

**True Cost of Electricity in Rural Alaska
and
True Cost of Bulk Fuel in Rural Alaska**

Prepared for
Alaska Affordable Energy Strategy
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True Cost of Electricity in Rural Alaska

Introduction

In this analysis, we compile data from several sources to estimate the true cost of electricity in rural Alaska. The true cost includes expenses listed on the utilities' books plus costs paid by other entities in the form of explicit and implicit subsidies.

Our focus is on the nonfuel costs of power. Fuel costs are quite volatile and are tracked carefully by AEA on a monthly basis. The concept of "Fuel cost" typically includes the price paid at the point of delivery into a bulk storage tank. We do include here as contributed resources the estimated subsidies to the fuel delivery system for electricity due to provision of bulk fuel storage by, for example, the Denali Commission.

Data sources

We used data from the following sources.

Primary: Nonfuel expenses approved by RCA for PCE reimbursement. The primary data source for unregulated utilities is RCA Letter Order L1500329 "Notice of calculation of Power Cost Equalization (PCE) level changes due to the base rate change effective July 1, 2015", and dated June 25, 2015. For regulated utilities, we located RCA-approved nonfuel amounts for most of the larger ones. These amounts are set from time to time in rate cases and are subject to "regulatory lag."

Secondary: "RCA/AEA dataset". AEA compilation of prior years approved amounts. Data cover several years during the period 2007-2014. For most utilities, there are 3 years of data. In at least some cases, these data are quite inconsistent with the PCE monthly reporting and/or inconsistent across years.

Secondary: Annual reports to RCA by each regulated utility. These follow FERC Form 1 templates and can provide a good accounting of nonfuel costs when cost items such as fuel, depreciation, and return on equity (net income) are properly entered. But in some cases (e.g., Alaska Power Co.), the data on nonfuel expenses are not consistent within the report, as fuel expense is broken out in one table but not in the main income statement.

Tertiary: PCE Statistical Report for FY2014. We used this source as a "backstop" when RCA-approved amounts could not be located. We compensated for partial reporting (less than 12 months of data) by multiplying reported amounts by an adjustment factor of 12/ (number of months of data).

Auxiliary Source: PCE monthly data reported to AEA for CY2012 and CY2013. We downloaded this monthly data from the Alaska Energy Data Gateway. This dataset shows where a utility has missing months of data for total kWh sold or total nonfuel expenses. We cross-checked the PCE Statistical Report FY2014 annual data with these data to verify that the Statistical Report data is capturing 12 months. This dataset also helped locate some significant typographical errors present in the Statistical Report.

Data Issues and Caveats

Nonfuel expenses reported in the PCE Statistical Reports are subject to significant errors. Also, RCA-approved nonfuel expenses per kWh are pro-forma calculated numbers used for setting rates. In particular, RCA adjusts the kWh sales number to reflect a hypothetical 12% line loss when actual line loss exceeds 12%.

The basic challenge in determining total or “true” nonfuel costs is that some costs are not booked, while other costs get removed by RCA when determining PCE reimbursement rates. Utilities have no incentive to put contributed plant on their books because it will just get removed by RCA, and RCA has no incentive to enforce complete bookkeeping when they are not concerned with grant-funded plant or returns to invested capital.

The following examples are offered to further demonstrate these kinds of discrepancies between what is reported to different entities.

Example 1. Kotzebue

Nonfuel expense data is reported as:

Kotzebue Electric Association			
RCA filing data compiled by AEA - 2012	2012	3,953,279	
RCA filing data compiled by AEA - 2013	2013	4,064,600	
RCA Commission approved as of June 2015	2014	4,308,018	
AEA PCE statistical monthly data for CY13 (12 mos of data)	2013	2,752,978	12 mos
AEA PCE Statistical Report FY14	FY14	1,458,859	only 6 mos

Here the problem might seem to be partial reporting of monthly data, which is indicated in a note in the FY14 statistical report. However, a closer look at 2013 monthly data,¹ for which all 12 months are reported, still shows a serious discrepancy between what was reported to AEA and appears in the Statistical Report and what was reported to and/or approved by RCA.

Example 2. Nome

Nonfuel expense data is reported as about \$6.7 million in the Statistical Report and by the utility in its annual information report to RCA.

In this example, further research shows that RCA staff is adjusting Nome’s reported nonfuel costs down because some costs are reported for the entire joint utility system and some of them should be allocated to water and solid waste. The following two RCA staff recommendations illustrate such adjustments:

¹ Obtained from Alaska Energy Data Gateway

Consumer Accounts Expense increased \$186,599 from \$148,706 (prior approved) to \$335,305 (FY13) NOME applies 55% of the total Consumer Accounting Expenses to the Electric Distribution, 25% to Water and Sewer and 20% to Garbage. Staff recommends **Adjustment 3 (Appendix 2)** to reduce the total Consumer Expense by the 45% not related to the electric distribution or \$150,608. After this adjustment Staff considers the test balance reasonable and recommends no additional adjustments.

...

Based on the above discussion, Staff recommends **Adjustment 4 (Appendix 2)** to reduce *General & Administrative Expense* by \$476,344 which consists of the 39% allocated to Water & Sewer and Trucked water. Along with the following costs: ineligible lobbying costs \$87,870, \$36,786 for ineligible electric costs, and \$2,876 for Other Expenses.

Source: RCA Letter Order L1400495 to Nome Joint Utilities dated November 6, 2014.

Staff also removed depreciation of grant-funded plant, which in Nome's case is significant:

Depreciation expense increased \$1,222,995 from \$841,348 (prior approved) to \$2,064,342 (FY13). Upon request, Mr. Cusack provided a schedule showing that \$1,365,295 of the depreciation expense was related to contributed capital. Because depreciation expense is not allowed on plant funded with grants, contributions in aid of construction, or other non-utility money², Staff recommends removing the expense from PCE consideration. Additionally, only 61% of the Depreciation recorded in account 932.500 - \$92,219 was applied to the Electric Utility. Staff recommends decreasing account 932.500 by \$35,965 or 39%.

Based on the above, Staff recommends **Adjustment 5 (Appendix 2)** to reduce depreciation expense by \$1,401,260

Source: RCA Letter Order L1400495 to Nome Joint Utilities dated November 6, 2014.

The overall result is that RCA-allowed nonfuel costs are reduced from \$6.8 million (which is reported in the PCE Statistical Report) to \$4.3 million:

Nome - NJUS		
	Data year	Total nonfuel expense
RCA data for utility-filed CY13 test year amount	CY 2013	6,795,820
less: Staff adjustments		
Station service cannot be separately recovered	CY 2013	(450,928)
Dist'n and G&A allocable to water, solid waste	CY 2013	(635,614)
Depreciation	CY 2013	(1,401,261)
equals: RCA commission approved amount for CY13 test year	CY 2013	4,308,018
PCE Statistical Report FY11	FY11	5,898,445
PCE Statistical Report FY13	FY13	6,720,590
PCE Statistical Report FY14	FY14	6,700,063

In this example, the amount reported in AEA PCE Statistical Report is a better reflection of true cost than the RCA-approved amounts. However, a casual reader has no way of knowing this. If contributed plant were added to the PCE Statistical Report amount, the result for the nonfuel cost of power in Nome would be seriously overstated.

Example 3. Iguigig

The RCA in Feb 2016 removed \$37,000 of booked depreciation because RCA determined that this depreciation related to grant-funded plant.

Depreciation Expense increased \$36,363 from \$10,829 (FY12) to \$47,192 (FY15). IGIUGIG maintains its own schedule of depreciation and amortization, which Staff reviewed (see Schedule BKC-3). Staff asked Ms. Alvarez if the Powerhouse and line extension placed in service in 2010 were grant funded and Ms. Alvarez replied yes they were grant funded.⁵ Because these assets are grant funded they should not be included in the calculation of the PCE subsidy. Staff recommends Adjustment 2 (Appendix 2) to decrease depreciation by \$37,786.

Source: RCA Power Cost Equalization Memorandum PC 23-1215, Feb. 18, 2016.

RCA-allowed nonfuel cost dropped from \$70,000 requested to \$35,000 approved, as compared to \$41,000 in the prior approval. Apparently, the utility was attempting to book all of its plant, and neglected to segregate out the grant-funded plant. The PCE Statistical Report lists FY14 nonfuel expense as \$37,000. The amount drops further, to \$22,367, in the FY15 Statistical Report.

Example 4. Elfin Cove

This example shows why RCA-approved nonfuel costs per kWh should not be used directly for analysis without further verification and/or adjustment. If line loss exceeds 12%, RCA adjusts the kWh sales amount to be what would have been sold given reported generation and 12% line loss. In the Elfin Cove example, kWh sold was adjusted up by 7%, resulting in the nonfuel expense per kWh calculated by RCA to decrease from 24 cents per kWh to 22.4 cents per kWh. The point of this example, again, is that RCA data on total nonfuel cost is actual data, while RCA-approved nonfuel cost per kWh is a pro-forma calculation used for rate-setting.

