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February 1, 2016

Mr. Timothy R. Schneider, Public Advocate
Office of Public Advocate
112 State House Station
Augusta, Maine 04333-0112

Dear Mr. Schneider:

Subject: Review of Matinicus Plantation Electric Company and Monhegan Plantation Power District

Attached is the final report of the two subject electric systems. In addition to this review, an Excel spreadsheet program was prepared to assist the two systems in setting rates that are commensurate with their sales and expenses as well as helping them establish and maintain solid financial operations. The spreadsheet program was forwarded at an earlier date, and a meeting was held with the Island Institute staff to explain how to use the model.

Very truly yours,

THE FINANCIAL ENGINEERING COMPANY

Michael D. Hubbard

c: Suzanne MacDonald, Island Institute
Ben Algeo, Island Institute

MATINICUS PLANTATION ELECTRIC COMPANY

SYSTEM REVIEW

MATINICUS PLANTATION ELECTRIC COMPANY

OVERVIEW AND SYSTEM DESCRIPTION

INTRODUCTION

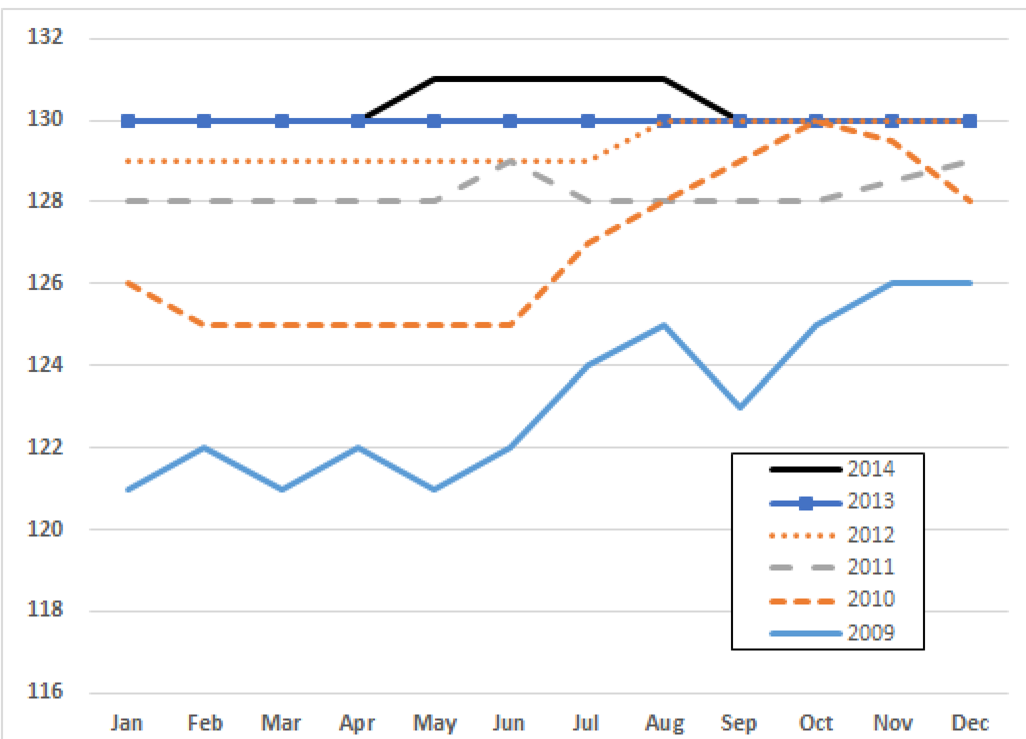
Matinicus Plantation Electric Company ("MPEC") is a municipally-owned electric utility providing service to the businesses and residents of Matinicus Island, a small, 720-acre island approximately 20 miles south-southeast of Rockland, Maine. Approximately 30 people live on Matinicus Island year round with the summer population increasing to approximately 100.

Due to the small number of people living on the island, transportation is limited. Access to the island is via the State ferry system (1 – 4 times per month depending on the season), twice-daily air service (via the mail plane with approximately three seats per flight), or private boat. The island is electrically isolated from the mainland.

MPEC CUSTOMERS AND ENERGY SALES

Even though population on the island increases over threefold in the summer, the number of MPEC customers connected to the system remains stable throughout the year. Figure 1 shows a summary of the number of customers by month for the past several years. Since 2011, the change in the number of monthly customers has been limited to one within a single year.

