate is from Railbelt area (Regulatory Commission of Alaska, 2012), of that generation 73.50% is from natural gas (Fay, Meléndez & West, 2012). Thus, 63.95% of the base rate for PCE calculations is affected by the price of natural gas. A new base rate was calculated using the 30% and 40% increases in the price of natural gas. From those results a new electrical rates eligible for PCE subsidies were calculated, with further calculations to determine the associated percent change to the PCE subsidies. It should be noted that with the decrease in PCE subsidies, there will also be an increase in electrical rates paid by residents in PCE communities; almost all Alaskans would be adversely affected by the importation of natural gas into Southcentral Alaska. A weakness of this scenario is that “overnight” implementation is assumed, when in reality there would be a transition period of several years. The exhibit below summarizes the values chosen for the potential market change that may affect the demand for subsidies.

Exhibit 13 Values for Market Event Variables
3.4. Policy Changes that Affect Demand
The exhibit below summarizes the values chosen for the policy changes that may affect the demand for subsidies.

### Exhibit 14 Values for Policy Variables

<table>
<thead>
<tr>
<th>Policy Variables</th>
<th>One Time Step Increase/Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>Residential Limits</td>
<td>0.00%</td>
</tr>
<tr>
<td>Commercial Limits</td>
<td>35.00%</td>
</tr>
<tr>
<td>Community Facilities</td>
<td>0%</td>
</tr>
<tr>
<td>HB 39</td>
<td>0%</td>
</tr>
<tr>
<td>Large Hydro</td>
<td>0%</td>
</tr>
<tr>
<td>Change in Conservation</td>
<td>-22.32%</td>
</tr>
<tr>
<td>More Renewable Energy</td>
<td>-4.13%</td>
</tr>
</tbody>
</table>

The policy variables are further described below.

#### 3.4.1. Residential Limits
The residential limits have been proposed to be changed from 500 kWh/month to 600kWh/month (Edgmon, Herron, & Kreiss-Tomkins, 2013), approximately 150% of “lifeline”, and 500 kWh/month to 700 kWh/month (Fay, Meléndez & Schwörer, 2012) to match the statewide average. From the report by ISER PCE Program Funding Formula Review: "We estimated the increase in total disbursements to residential customers in CY2009 if the eligibility cap were 700 kWh per month. Raising the cap would have increased disbursements to almost $34 million from $31 million, or less than 8%." Assuming a linear increase, raising the residential limit to 600kWh per month should result in a 4% increase in subsidies. The baseline, and high values chosen are, respectively, 4.00%, and 8.00%.

#### 3.4.2. Commercial Limits
The commercial limits have been proposed to change from zero to 500 kWh/month (Fay, Meléndez & Schwörer, 2012), and from zero to 600kWh/month for businesses using less than 2,400 kWh/month (Edgmon, Herron, & Kreiss-Tomkins, 2013), and from zero to 700 kWh/month (Fay, Meléndez & Schwörer, 2012). From the report by ISER PCE Program Funding Formula Review: "Under the current PCE program structure, funding for disbursements would have to increase about $11 million or 35%, to provide assistance to commercial customers at the 500 kWh per month level. If eligibility was available for 700 kWh per month, funding would have to increase about $15 million or 47%." Assuming a linear relationship, raising the commercial limit to 600 kWh/month results in a 41% increase in PCE subsidies. The low, baseline, and high values chosen are, respectively, 35.00%, 41.00%, and 47.00%.

#### 3.4.3. Community Limits
The current limit for communities is 35 kWh per person per month (Alaska Energy Authority, 2012). Assuming the current 35 kWh per person per month is the “lifeline”, a value for 150% of “lifeline” is extrapolated. The 150% of “lifeline” is similar to what was proposed by ISER for the residential limits (Fay, Meléndez & Schwörer, 2012). The 150% community limit was calculated proportionally based upon the residential limits, resulting in a 0.70% increase in PCE subsidies. The high value chosen is 0.70%.