Line Loss

ELFIN's line loss of 17.84% is higher than the 12% maximum allowed by 3 AAC 52.620(b). In accordance with Generation Efficiency and Line Loss Standards, 3 AAC 52.620(b), "A line loss standard of 12 percent applies to all electricity sold, and is measured as all kilowatt-hours generated or purchased, from whatever source, minus kilowatt -hours sold, divided by all kilowatt-hours generated or purchased." 3 AAC 52.620(j) states that fuel and nonfuel costs per kWh are calculated by dividing total fuel and nonfuel costs by the greater of actual number of kWhs sold or the number of kWhs that would have been sold if the utility had achieved line loss standards. Staff recommends **Adjustment 4 (Appendix 2)** to increase ELFIN's reported kWh sales of 227,786 by 16,204 to 243,990 kWh in order to impute a line loss of 12%.

Source: RCA Letter Order 150091 dated March 6, 2015

Elfin Cove		
Reported sales for test year FY14	FY14	227,786
RCA adjusted sales - "as if" line loss were 12%	FY14	243,990
RCA approved total nonfuel expense	FY14	54,740
RCA approved nonfuel expense per kWh based on 243,990	FY14	0.2244
RCA approved nonfuel expense based on actual sales	FY14	0.2403

Data Compilation Notes

The primary data source, which covers unregulated utilities, is RCA Letter Order L1500329 "Notice of calculation of Power Cost Equalization (PCE) level changes due to the base rate change effective July 1, 2015." and dated June 25, 2015.

Specific differences and comments on the data are noted here.

Correction of formula error in RCA/AEA data compilation

We corrected a significant formula error in the calculation of the RCA/AEA “Year 3” and “Year 4” nonfuel costs. The formulas were double-counting operator and maintenance labor. We did not correct the errors in other worksheets used in previous AEA analyses because these other worksheets contain pasted values. We are noting this problem here for future reference.

Buckland

We substituted FY13 data for missing nonfuel expenses data in the FY14 PCE Statistical Report.

Chignik Lagoon

We substituted FY15 data for missing nonfuel expenses data in the FY14 PCE Statistical Report.

Clark’s Point

Clark’s Point re-entered the PCE program in October 2014. We adjusted FY15 data for which 9 months were reported. There are no nonfuel expenses reported so we substituted the RCA-approved amount.

City of Unalaska

The City of Unalaska reports \$3,125,652 nonfuel expenses on the FY14 PCE Statistical Report (and a similar number in FY13), but its RCA-approved nonfuel expenses are \$7,378,781. This number is the latest number approved by RCA and appears in a fuel adjustment approval dated December 2015. There was a big addition of depreciation and interest that shows up in RCA/AEA compilation in 2012. Our limited review of RCA correspondence indicates that these additions reflect booking of existing assets and/or adding new assets. Apparently, depreciation and interest are not being reported to AEA monthly and therefore do not appear in the PCE Statistical Reports.

Inside Passage Electric

IPEC filed TA199-240 on March 29, 2016 with supporting calculations. Schedule 14.1 provides detail on allowable PCE nonfuel expenses. RCA staff approved the requested updated cost for PCE purposes. The filing also included RUS Form 7 financial statements that we analyzed. This example shows that including return on customer-supplied capital adds about 4% to the measured nonfuel cost of service. We included this return as part of our estimate of the booked nonfuel cost of service. The following work-up also provides an estimate of how the nonfuel expense reported monthly to AEA, in this case by a very accurate and conscientious utility, seems to omit fixed costs and therefore under-reports by about 15% relative to the amount actually used for PCE rate determinations.

Inside Passage Electric Coop

SRF filing March 29, 2016

TA199-340

Test year 2015

Total kWh sold 9,357,103

Schedule 14.1

	Total	per kWh
Total adjusted cost of electric service	4,898,534	
less fuel	(1,691,555)	
less purchased power	(80,354)	
less cost = waste heat revenue	(66,396)	
less cost = pole attachment revenue	(13,956)	
Equals PCE nonfuel expense	3,046,273	0.3256
add RCC		0.000732
approved nonfuel per kWh		0.3263
add: patronage capital credits & div	134,997	
nonfuel cost with return on patron capital	3,181,270	0.3400
percent increase due to include rpc	4.4%	
Compare RCA-approved PCE nonfuel exp:	3,046,273	
to: nonfuel exp in FY14 PCE Stat Report	2,606,840	
Difference (under-reported)	439,433	14.4%
compare to depreciation+interest+taxes	547,052	

Kipnuk

Kipnuk is regulated by RCA and its reported nonfuel costs in the PCE Statistical Report -- \$1.8 million -- are much too high. We suspect this is due to a typographical error in the data reported to AEA for the second half of CY2013. We found a RCA determination of allowed nonfuel costs in Tariff Advice Letter TA104-446. The total allowable nonfuel costs are \$0.1620 per kWh. However, this number seems to be based on a not very recent test year. For this draft, we are simply replacing the FY14 number with the FY13 nonfuel expenses reported to AEA and published in the FY13 PCE Statistical Report.

McGrath

McGrath Light and Power is formally known as "MTNT Energy dba McGrath Light & Power." The PCE Statistical report only has 5 months of data reported, so we multiplied the reported amount \$321,138 by 12/5 to equal \$770,731 or \$ 0.3298 per kWh. We checked McGrath's most recent rate case approval of a PCE nonfuel cost amount and determined it to be \$771,135 or \$ 0.3043 per kWh. This amount agrees well with the estimate of PCE Statistical Report

Our review of McGrath’s 2015 “Operating Report” to RCA² for 2015 shows nonfuel expenses per kWh of \$ 0.1617 if net income is not included or \$ 0.2672 if net income is included. Both estimates are less than the approved amount of \$ 0.3043.

McGrath Light and Power

kWh sold CY15	2,198,214
Operating Revenues	1,727,345
Expenses functionally (p 21):	
Fuel expense	1,141,600
Distribution expense	90,377
Customer Account	8,417
Customer service	(11,956)
Admin & General	266,987
Total expense p 21	1,495,425
Expenses financially (p 6)	
Operating	1,319,008
Maintenance	60,517
Depreciation	115,817
Taxes	83
Total	1,495,425
Total less fuel	353,825

Nonfuel expense per kWh

	total	per kWh	Add RCC	total \$/kWh
total nonfuel w/o net income	353,825	0.1610	0.000732	0.1617
net income	231,920	0.1055	0.000732	
total nonfuel exp including net income	585,745	0.2665	0.000732	0.2672
Alternative estimate:				
Allowed nonfuel PCE reimbursement	667,307	0.3036	0.000732	0.3043

New Koliganek Village Council

We substituted FY13 data for missing nonfuel expenses data in the FY14 PCE Statistical Report.

² <http://rca.alaska.gov/RCAWeb/ViewFile.aspx?id=DD725409-1757-49E5-AF87-0BE11D2CA2A0>
Tracking number TR1606091

North Slope Borough

The North Slope Borough is treated as a single utility entity. NSBPL filed a request for updated nonfuel costs and PCE rates in January 2016. The previous test year was 2011. We have used the RCA-approved nonfuel cost calculated from the 2016 filing and contained in Letter Order L1600153 dated April 7, 2016.

Perryville

Perryville has RCA-approved nonfuel costs for PCE purposes, but is not currently in the program (or at least was not in FY14 and FY15.) Perryville was deleted from the dataset by moving the row to below the main dataset.

Perryville does have Denali Commission support shown in our data, amounting to about \$1.00 per kWh sold.

Saint Paul

Year 3 of the RCA/AEA data compilation seems to be incomplete and/or contains sign errors. The average of the RCA/AEA data compilation for Saint Paul therefore excludes year 3. (This average is used as a quality control check on the RCA L1500329 data). RCA/AEA year 2 value equals the RCA L1500329 value.

Stevens Village

Stevens Village apparently is no longer in PCE after FY2009. RCA primary data does specify a rate, but we have left Stevens Village out of our data set.

Tanana

We developed two estimates for Tanana Power. The first is their RCA-approved amount from rate case U-99-117, which is somewhat dated. The second is a workup of their Annual Report to RCA.

Tanana Power Co

Annual report to RCA for 2015

	Total	per kWh	RCC	total \$/kWh
Total kWh sold	1,166,883			
Op revenue	784,367			
Op expense (401)	599,982			
Maint exp (402)	94,098			
Depreciation	41,504			
Deferred income taxes provision	31,418			
Total expenses including fuel	767,002	0.6573	0.000732	0.6580
Net operating income	17,365			
less: fuel (from part XVII)	(477,848)			
Total nonfuel cost with op income	306,519	0.2627	0.000732	0.2634

AVEC

AVEC filed for approval of updated nonfuel costs in May 2016, stating that this was the first update since 2012.³ We have used these AVEC-filed cost numbers as the primary data instead of the RCA-approved numbers based on 2012 data, which was prior to the acquisition of Bethel into AVEC. We have included Bethel as part of the AVEC total and have also computed cost numbers for AVEC excluding Bethel. The PCE Statistical Report allocates AVEC excluding Bethel nonfuel costs among all communities based on kWh sold. Thus, these numbers are not actually data. We do not use them; instead we use a constant average amount for booked nonfuel cost for all non-Bethel AVEC communities.

Alaska Power Company (APC)

Subsequent to the preparation of this dataset, in July 2016, APC filed a complete cost of service study in support of a rate case based on test year CY2015. This study incorporates APC's acquisition of Gustavus Electric Company, Inc. and will be a unique opportunity to understand cost of service elements for a small Alaska utility.

We moved Gustavus data in the FY14 PCE Statistical Report into the APC section of the database, along with REF and Denali Commission assistance to the former Gustavus Electric.