Figure 1
Number of Active Customers



Although MPEC's tariffs have not been reviewed for this report, it is anticipated that the lack of disconnects at the end of the summer season is due to a re-connect policy similar to numerous other utilities that impose large fees if a meter is re-connected within a 12-month period. Thus, minimal amounts of power are being delivered to many of these meters in the off-season – an important consideration when reviewing usage statistics and evaluating options for future actions.

With the increase in population during the summer months, MPEC is a summer-peaking utility with approximately 50 percent of its sales occurring during the June – October time period. On an annual basis, annual sales have decreased by over 40,000 kilowatt-hours since 2009 even with a slight increase in the number of customers. Recent conservation programs such as exchanging lights for more efficient LED bulbs in late 2015 may lead to further decreases. Various metrics of MPEC's sales and generation are summarized in the following table and figures.

Figure 2
MPEC Annual Sales
(kilowatt-hours/year)

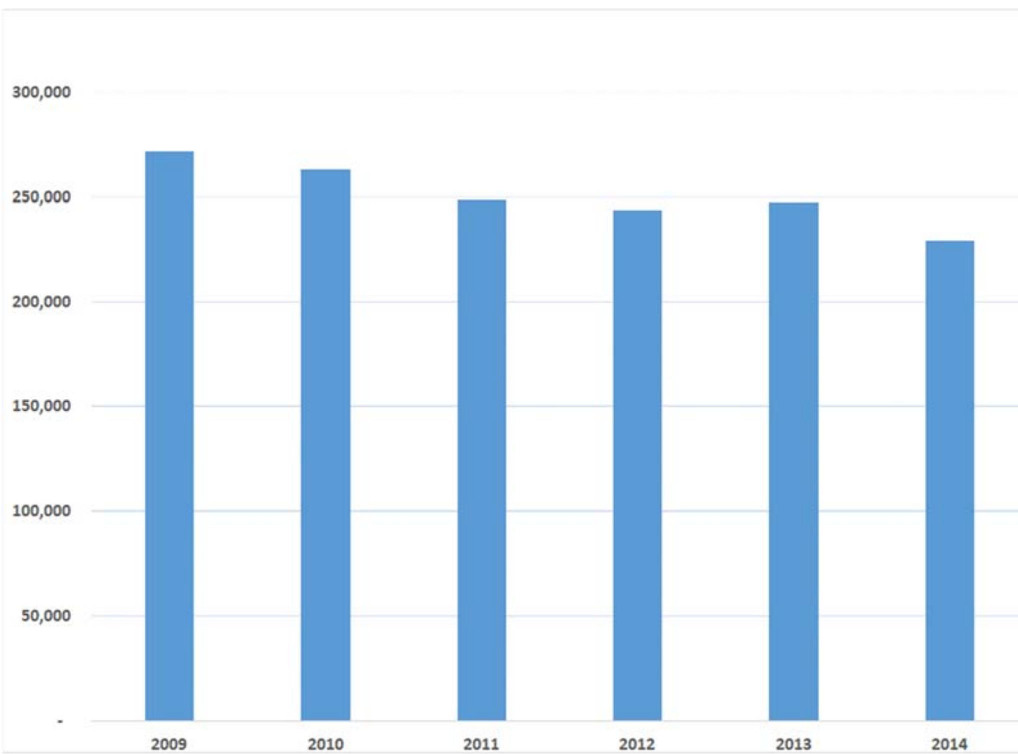


Figure 3
Monthly Energy Sales
2009 – 2014 Average
(Percent of Annual Total)