#### 3.4.4. House Bill No. 39
House Bill No. 39 was introduced in January 2013 and proposes to raise the residential limit from 500 kWh/month to 600 kWh/month, and simultaneously raise the commercial limit from 600 kWh/month for commercial enterprises that use less than 2,400 kWh/month. From Fiscal Note for House Bill No. 39, in FY 2013 (Alaska Energy Authority, 2013a):

$$\begin{align*}
\text{Total Program Cost without HB39} & = 40,351 \\
\text{Total Program Cost with HB39} & = 61,039
\end{align*}$$

By proportionality, the increase to the PCE subsidies is 51.27%. An alternate method of calculation is to combine the baseline values determined above for the residential (3.4.1) and commercial limits (3.4.2). The result is 46.64%. The baseline, and high values chosen are, respectively, 46.64%, and 51.27%.

### 3.4.5. Large Hydro

A large hydroelectric project on the Susitna River has been proposed to provide power for the Railbelt area. This project has the potential to lower electric rates in Southcentral Alaska, which in turn would decrease the base rate used in the PCE formula. The Susitna project estimates that the facility could begin generating power in 2024, and the 10 year average rate would be $0.124, for the timeframe 2024 to 2035, expressed in 2013 dollars (Alaska Energy Authority, 2013c). Specifically, 87.00% of the weighted average for the base rate is from Railbelt area (Regulatory Commission of Alaska, 2012), and 50.00% of the Railbelt generation would be provided by Susitna (Alaska Energy Authority, 2013c). Thus, 43.50% of the base rate for PCE calculations is affected by the price of by adding Susitna hydroelectric into the system. A new base rate ($0.1347/kWh) was calculated using 10 year average rate listed above. From those results a new electrical rate eligible for PCE subsidies was calculated, with further calculations to determine the associated percent change to the PCE subsidies, 4.23%. The high value chosen is 4.23%.

### 3.4.6. Conservation

A change in conservation could reduce the demand for PCE subsidies. This may seem counter-intuitive since many residents in PCE communities are already using less energy than the statewide average, and in many cases just barely above lifeline (Fay, Meléndez & Schwörer, 2012). However, as of March 2012 the Rural Cap Energy Wise program has been able improve energy efficiency in 18 PCE communities (approximately 10%) through a combination of training and capital investment (Rural Cap, 2012). Four more communities were scheduled to be improved in 2012. In 2010 the average electrical savings to the PCE program for each home improved under the Energy Wise program was $39/month, or a 31.71% decrease to the PCE program for that home. The cost to improve each home under the Energy Wise program in 2010 was $2,000.

Using the Rural Cap Energy Wise program as an example, it assumed that 80% of the households participate in the improvements due to the obvious economic advantages to the homeowner. The rationale to limiting the number to 80% is that, in my experience, some people would rather maintain their privacy than gain energy savings, and that others will not get around to completing the paperwork.

From the 2011 PCE Report there were 26,753 residential customers in 183 communities (Alaska Energy Authority, 2012). Using the information and assumptions above there are 18,829 residences remaining to be improved. Using the average decrease in electrical usage per residence, the overall decrease to the subsidies is calculated to be -22.32%.

Of note, the cost to fully implement this scenario would be $37,658,000 (using $2,000/home). The weaknesses of this scenario are that 1) “overnight” implementation is assumed when in reality it would take many years to fully to implement, and that 2) 80% participation may be too optimistic.

To develop a less optimistic scenario, the same calculation was performed using only 50% of the remaining homes being improved, resulting in a -13.95% decrease in subsidies. The low, and baseline values chosen are, respectively, -22.32%, and -13.95%.
3.4.7. Renewables
As fuel prices have risen, more sources of renewable energy in rural Alaska has been explored (Fay, Meléndez & Schwörer, 2012), specifically wind energy. Nearby hydroelectric sources are mostly developed, and hydrokinetic and tidal is still experimental. The "PCE Program Funding Formula Review" performed by ISER for the National Renewable Energy Laboratory (Fay, Meléndez & Schwörer, 2012) developed several scenarios, one of which was: "a PCE utility moving from generating all electricity with diesel to having a low renewable penetration hybrid system of 9% wind and 91% diesel generation. This change leads to a decrease in fuel costs of about 9%. In this scenario, we assumed an increase in non-fuel costs of 3 cents per kWh sold and this leads to an increase of 17% in total non-fuel costs. After the decrease in fuel costs and the increase in non-fuel costs, the total cost per kWh increases 2 cents/kWh and the PCE level increases 1 cent/kWh."