APC reports nonfuel expenses to the PCE Statistical Report that are only O&M. Depreciation, interest, and taxes are not included, based on a comparison with APC annual financial statements filed with RCA. Purchased power is also not included. In FY14, APC purchased about 81% of the kWh it sold.

APC calculates PCE amounts and allowable costs separately for 5 rate groups:

- Rate Group 1 - Skagway and Haines
- Rate Group 2 - South Prince of Wales/Coffman Cove
- Rate Group 3 - Naukati
- Rate Group 3 - Whale Pass
- Rate Group 4 - Tok/Dot Lake/Tetlin
- Rate Group 5 - Allakaket/Alatna
- Rate Group 5 - Bettles/Evansville
- Rate Group 5 - Chistochina/Mentasta/Slana
- Rate Group 5 - Eagle
- Rate Group 5 - Healy Lake
- Rate Group 5 - Northway

³ AVEC PCE Annual Report covering CY 2015. Filed May 17, 2016.

<http://rca.alaska.gov/RCAWeb/ViewFile.aspx?id=29c37800-afa8-46bd-8dec-ff7191063ac4>

We understand the Commissions limited resources and resultant policy decision to only update PCE rates when preliminary review reflects a significant change in non-fuel costs per kwh. AVEC's non-fuel cost have not been reviewed or modified since the 2012 annual PCE report was submitted and approved for .2673 per kWh. We respectfully request review and approval of our non-fuel cost as filed for year ended December 31, 2015 calculated at .0734 per kWh for Bethel and .2841 per kWh for all other locations. If you have any questions, please contact me.

We used data from APC's approved PCE expenses from its recent rate case U-14-002, combined with data from APC's annual reports to RCA and APC's own financial statements, to generate two estimates of nonfuel costs per kWh that include taxes and return on equity. These are summarized in the following work-up:

Alaska Power Company

March 2016 filing TA855-2 APC Quarterly COPA and PCE Update filing

Rate Group	Test yr kWh - test yr 2012	Test yr nonfuel expense	\$/kWh	RCC/kWh	Total \$/kWh
1	24,391,297	2,504,600	0.1027	0.000732	0.1034
2	26,904,279	2,644,479	0.0983	0.000732	0.0990
3	652,484	144,737	0.2218	0.000732	0.2226
4	13,491,999	1,942,496	0.1440	0.000732	0.1447
5	4,323,617	1,185,900	0.2743	0.000732	0.2750
Total	69,763,676	8,422,212	0.1207	0.000732	0.1215
add 2015 net income (ROE + taxes)		2,234,916			
Nonfuel cost with ROE and taxes		10,657,128	0.0320		
Apply to 2015 kWh sales:		64,834,688	\$/kWh	RCC	Total \$/kWh
Equals nonfuel cost per kWh			0.1644	0.000732	0.1651

Alternative calculation using Annual Report to RCA

	2015				
Op expense incl fuel		12,204,941			
Maint		1,988,667			
Depreciation		2,441,808			
Taxes & Other expense		985,449			
Total Utility Op expense		17,620,865			
subtract Fuel		(4,932,133)			
subtract Purch Power		(4,061,424)			
subtotal nonfuel before ROE		8,627,308			
Equity Jan 1 2015:	24,513,465				
assumed ROE	10.0%				
Return component cost		2,451,347	\$/kWh	RCC	Total \$/kWh
Nonfuel cost with ROE and taxes		11,078,655	0.1709	0.000732	0.1716

Non-Booked Contributed Resources

Renewable Energy Fund (REF) Projects

We examined about 200 REF projects listed in the “Alaska Renewable Energy Fund Status Report, Rounds I-VIII” dated January 29, 2016.⁴ We included 136 projects with a total award value of about \$140 million. We annualized the award amount using a 3% discount rate and lifetimes as follows:

Wind and diesel heat recovery	20 yrs.
Hydro	50 yrs.
Geothermal	30 yrs.
Transmission	30 yrs.

The total annualized amount of REF assistance is \$8.0 million per year.

We assigned almost all of the relevant projects to individual communities, although a few were allocated to a regional utility without further allocation to communities.

The following possibly non-REF funding source was included in the REF section of the worksheet.

Bethel Wind Farm Cons	410034	2195432	1	wind	construct	2,998,097	20	149,905
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This project total includes \$399,777 listed as “additional state funding” and mentioned in the project description as “contains \$399,777 from a Round 0 Denali Commission grant.”

The following project was entered with adjustments.

Buckland Deering Noor	410042	2195377	1	140	wind	construct	7,538,053
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This is the Buckland Deering Noorvik Wind Farm. Only the expended amount \$7,538,053 is included. The original grant was for \$10,758,928. Also, the entire project is listed under Buckland. We did not attempt to allocate regional projects to different communities.

4

<http://www.akenergyauthority.org/Portals/0/Programs/RenewableEnergyFund/Documents/Round%209/REFR9StatusReportAppendix.pdf>

The following REF projects were excluded:

REF projects not included in true cost analysis							
Description	AEA Project number	AEA Grant number	REF Round	Report page	Resource	Project Phase	Renewable Energy Fund (REF) Cost
Pilgrim Hot Springs	406013	multiple	3,4		geotherm	feasibilit	1,943,410
Lake and Peninsula BoroughWood Boilers	402026	multiple	1,4	45	biomass	construct	327,000
Port Alsworth Hydroelectric	407073	7030008	3		hydro	feasibility	0
Lake Pen BoroughWind Feasibility Study	410032	2195374	1		wind	feasibility	184,000
Nushagak CommunityWind Power Project	410019	2195480	1		wind	feasibility	0
Chistochina Central Wood Heating	402028	2195380	1		biomass	constructi	500,000
Cordova Community Biomass	402115	7040054	4		biomass	feasibility	63,999
Cordova Wood Processing Plant	402027	2195399	1		biomass	constructi	136,760
Gulkana CentralWood Heating	402030	2195381	1		biomass	constructi	500,000
Kenny Lake SchoolWood Fired Boiler	402019	multiple	1,4		biomass	constructi	685,485
MentastaWoody Biomass Community Facilit	402127	7060982	6		biomass	construct	460,000
Allison Lake Hydro	407038	multiple (	1,6,7		hydro	construct	10,288,009
Terror Lake Unit 3 Hydroelectric Project	407059	multiple (	2,3,4		hydro	construct	4,224,419
Pillar MountainWind Project Kodiak	410025	multiple (	0,1,5		hydro	construct	11,800,000
Kisaralik/Chikuminuk Hydro	407056	2195447	2		hydro	feasibility	229,952
Wainwright Heat Recovery	403037	2195471	2		diesel	feasibility	0
Kotzebue Paper andWoodWaste to Energy P	402117	7040029	4	132	biomass	feasibility	66,578
Upper Kobuk River Biomass	402031	multiple (	1,4,5	134	biomass	construct	773,897
Kake Biomass	402124	7071087	7	187	biomass	feasibility	175,000
Excursion Inlet Hydro Project	407083	7040069	4	207	hydro	feasibility	78,384
Ruth Lake Hydro	407047	2195415	1	218	hydro	feasibility	155,702
Takatz Lake Hydro	407049	2195418	1	220	hydro	feasibility	2,000,000
Triangle Lake Hydro	407085	7040074	4	223	hydro	feasibility	500,000
Whitman Lake Hydro	407046	multiple	1,4	224	hydro	construct	10,025,000
Wrangel EV feasibility	407086	7040070	4	226	other	feasibility	25,000
Metlakatla Ketchikan Intertie	409020	multipl	1,4	229	Transmiss	construct	2,000,000
Snettisham Transmission	409030	7040039	4	232	Transmiss	construct	2,000,000
Wood Heating in Interior AK	402113	multiple	4,5,6	251	biomass	construct	1,438,525
Venetiie District Heating	402042	2195452	2	250	biomass	feasibility	32,500
Tok Wood Heating	402038	2195417	1	247	biomass	constructi	3,245,349
Tanacros woody biomass space heating	402118	7050881	5	246	biomass	construct	420,000
Louden Tribal Council Renewable Energy	402112	multiple	4,6,7	242	biomass	constructi	3,504,316
Kaltag Biomass hydronic heating	402045	2195474	2	241	biomass	feasibility	12,710
Interior Regional Housing Wood Energy	402037	2195443	1	240	biomass	constructi	0
Huslia water system & clinic wood boiler	402119	7050821	5	239	biomass	constructi	50,000
Fort Yukon Central Wood heating	402040	2195405	1,3	237	biomass	constructi	2,528,255
City Tribe Biomass Tanana	402048	7030022	3	236	biomass	constructi	412,641
Chalkyitsik Biomas Central Heating	402041	2195451	2	235	biomass	feasibility	32,500
Biomass heat for Minto buildings	402128	7071032	7	234	biomass	none give	274,800

Denali Commission

We examined about 2,000 projects listed in the Denali Commission's project database as of December 2015. We extracted projects with listed completion dates from 2000 through 2018 in the them areas listed as Bulk Fuel, RPSU, or Other Energy. We constructed a pivot table to sort projects by community and theme. We ended up with about \$520 million worth of projects applicable to the PCE communities, about half of which (\$226 million) was for bulk fuel. We allocated 1/3 of the bulk fuel projects to the electric sector so that the value of bulk fuel projects included in our analysis was about \$76 million, or about \$4.7 million per year using 30-year life and 4.5% discount rate.