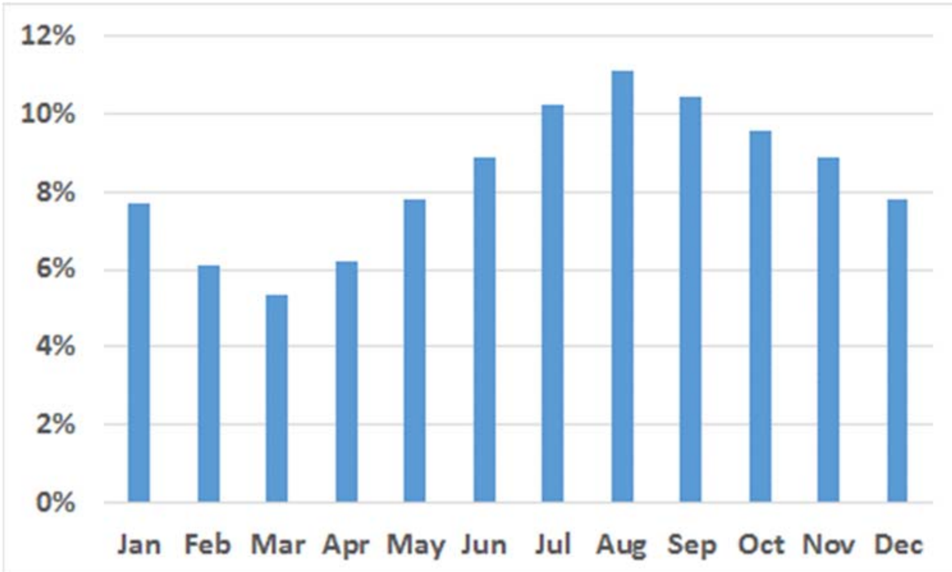
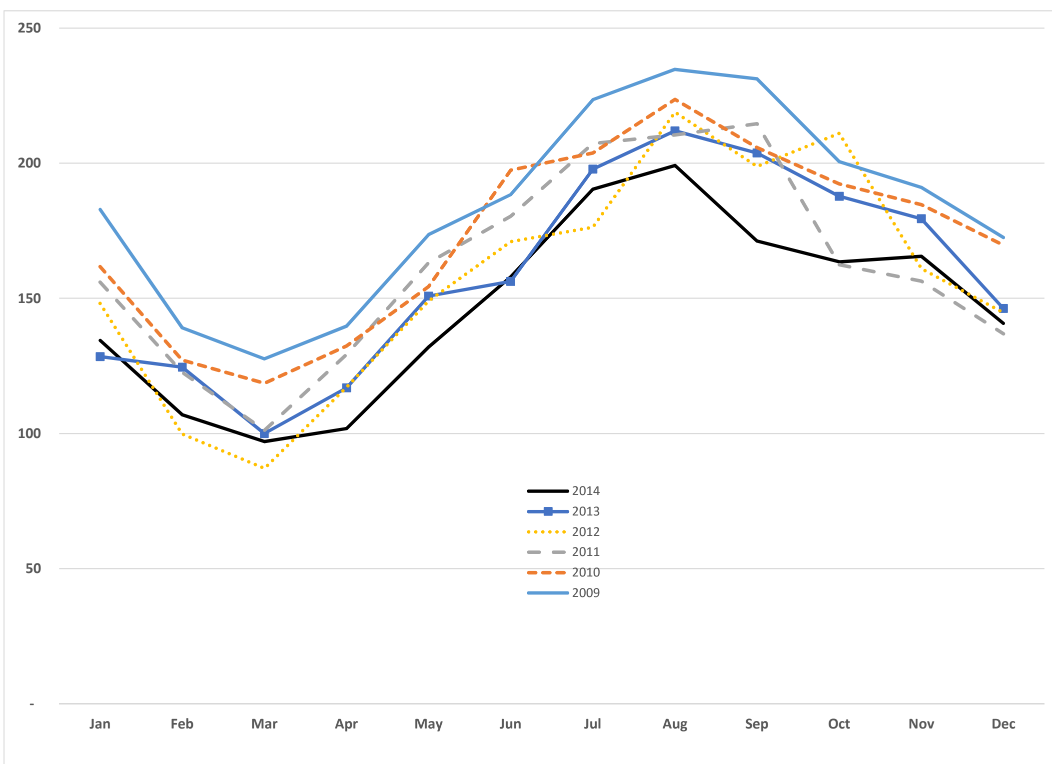


Figure 4
Monthly Energy Sales
(kilowatt-hours / meter)



The usage per customer shown in Figure 4 reaffirms the decreased usage summarized in Figure 2. Usage has decreased by 30 – 50 kilowatt-hours/month/meter since 2009, thereby reducing the overall sales. Another observation of note in Figure 3 is the usage per customer during the off-season. Here in the figure, winter usage is shown to be less than that during the summer. However as discussed earlier, many of the meters during the winter months are believed to use little or no power. For full-time residents, usage per customer may well be higher during the winter months than the summer.