Of note, wind generation was 0.3% of total statewide energy generation in 2011 (Alaska Energy Authority, 2012). Assuming the scenario developed by ISER for one utility is scalable to all PCE communities, the information above was used to calculate the changes to the PCE subsidies. Another assumption is that overall 9% wind generation would be the highest level, with 6% the baseline, and 3% the low. The weaknesses of this scenario are that 1) "overnight" implementation is assumed when in reality it would take many years to fully to implement, and that 2) all PCE communities combined achieve up to 9% wind generation may be too optimistic. This scenario would require large amounts of capital to implement. The low, baseline, and high values chosen are, respectively, -4.13%, -2.75%, and -1.38%.

4. Methodology

4.1 Process
The process used in this evaluation included justifying the data in the previous chapter, and in this chapter will include identifying the assumptions, developing a scenario of the current conditions, developing scenarios using variables that affect supply and demand, an initial evaluation of economic self-sufficiency, a sensitivity analysis to screen variables, developing scenarios for market change and policy changes, an evaluation of economic self-sufficiency of the market and policy changes, a sensitivity analysis of the market and policy changes, followed by a comparison of results.

Economic self-sufficiency for each scenario will be measured by the endowment’s ability to provide funds for subsidies by the: number the years that subsidies are completely funded, percent of subsidies funded, and net present value.

4.2. Assumptions
Certain assumptions have been developed to establish the context for the evaluation:
   a. There are no additions or withdraws to/from the PCE endowment fund to/from external sources.
   b. Earnings from the endowment fund will be used for subsidies or reinvested into the fund, and not used for utility improvement grants.
   c. Any yearly surplus will be reinvested into the endowment.
   d. Minor administrative expenses associated with the endowment fund are excluded.
   e. The timeframe for this analysis is through 2035.
   f. There will be no significant transformational technological changes within the analysis period.
   g. All PCE communities will be aggregated into a single unit for analysis
   h. Certain variables will be approximated to have a uniform rate of change.

4.3. Current Conditions Scenario
A cash flow was developed in Excel to reflect the mechanisms of the PCE endowment fund using values that reflect the baseline condition. The cash flow calculates yearly:
   a. Endowment Balance ($); annual balance using the previous year’s balance plus reinvestment.
   b. Investment Gain/Loss ($); earnings using the target percent return multiplied by the balance.
c. Statutory Disbursement ($); amount of disbursement available for subsidies using the average three years previous balance multiplied by the target percent for disbursement.
d. Demand for Subsidies ($); amount required to meet the demand for subsidies.
e. Surplus Reinvested in Endowment ($); any positive difference of the gain/loss less the disbursement is a surplus to be reinvested.
f. Subsidies Funded by Endowment ($); is the lessor of the statutory disbursement or the required subsidies.
g. Appropriation for/or Reduction of Subsidies ($); any negative difference is either requires an appropriation from other funding sources, or is a reduction to the disbursement (disbursement is reduced on a prorated basis per Regulations, and has occurred in the past).
h. Outputs from the scenario are:
   i. A count of the years that either appropriations from other funding sources or reductions to the subsidies are required. This is an indicator of whether the PCE program is meeting the intent of being economically self-sufficient.
   ii. Percent of subsidies funded by the endowment. The percent is calculated by dividing the NPV’s of all yearly values for the “Demand for Subsidies” by the NPV’s of all yearly values for “Subsidies Funded by the Endowment”. This is an indicator of how well the PCE program meets the intent of being economically self-sufficient.
   iii. The net present value (NPV) of:
      1. The constant dollar amount of yearly funding available from the endowment fund for subsidies. Considered to be “benefits”.
      2. The constant dollar amount of yearly appropriations required from other funding sources to fully fund the subsidies or reductions to the subsidies if other funding sources are not available. Considered to be “disbenefits”.
      3. The NPV’s from 1. and 2. above are added together; i.e. the benefits and disbenefits are combined to achieve a cumulative net benefit for the scenario. Larger NPV’s generally indicate more benefits are provided, particularly when evaluating the supply variables while the demand variables are held constant at the baseline level. The NPV value as an indicator of net benefits is more difficult to distinguish in those cases where the demand for subsidies is below the baseline level.