We included about 97 RPSU projects with a combined Denali Commission contribution of \$148 million.

We included about 124 "Other Energy" projects with a Denali Commission contribution of about \$89 million.

The total annualized value of Denali Commission contributions to projects included in our analysis is \$18.3 million per year.

USDA Rural Development

We obtained a database of USDA-RD assistance from the State Director in March 2016 and located 40 projects with a combined award value of \$49.7 million and an annualized value of \$3.4 million per year.

We did not include \$5.4 million of "unassigned rural support" in the analysis completed for this draft.

Allocation of Project Assistance Data to Regional Utilities

For regional utilities such as AVEC, it may not make sense to attach project assistance amounts to particular communities for the purpose of determining their "true cost" of producing electricity. However, since some of the nonfuel costs are incurred expressly to reduce fuel costs, it may make sense to recognize a tie-in between, for example, a wind project in community X and future fuel costs in community X. The best solution to this problem appears to be simply to treat AVEC as a single utility. AEA should consider adopting a functional accounting approach to PCE data collection that considers generation costs as such, regardless of whether they are fuel or capital cost payments for a wind farm.

Analysis

An important empirical question is: Which changes more (and/or more rapidly) when kWh sales change: the total nonfuel cost, or the nonfuel cost per kWh (the average cost)? There are reasons why either outcome is possible. If sales drop, total nonfuel costs are likely to remain constant. If plant is added to meet load, cost per kWh is more likely to remain constant. The total nonfuel cost is a mix of fixed and variable costs at any given time. In the "long run" all costs are potentially variable but the "long run" varies and some costs are more fixed than others.

Our approach is to first generate estimated booked nonfuel costs on a per kWh basis, because that is how they are used in the PCE reimbursement process. Utilities are likely to adapt their practices and build their budgets using these numbers.

We developed between 1 and 3 estimates of booked nonfuel costs per kWh.

- Estimate 1: using FY14 PCE Statistical Report data, total nonfuel expenses / total kWh sold
- Estimate 2: RCA-approved PCE-reimbursable \$ per kWh
- Estimate 3: \$ per kWh based on utility financial statements

The purpose of developing these three estimates is to capture the range of reasonable values and to not arbitrarily discard data from the analysis. In making each estimate the total nonfuel cost is matched as well as possible to the kWh sales from the same time period.

The second step in the analysis is to “fold in” externally contributed resources. Since these are fixed amounts of dollars, we simply added together the total amounts for each community from the sources discussed above (REF, Denali Commission, USDA RD, NSB).

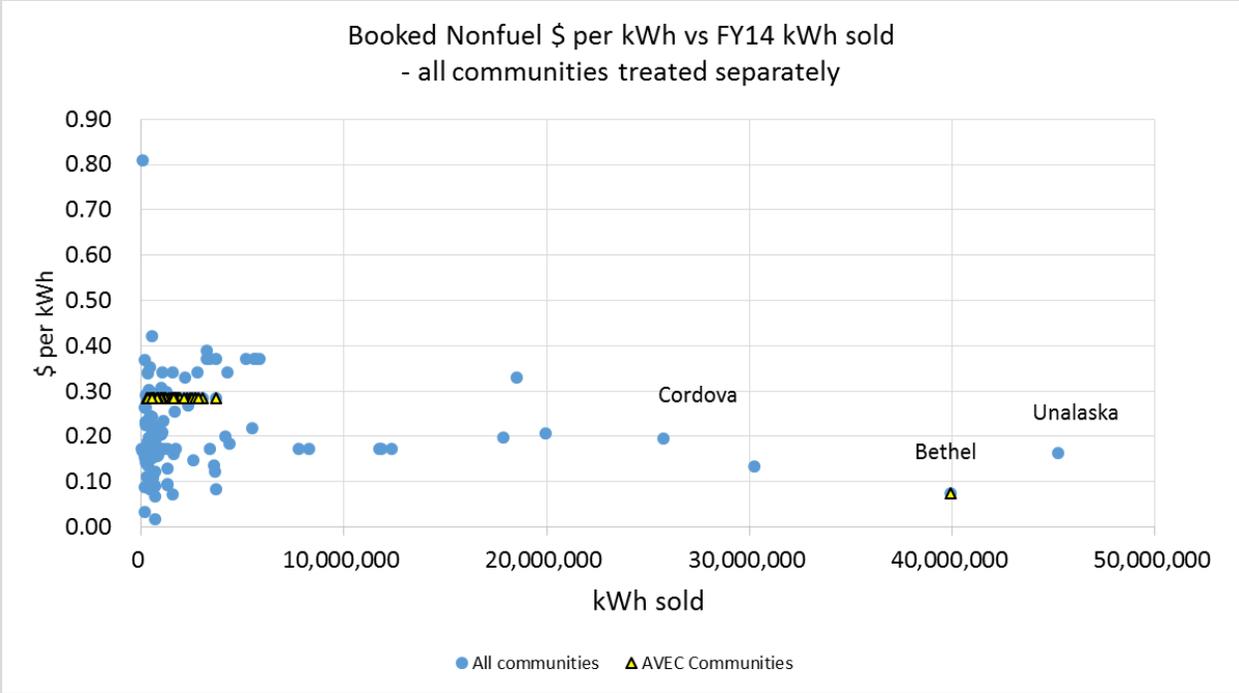
The third step is to combine the booked and externally contributed costs into an estimate of nonfuel cost per kWh and total nonfuel cost. For this we use data on FY14 kWh sold from the PCE Statistical Report as the estimate of “current output” of the electric system. We are careful to show these sales numbers as a separate column in the workbook so that these kWh sales numbers can be updated or replaced if better numbers are available or for sensitivity analysis.

Results

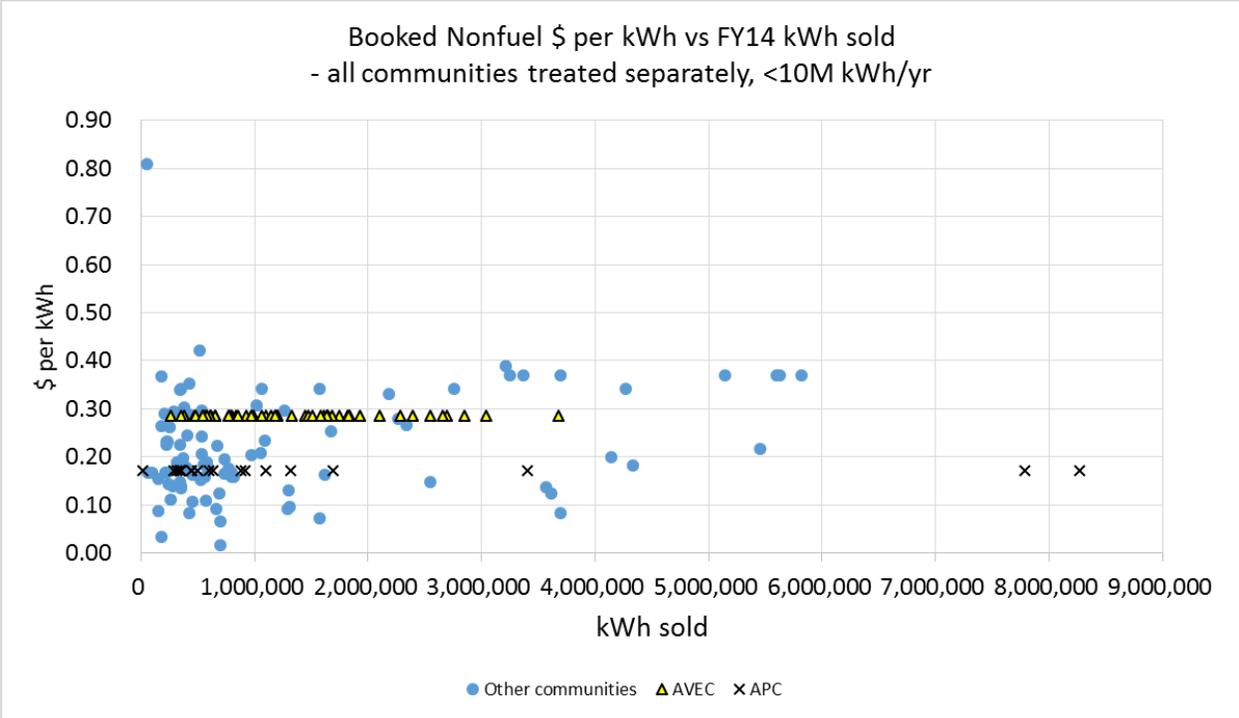
These results are based on a version of the calculations labeled “Case1” in the accompanying Excel spreadsheet for this task, “Nonfuel cost analysis 06June2016.”

Booked nonfuel costs

Booked nonfuel costs for the entire data set are shown in the following figure. AVEC communities are highlighted simply to provide a point of reference.



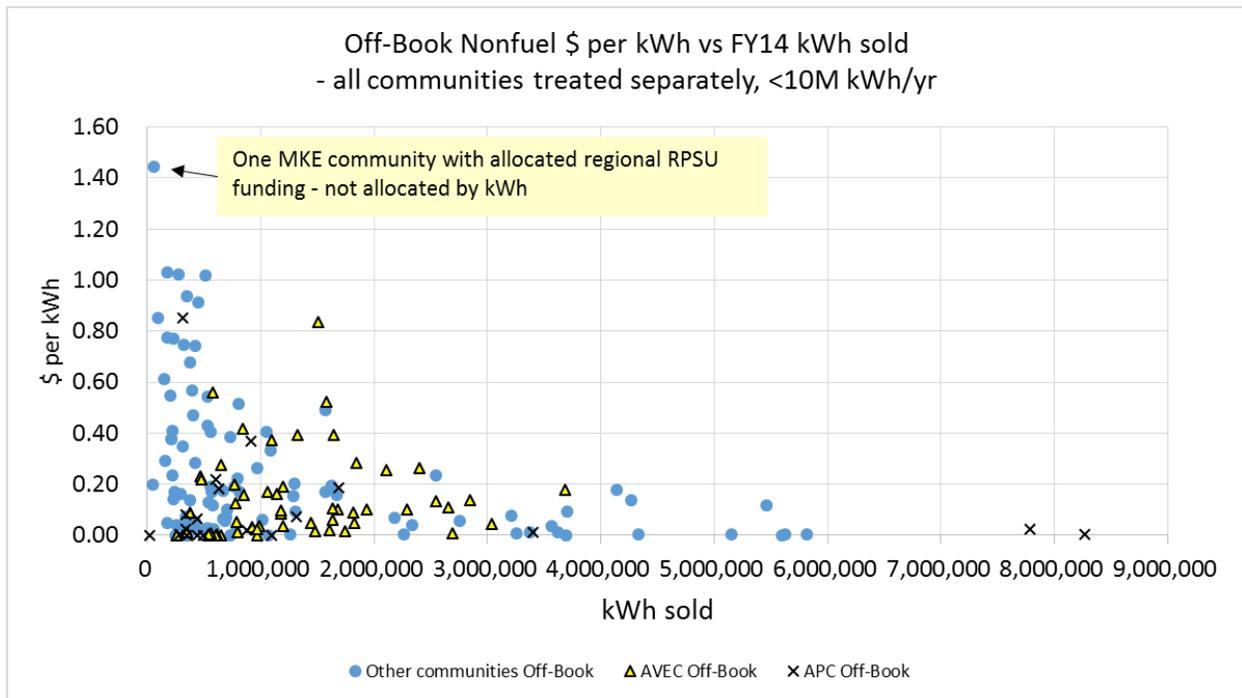
For the rest of this section, we will restrict the graphed data to communities with total sales of less than 10 million kWh per year. The appendix at the end of the section provides complete tabular results. With this restriction to less than 10 million kWh per year in place, the plot of booked nonfuel costs is:



There is a very weak upward trend in the non-AVEC data, suggesting perhaps that larger utilities may take on more costs as a routine part of doing business, or perhaps they are more conscientious about booking items such as depreciation, or simply have more rate-funded electric plant.

Off-book nonfuel costs

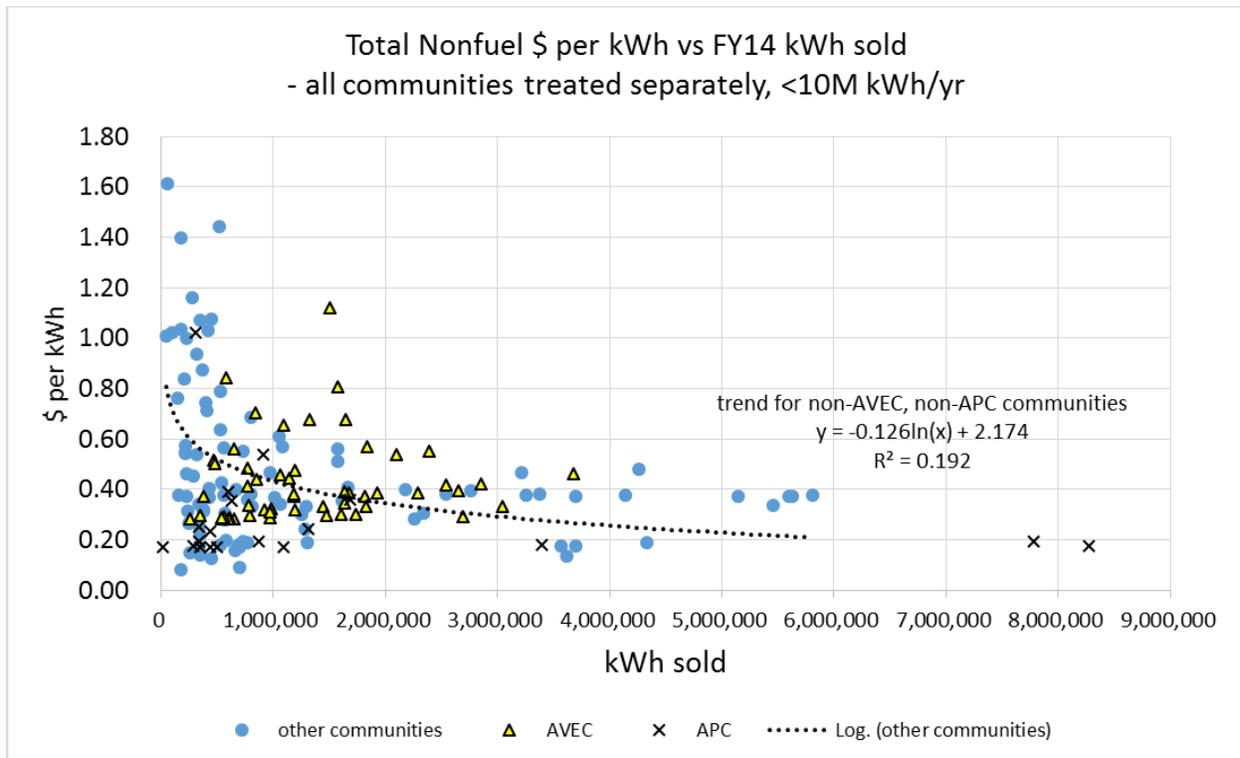
In the results case we are presenting here, contributions of resources are allocated to each community. (As discussed above, we are mindful that this may not be a helpful way to present the data for regional cooperatives such as AVEC.)



The outlier in this plot is a community in the Middle Kuskokwim Electric Coop (MKE) that was allocated an “equal share” of a regional RPSU grant. It is possible that the allocation should have been less based on the low sales amount. However, the point could also reflect how some costs are simply very high per kWh when a very small system is upgraded.

Total nonfuel costs

This plot shows the total nonfuel costs per kWh with AVEC and APC communities highlighted.



The non-AVEC, non-APC data displays a weak trend toward lower total cost for larger utilities. This seems to reflect the fact that some of the smallest communities are awarded significant assistance through established need-based programs like RPSU.

Summary: Total cost of electric power

The total annual cost of providing about 450 million kWh to the PCE communities is about \$125 million per year. Of this, booked costs, which are theoretically covered by rates and PCE, amount to 76% of this total, or \$95.2 million per year. Annualized external contributions, which are in addition to PCE, total \$29.7 million per year, or about 24% of the total.

Caveats on Interpretation of Results

While fuel cost varies directly with kWh output, nonfuel costs may be only indirectly connected to output. Some nonfuel costs are fixed per utility (such as management expense), while some vary but only in the long run as plant is added to meet new load (such as depreciation). It may therefore be misleading to think about these costs as per kWh.

If data on nonfuel costs are to be used to assess supply alternatives or efficiency investments, it is important to consider how components of these costs will (or will not) change in response alternatives. Although the nonfuel components of “true cost” are important to understand, care must be taken to determine which of these costs would in fact be avoided or reduced by initiatives to reduce cost via alternative energy sources.

Appendix to True Cost of Electric Service in Rural Alaska

Complete table of results

Utility	Community	kWh	nonfuel \$/kWh		
			booked	off-book	total
City of Akhiok	Akhiok	177,922	0.0338	0.0500	0.0838
Akiachak Native Community	Akiachak	1,668,607	0.2540	0.1561	0.4101
Akiak City Council	Akiak	797,110	0.1576	0.2226	0.3802
City of Akutan	Akutan	517,287	0.4217	1.0190	1.4407
Alutiiq Power Company	Karluk	232,826	0.2310	0.1404	0.3714
Aniak	Aniak	2,182,892	0.3300	0.0682	0.3982
Arctic Village Electric	Arctic Village	426,066	0.0839	0.2842	0.3681
City of Atka	Atka	423,574	0.2882	0.7415	1.0297
Atmautluak Tribal Utilities	Atmautluak	555,442	0.1839	0.1913	0.3752
Beaver Joint Utilities	Beaver	249,817	0.2628	0.0010	0.2639
City of Buckland	Buckland	1,573,458	0.0727	0.4898	0.5625
Chalkyitsik Village	Chalkyitsik	350,427	0.1392	0.0008	0.1400
Chenega IRA Village Council	Chenega	239,161	0.1429	0.1706	0.3135
Chignik City	Chignik	731,094	0.1654	0.3846	0.5500
Chignik Lake Electric Utility	Chignik Lake	335,311	0.1435	0.0294	0.1729
Chignik Lagoon	Chignik Lagoon	406,071	0.2444	0.4701	0.7145
Chitina Electric Utility	Chitina	395,819	0.1780	0.5682	0.7462
Circle	Circle	338,782	0.3394	0.0005	0.3399
Clarks Point	Clarks Point	153,731	0.0884	0.2908	0.3792
Cordova Electric Cooperative	Cordova	25,738,351	0.1944	0.0183	0.2127
Diomedede Joint Utilities	Diomedede	204,845	0.2905	0.5462	0.8366
Egegik Light and Power Co.	Egegik	584,765	0.1757	0.0234	0.1992
Elfin Cove Utility Commision	Elfin Cove	225,593	0.2251	0.2357	0.4608
City of Fa;se Pass	False Pass	664,363	0.0914	0.0646	0.1560
City of Galena	Galena	4,331,011	0.1829	0.0047	0.1875
G&K Inc.	Cold Bay	2,263,534	0.2788	0.0038	0.2826
Gold Country Energy	Central	449,021	0.1078	0.0200	0.1277
Golovin Power Utilities	Golovin	769,830	0.1697	0.1891	0.3588
Gwitchyaa Zhee Utility Co.	Fort Yukon	2,545,956	0.1470	0.2329	0.3799
Hughes Power and Light	Hughes	316,398	0.1889	0.3496	0.5386
Igiugig Electric Company	Igiugig	274,521	0.1397	1.0210	1.1607
I.N.N.	Iliamna, Newhalen,	3,211,086	0.3891	0.0776	0.4667
Inside Passage Electric	Angoon	1,571,232	0.3407	0.1705	0.5112
Inside Passage Electric	Chilkat Valley	1,065,433	0.3407	0.0000	0.3407
Inside Passage Electric	Hoonah	4,265,453	0.3407	0.1374	0.4781
Inside Passage Electric	Kake	2,758,557	0.3407	0.0557	0.3964
Inside Passage Electric	Klukwan	352,516	0.3407	0.0000	0.3407