The exhibit below graphically shows for each year the amount of subsidies that are funded by the earnings of the endowment and amount of subsidies that will either require appropriations or reductions. This exhibit uses the current conditions as input variables, and the upper line represents the total demand for subsidies. As currently configured, the endowment will only partially fund the future subsidies.

**Exhibit 15 Projected Funding Source for Subsidies by Year using the Current Conditions**
4.4. Supply and Demand Scenarios
Using the Scenario Manager function in Excel, multiple scenarios were generated by substituting supply and demand variables, one at a time, from the exhibits in sections 3.1 and 3.2.

4.5. Initial Evaluation of Economic Self-Sufficiency
Using the “count” of years and the “percent” funded, the supply and demand scenarios were inspected for years that subsidies are not fully funded by the earnings of the endowment. The exhibit below shows, by supply and demand variable, the number of years that the endowment fund does, and does not, fully fund the subsidies.

Exhibit 16 Count of Years the Subsidies are Fully Funded by the Endowment, by changing Supply and Demand Variables Individually
The exhibit below shows the percent of subsidies funded by the endowment.

**Exhibit 17** Percent of Subsidies Funded by the Endowment Over 21 Years, by changing Supply and Demand Variables Individually

4.6. Sensitivity Analysis to Screen Variables

4.6.1. Supply and Demand Variables

From the scenarios generated in section 4.4, the low and high range of NPV of net benefits for each variable were charted to ascertain which variables show significant difference relative to the current conditions. The exhibit 18 summarizes the low and high ranges for the NPV’s for net benefits for the supply and demand variables.

Examination shows that Climate Change and Inflation are less significant than the other variables. To simplify the subsequent scenarios the low and high values for these two variables will be excluded from further consideration as they are unlikely to significantly influence the cash flow. The baseline values for these variables are used in subsequent scenarios.
4.6.2. Additional Values for Percent Disbursement

The range of NPV for percent disbursement is biased higher that the current conditions scenario, instead of usual bracketing, because the current conditions scenario uses the high value for disbursement. Non-linear results were observed for the percent disbursement, so further analysis of this variable was performed. The exhibit below summarizes the NPV’s of net benefits for additional values of the percent disbursement variable.

Exhibit 19 NPV of Net Benefits versus Percent Disbursement

For further reference, the evaluation of economic self-sufficiency was performed for the additional values of percent disbursement variable. The exhibit 20 shows for the percent disbursement the number of years that the endowment fund does, and does not, fully fund the subsidies.

The exhibit 21 shows the percent of subsidies funded by the endowment when using the additional values for the percent disbursement.
4.7. Market Change and Policy Scenarios
Using the Scenario Manager function in Excel, multiple scenarios were generated by substituting the market change and policy variables, one at a time, from the exhibits in sections 3.3 and 3.4.

4.8. Evaluation of Economic Self-Sufficiency
Using the “count” of years and the “percent” funded, the market change and policy scenarios were inspected the cash flow for years that subsidies are not fully funded by the earnings of the endowment. The exhibit 22 shows, by market change and policy variable, the number of years that the endowment fund does, and does not, fully fund the subsidies.

4.9. Sensitivity Analysis
From the market change and policy scenarios generated in section 4.7, the low and high range of NPV’s of net benefits for each variable were charted to ascertain which variables show significant difference relative to the NPV for the current conditions. The exhibit 24 summarizes the low and high ranges for the NPV’s for net benefits of the market change and policy variables.