			nonfuel \$/kWh		
Utility	Community	kWh	booked	off-book	total
Ipnotchialq Electric Company	Deering	668,169	0.2237	0.1750	0.3987
King Cove	King Cove	3,697,617	0.0828	0.0939	0.1767
Kipnuk Light Plant	Kipnuk	1,621,062	0.1620	0.1946	0.3566
Kokhanok	Kokhanok	372,327	0.1967	0.6772	0.8740
Kotzebue	Kotzebue	19,949,140	0.2070	0.0329	0.2399
City of Koyukuk	Koyukuk	226,875	0.2309	0.7693	1.0003
Kwethluk Incorporated d/b/a	Kwethluk	1,294,217	0.1299	0.2025	0.3325
Kwigillingok IRA Council	Kwigillingok	1,085,092	0.2338	0.3339	0.5677
Larsen Bay	Larsen Bay	700,438	0.0664	0.1026	0.1690
Levelock	Levelock	339,464	0.2262	0.0312	0.2575
Lime Village	Lime Village	51,643	0.8101	0.1990	1.0091
Manokotak	Manokotak	1,305,342	0.0954	0.0916	0.1871
McGrath Light & Power	McGrath	2,337,307	0.2672	0.0393	0.3065
Middle Kuskokwim Electric	Chuathbaluk	214,532	0.1677	0.3787	0.5463
Middle Kuskokwim Electric	Crooked Creek	214,650	0.1677	0.3756	0.5433
Middle Kuskokwim Electric	Red Devil	55,833	0.1677	1.4432	1.6108
Middle Kuskokwim Electric	Sleetmute	219,912	0.1677	0.4083	0.5759
Middle Kuskokwim Electric	Stony River	95,039	0.1677	0.8531	1.0208
Naknek	Naknek	18,506,758	0.3299	0.0035	0.3334
Napakiak	Napakiak	575,267	0.1877	0.1182	0.3060
Napaskiak	Napaskiak	774,406	0.1753	0.0135	0.1889
Naterkaq Light Plant (City of	Chefornak	1,287,937	0.0916	0.1526	0.2442
Nelson Lagoon	Nelson Lagoon	290,779	0.2934	0.1617	0.4551
New Koliganek Village	Koliganek	561,907	0.1586	0.4046	0.5632
Nikolai	Nikolai	344,121	0.1479	0.0719	0.2197
Nome	Nome	30,234,876	0.1344	0.0377	0.1722
North Slope Borough	Anaktuvuk Pass	3,694,032	0.3707	0.0000	0.3707
North Slope Borough	Point Hope	5,628,407	0.3707	0.0016	0.3722
North Slope Borough	Nuiqsut	5,596,138	0.3707	0.0000	0.3707
North Slope Borough	Point Lay	3,371,016	0.3707	0.0105	0.3812
North Slope Borough	Wainwright	5,814,148	0.3707	0.0050	0.3757
North Slope Borough	Kaktovik	5,146,463	0.3707	0.0017	0.3724
North Slope Borough	Atkasuk	3,252,931	0.3707	0.0058	0.3764
Nunam Iqua Electric Co.	Nunam Iqua	816,327	0.1588	0.1717	0.3305
Nushagak Electric Cooperativ	Dillingham, Aleknag	17,836,650	0.1974	0.0207	0.2181
Ouzinkie	Ouzinkie	688,967	0.1233	0.0556	0.1789
Pedro Bay	Pedro Bay	151,276	0.1534	0.6103	0.7637
Pelican	Pelican	451,319	0.1627	0.9139	1.0766
Pilot Point	Pilot Point	351,537	0.1354	0.9350	1.0704
Port Heiden	Port Heiden	537,481	0.2958	0.1284	0.4242
Puvurna Power	Kongiganak	1,053,932	0.2082	0.4034	0.6116

Utility	Community	kWh	nonfuel \$/kWh		
			booked	off-book	total
Ruby	Ruby	534,806	0.2434	0.5447	0.7881
Saint George	Saint George	533,695	0.2068	0.4305	0.6373
Saint Paul	Saint Paul	3,567,115	0.1360	0.0378	0.1738
Takotna	Takotna	176,425	0.2634	0.7726	1.0360
Tanalian Electric Cooperative	Port Alsworth	732,477	0.1949	0.0000	0.1949
Tanana Power Company Inc	Tanana	1,015,621	0.3070	0.0618	0.3688
Tatitlek	Tatitlek	375,274	0.1783	0.1370	0.3153
TDX Adak Generating LLC	Adak	1,258,595	0.2974	0.0041	0.3015
TDX Corporation	Sand Point	3,616,416	0.1234	0.0119	0.1352
TDX Manley Generating LLC	Manley	375,324	0.3032	0.0140	0.3172
Tenakee Springs	Tenakee Springs	322,770	0.1878	0.7479	0.9356
Tuluksak	Tuluksak	571,937	0.1081	0.1693	0.2774
Tuntutuliak	Tuntutuliak	968,414	0.2034	0.2646	0.4679
Twin Hills	Twin Hills	256,133	0.1104	0.0388	0.1491
Umnak Power Company	Nikolski	177,989	0.3686	1.0312	1.3998
Unalakleet Valley Electric	Unalakleet	4,139,993	0.2003	0.1762	0.3765
City of Unalaska	Unalaska	45,202,230	0.1640	0.0019	0.1659
Ungusraq Power Company	Newtok	424,844	0.3520	0.0532	0.4052
Venetie	Venetie	527,333	0.1522	0.0284	0.1807
White Mountain	White Mountain	699,130	0.0171	0.0735	0.0906
Yakutat	Yakutat	5,457,049	0.2177	0.1175	0.3352

Utility	Community	kWh	nonfuel \$/kWh		
			booked	off-book	total
AVEC	Alakanuk	2,286,111	0.2848	0.1028	0.3876
AVEC	Ambler	1,180,970	0.2848	0.0865	0.3713
AVEC	Anvik	377,491	0.2848	0.0891	0.3739
AVEC	Bethel	39,928,003	0.0741	0.0054	0.0796
AVEC	Brevig Mission	1,095,927	0.2848	0.3717	0.6565
AVEC	Chevak	2,394,695	0.2848	0.2650	0.5498
AVEC	Eek	794,360	0.2848	0.0124	0.2972
AVEC	Ekwok	468,218	0.2848	0.2311	0.5159
AVEC	Elim	1,141,068	0.2848	0.1610	0.4458
AVEC	Emmonak	3,681,195	0.2848	0.1764	0.4612
AVEC	Gambell	1,839,194	0.2848	0.2843	0.5690
AVEC	Goodnews Bay	651,064	0.2848	0.0000	0.2848
AVEC	Grayling	544,275	0.2848	0.0000	0.2848
AVEC	Holy Cross	613,690	0.2848	0.0017	0.2865
AVEC	Hooper Bay	3,039,243	0.2848	0.0456	0.3304
AVEC	Huslia	922,893	0.2848	0.0328	0.3176
AVEC	Lower Kalskag	480,543	0.2848	0.2182	0.5030
AVEC	Kaltag	653,359	0.2848	0.2745	0.5593
AVEC	Kasigluk	1,643,784	0.2848	0.3917	0.6765
AVEC	Kiana	1,446,305	0.2848	0.0477	0.3325
AVEC	Kivalina	1,196,280	0.2848	0.0361	0.3209
AVEC	Kobuk	602,427	0.2848	0.0000	0.2848
AVEC	Kotlik	1,814,235	0.2848	0.0884	0.3732
AVEC	Koyuk	1,196,741	0.2848	0.1920	0.4767
AVEC	Marshall	1,475,852	0.2848	0.0137	0.2985
AVEC	Mekoryuk	837,240	0.2848	0.4174	0.7022
AVEC	Minto	562,453	0.2848	0.0084	0.2932
AVEC	Mountain Village	2,693,134	0.2848	0.0057	0.2905
AVEC	New Stuyahok	1,326,841	0.2848	0.3912	0.6759
AVEC	Nightmute	579,832	0.2848	0.5581	0.8429
AVEC	Noatak	1,740,727	0.2848	0.0174	0.3022
AVEC	Noorvik	1,828,814	0.2848	0.0463	0.3311
AVEC	Nulato	968,930	0.2848	0.0014	0.2862
AVEC	Nunapitchuk	1,179,055	0.2848	0.0974	0.3822
AVEC	Old Harbor	785,298	0.2848	0.0524	0.3372
AVEC	Pilot Station	1,681,041	0.2848	0.0993	0.3841
AVEC	Pitka's Point	261,295	0.2848	0.0000	0.2848
AVEC	Quinhagak	1,931,141	0.2848	0.1004	0.3852
AVEC	Russian Mission	985,738	0.2848	0.0378	0.3226
AVEC	Savoonga	2,103,110	0.2848	0.2553	0.5401
AVEC	Scammon Bay	1,608,052	0.2848	0.0177	0.3025
AVEC	Selawik	2,543,358	0.2848	0.1317	0.4165
AVEC	Shageluk	350,358	0.2848	0.0099	0.2947
AVEC	Shaktolik	1,058,574	0.2848	0.1719	0.4567
AVEC	Shishmaref	1,633,550	0.2848	0.0616	0.3463
AVEC	Shungnak	971,754	0.2848	0.0232	0.3080
AVEC	Saint Mary's	2,652,143	0.2848	0.1082	0.3929
AVEC	Saint Michael	1,634,615	0.2848	0.1049	0.3897
AVEC	Stebbins	1,506,764	0.2848	0.8349	1.1197
AVEC	Teller	773,560	0.2848	0.1260	0.4107
AVEC	Togiak	2,847,910	0.2848	0.1374	0.4222
AVEC	Toksook Bay	1,580,412	0.2848	0.5235	0.8082
AVEC	Tununak	850,982	0.2848	0.1571	0.4419
AVEC	Upper Kalskag	771,093	0.2848	0.1997	0.4845
AVEC	Wales	539,990	0.2848	0.0039	0.2887

			nonfuel \$/kWh		
Utility	Community	kWh	booked	off-book	total
Alaska Power Company	Allakaket, Alatna	635,174	0.1716	0.1815	0.3532
Alaska Power Company	Bettles	498,537	0.1716	0.0015	0.1731
Alaska Power Company	Chistochina	312,008	0.1716	0.8507	1.0224
Alaska Power Company	Coffman Cove	916,844	0.1716	0.3683	0.5399
Alaska Power Company	Craig	11,731,373	0.1716	0.0083	0.1799
Alaska Power Company	Dot Lake	347,448	0.1716	0.0000	0.1716
Alaska Power Company	Eagle	601,029	0.1716	0.2198	0.3915
Alaska Power Company	Gustavus	1,687,160	0.1716	0.1869	0.3585
Alaska Power Company	Haines	12,360,730	0.1716	0.0107	0.1823
Alaska Power Company	Healy Lake	18,392	0.1716	0.0000	0.1716
Alaska Power Company	Hollis	875,403	0.1716	0.0204	0.1920
Alaska Power Company	Hydaburg	1,315,249	0.1716	0.0729	0.2445
Alaska Power Company	Klawock	8,268,498	0.1716	0.0022	0.1738
Alaska Power Company	Mentasta	338,247	0.1716	0.0797	0.2513
Alaska Power Company	Naukati	443,610	0.1716	0.0000	0.1716
Alaska Power Company	Northway	1,095,189	0.1716	0.0000	0.1716
Alaska Power Company	Skagway	11,868,104	0.1716	0.0121	0.1837
Alaska Power Company	Slana	442,453	0.1716	0.0638	0.2354
Alaska Power Company	Tetlin (power from	343,116	0.1716	0.0233	0.1949
Alaska Power Company	Thorne Bay / Kasaar	3,400,007	0.1716	0.0105	0.1821
Alaska Power Company	Tok	7,782,609	0.1716	0.0242	0.1958
Alaska Power Company	Whale Pass	285,250	0.1716	0.0031	0.1747
Inside Passage Electric	IPE ALL	10,013,191	0.3407	0.1009	0.4416
Middle Kuskokwim Electric	MKE ALL	799,966	0.1677	0.5167	0.6843
North Slope Borough	NSB - ALL	32,503,135	0.3707	0.1899	0.5606
AVEC	AVEC - TOTAL	112,256,015	0.2099	0.0992	0.3092
AVEC	AVEC w/o Bethel	72,328,012	0.2848	0.1510	0.4358
AVEC	AVEC Bethel only	39,928,003	0.0741	0.0054	0.0796
Alaska Power Company	APC TOTAL	65,566,430	0.1716	0.0299	0.2015
TOTALS (nonduplicated)		453,519,211	0.2142	0.0790	0.2931

True Cost of Bulk Fuel in Rural Alaska

Methodology

To estimate the true cost of bulk fuel, we began with per gallon fuel prices obtained from the Department of Community and Regional Affairs (DCRA) Heating Fuel Survey (January 2016.) To those reported prices we added an estimate of the per gallon subsidy that results from bulk tank farm projects.

Bulk Fuel Program Cost Compilation and Cost Allocations

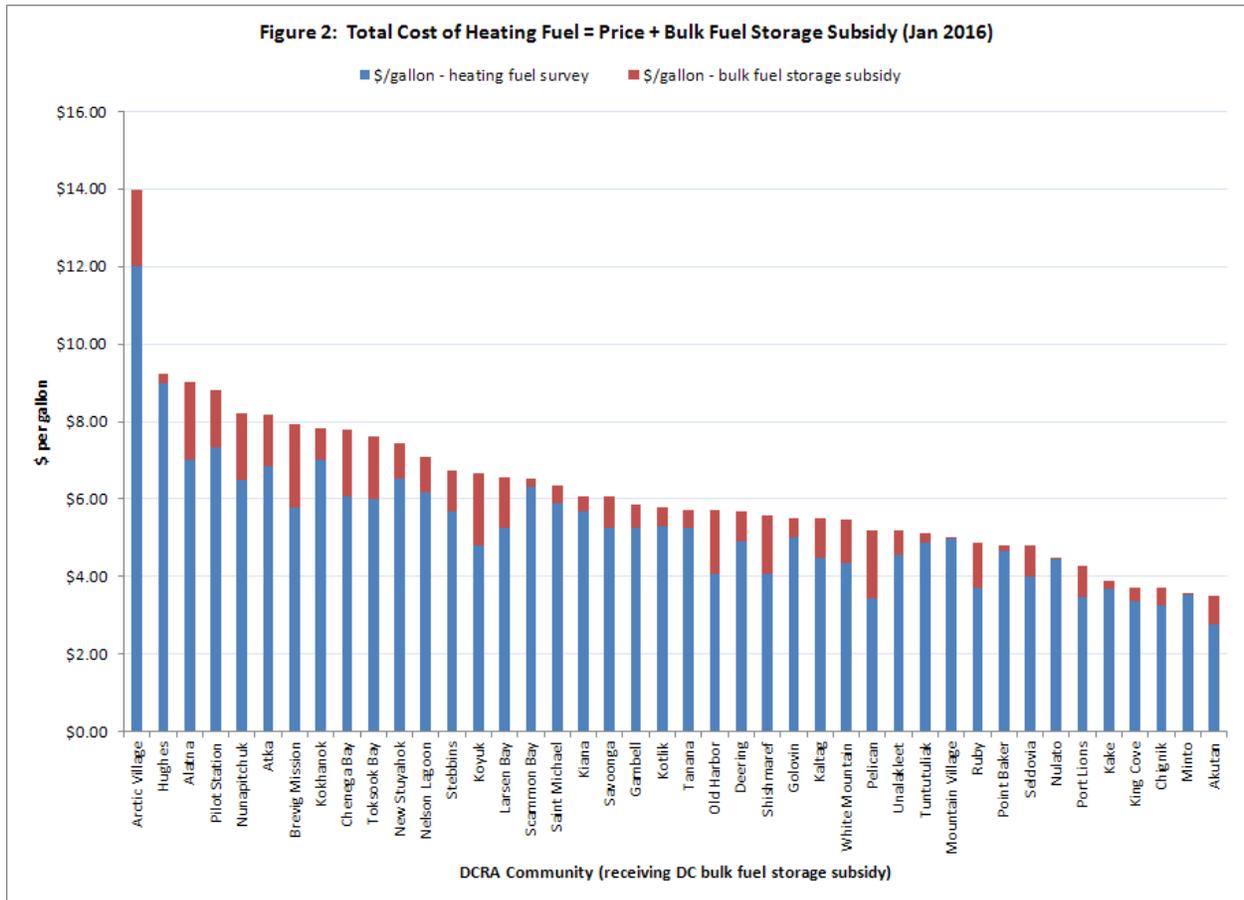
The data on bulk tank farm projects were extracted from the Denali Commission Project Database on December 15, 2015. This data included the total project cost as well as contributed capital from state and federal sources for bulk fuel tank farm project developments and construction across Alaska. We totaled the bulk fuel tank farm project costs that were contributed from other than ratepayers, also known as “contributed capital” for individual communities. We allocated regional or statewide project development costs to communities based on storage capacity.