4.10. Comparison of Results
The results from the scenarios tested are discussed in detail below.
4.10.1. Supply and Demand Variables

a. As expected the values that reduce the supply of funding or increase the demand yield unfavorable results compared to the current conditions. And, the values that increase the funding or decrease the demand for subsidies yield favorable results compared to the current conditions.

Exhibit 22 Count of Years the Subsidies are Fully Funded by the Endowment, by changing Market and Policy Variables Individually

The exhibit below shows the percent of subsidies funded by the endowment.

Exhibit 23 Percent of Subsidies Funded by the Endowment Over 21 Years, by changing Market and Policy Variables Individually

b. The evaluation of variables by the count of years indicates that most scenarios only last 5 to 8 years before the subsidies require appropriations or reductions. The two exceptions are the favorable scenarios of low differential inflation on fuel and a high return on investment. The low differential inflation of fuel scenario lasts 18 years before the subsidies require appropriations or reductions. The high return on investment scenario does not require appropriations or reductions for the subsidies.
For reference, the current conditions scenario will last 8 years before the subsidies require appropriations or reductions.

c. The evaluation of variables by the percent of subsidies funded by the endowment indicates that most of the favorable scenarios only increase over the current conditions by 1% to 5%. The two exceptions are the even more favorable scenarios of low differential inflation on fuel and a high return on investment; these scenarios fund all the subsidies using earnings of the endowment. Conversely, the evaluation of unfavorable scenarios indicates a decrease in the percent funded from the current conditions by 2% to 11%.

Exhibit 24 Range of NPV’s for Net Benefits by changing Market and Policy Variables Individually

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range of NPV (in $100,000,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Conditions</td>
<td>$0 to $250,000,000</td>
</tr>
<tr>
<td>Contact Limit</td>
<td>$250,000,000 to $500,000,000</td>
</tr>
<tr>
<td>Large Hydropower</td>
<td>$500,000,000 to $750,000,000</td>
</tr>
<tr>
<td>Renewables</td>
<td>$750,000,000 to $1,000,000,000</td>
</tr>
<tr>
<td>Renewable Limit</td>
<td>$1,000,000,000 to $1,250,000,000</td>
</tr>
<tr>
<td>Change in Conservation</td>
<td>$1,250,000,000 to $1,500,000,000</td>
</tr>
<tr>
<td>HB 39</td>
<td>$1,500,000,000 to $1,750,000,000</td>
</tr>
<tr>
<td>Commercial Limit</td>
<td>$1,750,000,000 to $2,000,000,000</td>
</tr>
</tbody>
</table>

The relative ranking of the variables is generally the same for the count of years and the percent funded; the exceptions are that in the percent funded the current conditions is shifted down in ranking compared to the count of years.

d. Evaluation of the range of NPV’s for the net benefits generally indicates the same ranking as above. However Exhibit 14 graphically shows that the following variables have significant ranges representing the uncertainty of those variables; from largest to lessor: return on investment, discount rate, differential inflation on fuel, per capita change, population change, and percent disbursement.

4.10.2. Additional Values for Percent Disbursement

a. Evaluation of additional values for the percent disbursement versus the NPV’s for the net benefits indicates a peak at 5.5% disbursement, which corresponds with the upper limit of disbursement while still preserving the principle of an endowment reported by Bowman et al.

b. The count of years that the additional values of percent disbursement do not require appropriations or reductions is not improved over the current conditions. One scenario lasts 7 years, another lasts 6 years, while the remaining scenarios require appropriations or reductions for the entire 21 year timeframe.

c. The percent funded by the additional values for the percent disbursement indicates that all values result in more favorable contributions to the subsidies over the current conditions. The increases are from 1% to 5%.

4.10.3. Market Change and Policy Variables

a. The evaluation of variables by the count of years indicates that a majority of the scenarios only last 6 to 13 years before the subsidies require appropriations or reductions. All the scenarios that include eligibility of commercial enterprises require appropriations or reductions for the subsidies during the
entire timeframe of 21 years. Interestingly, the scenarios with more renewable energy do not last longer than the current conditions before appropriations or reductions are required for the subsidies.

b. The evaluation of variables by the percent of subsidies funded by the endowment indicates that the favorable scenarios only increase funding over the current conditions by 1% to 9%. Conversely, the evaluation of unfavorable scenarios indicates a decrease in the percent funded from the current conditions by 2% to 24%. All the scenarios that include eligibility of commercial enterprises show significant decreases in the percent funding from the current conditions, ranging from 17% to 24% decrease.

c. The relative ranking of the variables is generally the same for the count of years and the percent funded; the exceptions are that in the percent funded the current conditions is shifted down in ranking compared to the count of years.

d. Evaluation of the range of NPV’s for the net benefits generally indicates the same ranking as above. However Exhibit 20 graphically shows that the following variables have significant ranges representing the uncertainty of those variables, and significant shift in value from the current conditions: commercial limit and HB 39. The shift downward from the current condition is explained by the fact that the baseline values for the market change and policy variables were not part of the current conditions scenario.

5 Analysis and Interpretation

This paper examined whether funding from the PCE endowment fund can provide for the future demand for subsidies when certain variables are changed. Sixteen scenarios were developed using variables that affect the supply of funding, the demand for subsidies, a potential market change, and potential policy changes. Economic self-sufficiency for each scenario was measured by the endowment fund’s ability to provide funds for subsidies by the: number the years that subsidies are completely funded, percent of subsidies funded, and net present value.

This evaluation found that the endowment, as currently configured, and most of the scenarios tested, will not provide adequate funding to meet the future demand for subsidies. After eight years the current PCE program is likely to require appropriations from other funding sources or reductions to the subsidies. Thus, the hypothesis is disproved; the PCE endowment fund will not be economically self-sufficient as intended.

The endowment fund’s ability to provide funding for subsidies is highly sensitive to the return on investment, but the return on investment is difficult to control by policy as it is largely affected by external influences. While higher returns would be very favorable to the economic self-sufficiency of the endowment fund, the target return is similar to other funds managed by the State of Alaska, so higher returns cannot be counted upon without further in-depth analysis. Points in case are the large standard deviations for investment returns of university endowments in the United States (7.3%), and the PCE endowment fund (11.24%).

The one factor in future shortfalls that can be controlled by policy is that the fund does not employ “inflation proofing”. In the current condition the percent disbursed equals the target return on investment, which results in the earnings growing initially and then reaching a plateau. However the demand for subsidies keeps growing by the baseline value of 5% per year resulting in the need for future appropriations or reductions for the subsidies. The baseline growth in demand for subsidies of 5% consists primarily of inflation and differential inflation for fuel. Inflation proofing the endowment fund can be accomplished by changing the percent disbursement downward from 7% to 5.5% which would improve the percent of the subsidies funded by the endowment by 5%. Reducing the percent disbursement allows for reinvesting earnings into the fund which offsets inflation, and has an important effect in later years when the demand for subsidies increases.

Adding renewables and changes in conservation do improve the economic self-sufficiency of the endowment fund, but not as much as expected because the improvements are in effect short-lived while the demand for subsidies keeps growing by baseline value of 5% per year. Also, the use of renewable energy is not a significant portion of the total electrical generation in Rural Alaska.
Allowing commercial enterprises to be eligible for PCE subsidies results in a large demand for subsidies and requires either appropriations from other sources or reductions to the subsidies. The most detrimental scenario to the endowment fund is HB 39, which raise residential limits and adds eligibility for commercial enterprises; however the commercial eligibility is the predominate factor in that scenario. Adding eligibility for commercial enterprises is second most detrimental scenario for the economic self-sufficiency of the endowment fund.

Importing LNG into Southcentral Alaska will raise electric prices for consumers in Alaska’s Railbelt. It will also increase electric prices in PCE eligible communities as the increased base rate used in the calculation will result in the PCE subsidies to decrease. However, with less disbursement from the PCE endowment, the economic self-sufficiency is slightly improved.

### 6 Suggested Changes

A policy change, or changes, is required to enhance the economic self-sufficiency of the PCE endowment fund. Changes are suggested below to increase the supply of funding for subsidies, and/or reduce the demand for subsidies.