We reviewed a sample of a dozen bulk tank farm project business plans to estimate the tank farm capacity associated with electric fuel and the capacity associated with heating fuel. Roughly one-third of the bulk fuel tank capacity was attributed to electric utility diesel fuel and roughly two-thirds of the bulk tank farm capacity was attributed to local heating fuel.

To annualize the resulting capital project cost allocations to electric (1/3) and heating markets (2/3), we assumed a 30-year life and a discount rate of 4.5% (a conservative lower-bound estimate of the long-run real return on the Permanent Fund, based upon historical returns through FY15 and preliminary projections for FY16.)

The underlying calculations for these can be found in the “BulkFuel to Electric” and “BulkFuel to Heating” tabs in the “Denali Commission Project Database 15 December 2015a” Excel workbook.

Figure 2 presents the data only for those 43 communities that have received bulk fuel storage project subsidies. For those communities, the total cost of heating fuel ranges from \$3.51 per gallon to \$13.99 per gallon in Arctic Village. The subsidy ranges from \$0.01 per gallon in Minto to \$2.12 per gallon in Brevig Mission.



Finally, we have computed regional average data for those 43 communities with bulk fuel tank storage projects, which is presented in Table 1. The average total cost of heating fuel ranged from \$4.64/gallon in Southeast, including \$0.72/gallon of fuel tank farm subsidy to \$7.04/gallon in Interior including \$1.26/gallon of fuel tank farm subsidy.

Table 1: Total Cost of Heating Fuel for Communities in DCRA Survey with Denali Commission Bulk Fuel Storage Subsidies

Row Labels	Average of Survey \$/gallon	Average of \$/gallon storage subsidy	Average of \$/gallon total
Gulf Coast	\$ 4.57	\$ 1.26	\$ 5.82
Interior	\$ 6.18	\$ 0.86	\$ 7.04
Northwest	\$ 5.10	\$ 0.99	\$ 6.09
Southeast	\$ 3.92	\$ 0.72	\$ 4.64
Southwest	\$ 5.13	\$ 0.79	\$ 5.92
Western	\$ 5.90	\$ 0.82	\$ 6.72
Grand Total	\$ 5.30	\$ 0.92	\$ 6.22

Appendix to True Cost of Bulk Fuel in Rural Alaska

Fuel oil cost per gallon by community

<u>Community</u>		<u>Survey \$/gallon</u>	<u>\$/gallon storage subsidy</u>	<u>\$/gallon total</u>
Arctic Village	Interior	\$12.00	\$1.99	\$13.99
Hughes	Interior	\$9.00	\$0.22	\$9.22
Alatna	Interior	\$7.00	\$2.03	\$9.03
Pilot Station	Western	\$7.32	\$1.51	\$8.83
Nunapitchuk	Western	\$6.49	\$1.74	\$8.23
Atka	Southwest	\$6.85	\$1.33	\$8.18
Brevig Mission	Northwest	\$5.80	\$2.12	\$7.92
Kokhanok	Southwest	\$7.00	\$0.84	\$7.84
Chenega Bay	Gulf Coast	\$6.05	\$1.74	\$7.79
Toksook Bay	Western	\$6.00	\$1.60	\$7.60
McGrath	Interior	\$7.45	\$0.00	\$7.45
New Stuyahok	Southwest	\$6.52	\$0.91	\$7.43
Saint George	Southwest	\$7.36	\$0.00	\$7.36
Wales	Northwest	\$7.21	\$0.00	\$7.21
Nelson Lagoon	Southwest	\$6.18	\$0.90	\$7.08
Stebbins	Northwest	\$5.69	\$1.06	\$6.75
Atmautluak	Western	\$6.73	\$0.00	\$6.73
Koyuk	Northwest	\$4.80	\$1.88	\$6.68
Larsen Bay	Gulf Coast	\$5.26	\$1.31	\$6.57
Noorvik	Northwest	\$6.56	\$0.00	\$6.56
Scammon Bay	Western	\$6.33	\$0.19	\$6.52
Huslia	Interior	\$6.50	\$0.00	\$6.50
Hooper Bay	Western	\$6.45	\$0.00	\$6.45
Saint Michael	Northwest	\$5.88	\$0.48	\$6.36
Upper Kalskag	Western	\$6.25	\$0.00	\$6.25
Akiak	Western	\$6.24	\$0.00	\$6.24
Galena	Interior	\$6.21	\$0.00	\$6.21
Kiana	Northwest	\$5.67	\$0.42	\$6.08
Savoonga	Northwest	\$5.25	\$0.82	\$6.07
Anvik	Interior	\$6.00	\$0.00	\$6.00
Gambell	Northwest	\$5.25	\$0.60	\$5.85
Kotlik	Western	\$5.30	\$0.50	\$5.80
Tanana	Interior	\$5.25	\$0.47	\$5.72
Old Harbor	Gulf Coast	\$4.07	\$1.63	\$5.70
Sleetmute	Western	\$5.70	\$0.00	\$5.70
Deering	Northwest	\$4.89	\$0.78	\$5.68
Bethel	Western	\$5.67	\$0.00	\$5.67

Shishmaref	Northwest	\$4.08	\$1.51	\$5.59
Holy Cross	Interior	\$5.55	\$0.00	\$5.55
Golovin	Northwest	\$5.00	\$0.52	\$5.52
Grayling	Interior	\$5.50	\$0.00	\$5.50
Kaltag	Interior	\$4.50	\$1.00	\$5.50
Teller	Northwest	\$5.46	\$0.00	\$5.46
White Mountain	Northwest	\$4.35	\$1.10	\$5.45
Marshall	Western	\$5.41	\$0.00	\$5.41
Nondalton	Southwest	\$5.24	\$0.00	\$5.24
Pelican	Southeast	\$3.43	\$1.76	\$5.20
Unalakleet	Northwest	\$4.57	\$0.62	\$5.18
Emmonak	Western	\$5.15	\$0.00	\$5.15
Tuntutuliak	Western	\$4.88	\$0.23	\$5.11
Quinhagak	Western	\$5.00	\$0.00	\$5.00
Mountain Village	Western	\$4.98	\$0.01	\$4.99
Ruby	Interior	\$3.70	\$1.19	\$4.89
Point Baker	Southeast	\$4.65	\$0.17	\$4.82
Russian Mission	Western	\$4.80	\$0.00	\$4.80
Seldovia	Gulf Coast	\$4.00	\$0.79	\$4.79
Kwigillingok	Western	\$4.65	\$0.00	\$4.65
Togiak	Southwest	\$4.62	\$0.00	\$4.62
Sand Point	Southwest	\$4.48	\$0.00	\$4.48
Nulato	Interior	\$4.45	\$0.02	\$4.47
Port Lions	Gulf Coast	\$3.45	\$0.81	\$4.26
Eagle	Interior	\$4.25	\$0.00	\$4.25
Goodnews Bay	Western	\$4.12	\$0.00	\$4.12
Kake	Southeast	\$3.68	\$0.22	\$3.90
Wrangell	Southeast	\$3.85	\$0.00	\$3.85
King Cove	Southwest	\$3.37	\$0.34	\$3.71
Chignik	Southwest	\$3.25	\$0.45	\$3.70
Gustavus	Southeast	\$3.58	\$0.00	\$3.58
Dillingham	Southwest	\$3.57	\$0.00	\$3.57
Minto	Interior	\$3.55	\$0.01	\$3.56
Angoon	Southeast	\$3.55	\$0.00	\$3.55
Unalaska	Southwest	\$3.54	\$0.00	\$3.54
Akutan	Southwest	\$2.75	\$0.76	\$3.51
Kotzebue	Northwest	\$3.16	\$0.00	\$3.16
Juneau	Southeast	\$3.15	\$0.00	\$3.15
Thorne Bay	Southeast	\$3.07	\$0.00	\$3.07
Petersburg	Southeast	\$2.97	\$0.00	\$2.97
Craig	Southeast	\$2.94	\$0.00	\$2.94
Ouzinkie	Gulf Coast	\$2.94	\$0.00	\$2.94
Hoonah	Southeast	\$2.85	\$0.00	\$2.85
Cordova	Gulf Coast	\$2.79	\$0.00	\$2.79

Kodiak	Gulf Coast	\$2.72	\$0.00	\$2.72
Valdez	Gulf Coast	\$2.70	\$0.00	\$2.70
Nenana	Interior	\$2.69	\$0.00	\$2.69
Healy	Interior	\$2.65	\$0.00	\$2.65
Anderson	Interior	\$2.59	\$0.00	\$2.59
Kaktovik	Northern	\$2.50	\$0.00	\$2.50
Chitina	Gulf Coast	\$2.45	\$0.00	\$2.45
Circle	Interior	\$2.45	\$0.00	\$2.45
Glennallen	Gulf Coast	\$2.45	\$0.00	\$2.45
Homer	Gulf Coast	\$2.35	\$0.00	\$2.35
Delta Junction	Interior	\$2.35	\$0.00	\$2.35
Fairbanks	Interior	\$2.32	\$0.00	\$2.32
Nuiqsut	Northern	\$2.05	\$0.00	\$2.05
Point Hope	Northern	\$1.74	\$0.00	\$1.74
Anaktuvuk Pass	Northern	\$1.55	\$0.00	\$1.55
Wainwright	Northern	\$1.50	\$0.00	\$1.50
Atqasuk	Northern	\$1.40	\$0.00	\$1.40