**Primary Recommendation:** Manage the PCE endowment fund to grow the principal at a rate commensurate to the increase in the demand to subsidies (“inflation proofing”), similar to other funds managed by the State of Alaska. The current situation of investing the PCE endowment fund to achieve at least a 7% return and also providing disbursements up to 7% will create a situation where the fund plateaus in value while the demand for subsidies will increase beyond what the fund can provide on an annual basis. Effectively, the annual disbursement will decline in purchasing power due to inflation. The fund will provide more funding for subsidies in the future if the principal grows at a trajectory similar to the change in demand. Inflation proofing the PCE endowment fund will require taking into account general inflation and the differential inflation on fuel. My recommendation is to remove the fixed targets for investment return and annual disbursements, and manage the fund similar to the Mental Health Trust and University of Alaska endowment funds. Specifically, the investment return would be at a higher level than the disbursement to preserve the benefits of the fund in terms of real dollars. Also, the goals would be periodically reviewed, and if necessary reset, to allow flexibility. This allows managers the ability to shift the goals upward in periods of better investment returns and downward in periods of lesser investment returns.

**Additional Recommendations:** Below are several recommendations that would increase the endowment fund’s economic self-sufficiency; however these recommendations have the burden of requiring additional capital to be implemented.

- a. Implement conservation improvements. Additional sources of funding in the range of $25 million to $40 million for capital improvements will need to be identified to make this change effective.
- b. Add renewable sources of energy in Rural Alaska. Additional sources of funding for capital improvements will need to be identified to make this change effective.
- c. While unlikely in the current political and economic climate in Alaska, consideration should be given to increasing the capitalization of the endowment fund. With adequate capitalization most scenarios examined in this report would not require additional appropriations from other sources of funding or reductions to the subsidies.

**Not Recommended:** One policy change that shouldn’t be undertaken is making commercial enterprises eligible for PCE subsidies. Given the PCE program’s past inability to acquire appropriations and the subsequent prorated reductions for subsidies, the likely result of providing for commercial enterprises would be to dilute the available funding and reduce subsidies the for residential customers. While some cost relief may be enjoyed by commercial enterprises, the likely result will also increase electrical costs for residences. If undertaken, additional sources of funding should be identified in advance.

### 7 Recommendations for Future Work
Since the endowment’s ability to provide funding for subsidies is highly sensitive to the return on investment, financial modeling of future investment decisions should be undertaken with the goal of improving the returns. This does not require a policy change for the PCE program or the endowment fund, but would require re-examination of the investment risk that can be tolerated and the implications for the program if downside outcomes do occur.

Consideration should be given to a significant policy change. Instead of treating the PCE endowment as a perpetual fund, consideration should be given to revising the disbursement formula so that all subsidies are funded, and that a declining balance of the endowment fund is tolerated. The weakness of this scenario is that the endowment fund would eventually be depleted; however the timeframe where appropriations or reductions are not required would be extended. The intent wouldn’t be to “kick the can down the road”, but to allow time for alternative sources of energy to displace diesel electrical generation. The appropriations from other sources that otherwise would be used for subsidies could be used instead to fund alternative sources of energy.

Below are recommendations for further work that could be performed to refine the scenarios used in this evaluation:

1. This report examines various scenarios by changing variables one at a time. Any further work should look at the benefits of combining percent disbursement, conservation, and renewables. Also, further work should take into account the external costs of improving conservation and implementing additional renewables.
2. Some calculations assume overnight costs due to immediate implementation. If refined evaluation of those scenarios is desired, then the effects of phased implementation should be examined.
3. The potential should be explored for reducing future demand for subsidies by using any early-timeframe surpluses to fund conservation measures and/or renewable energy, instead of reinvesting into the endowment fund. An optimization exercise may reveal potential benefits.
4. Perform computer simulations with appropriate probabilities assigned to each variable to generate future outcomes bounded by confidence intervals. This may refine the economic projections.
5. An Excel spreadsheet accompanies this report. Interested parties are encouraged to test their own scenarios.

References