MPEC GENERATION AND LOSSES

As a utility that is electrically and physically isolated from the grid, MPEC must rely on alternate forms of generation. To date, the sole source of power has been diesel-fired internal combustion generators (sometimes referred to as reciprocating engines, or "recips"). This type of generation is relatively inexpensive to install but expensive to operate. Historically, however, the combined fuel, operating, and maintenance costs have been less than alternative sources such as solar and wind.

Table 1, below, provides a summary of various generating statistics. Generating efficiency (kilowatt-hours generated / gallon of fuel) is quite low and losses (percent of generation) are high. While some of this may be due to the small size of the system, especially during the winter, other factors may also be involved. Both generating efficiency and losses are discussed later in this report.

Table 1
Annual Generating Statistics

	2009	2010	2011	2012	2013	2014
Generation (kWh)	348,800	341,760	337,760	322,100	327,140	309,260
Sales - Excluding Municipal (kWh)	271,957	263,307	248,794	243,838	247,516	229,598
Losses						
kWh	76,843	78,453	88,966	78,262	79,624	79,662
Pct of Generation	22.0%	23.0%	26.3%	24.3%	24.3%	25.8%
Fuel Usage (gallons)	38,450	38,910	36,890	36,450	36,930	35,340
Generating Efficiency Efficiency						
kWh Generated/gallon	9.07	8.78	9.16	8.84	8.86	8.75

RATES AND COST STRUCTURE

During the time period of the data in Table 1, MPEC's rate structure was as follows:

- A fixed customer charge of $15.00/meter/month
- An energy charge of $0.26/kilowatt-hour

- A fuel surcharge charged on a per kilowatt-hour basis that reflects the cost of generating fuel above $1.00/gallon

Since then, the fixed customer charge was increased to $25/meter/month and the energy charge to $0.3045/kilowatt-hour. The fuel surcharge remains the same.

As will be discussed later in this report, the inclusion of partial fuel costs on a dollars/gallon basis in the base rate can lead to under- or over-collections depending on the assumed and actual generating efficiency. Furthermore, it does not allow full transparency in fuel costs, and users will underestimate the actual fuel cost.

Financial operations since 2009 are summarized in the following table. This information is taken from spreadsheets developed by Island Institute personnel that calculated certain revenues using base rates and energy sales provided by MPEC. The calculated revenues are relatively close, but do not exactly match, revenue data provided in MPEC Annual Reports submitted to the Maine Public Utilities Commission.

Several adjustments are made to the financial data.

1. Revenues from base energy rates ($0.26/kilowatt-hour) are reduced by the amount collected for fuel in the base energy rates ($1.00/gallon x gallons of fuel used).
2. Revenues collected from the fuel surcharge are excluded.
3. Revenues collected for sales tax and PUC fees are excluded.
4. Fuel expenses are excluded.
5. Expenses representing sales tax and PUC fees are excluded.

Since 2010, utility revenues have been in excess of expenses. However, several important items should be noted.

- Depreciation is not included as an expense. Although depreciation is a non-cash expense and is not included in some methodologies of setting revenue requirements, some provision must be made for capital replenishment or future additions. "Other Expenses" through June 2010 included $500/month for capital reserves, but nothing after.
- Engine rebuilds appear to be expensed in a single year whereas they may better be amortized over the life of the rebuild.
- Labor expenses appear to be relatively steady with the exception of the last two years.
- Other expenses in 2009 and 2011 were significantly higher than other years, and no information was provided regarding the purpose of these large expenditures.

Table 2
Financial Operations

	2009	2010	2011	2012	2013	2014
Sales (kWh)	271,957	263,307	248,794	243,838	247,516	229,598
Generating Fuel (gallons)	38,450	38,910	36,890	36,450	36,930	35,340
Revenues						
Customer	$ 71,933	$ 69,645	$ 65,806	$ 64,495	$ 65,468	$ 60,729
Energy	52,308	67,004	95,892	103,653	102,271	92,368
Less Base Fuel Charge	(38,450)	(38,910)	(36,890)	(36,450)	(36,930)	(35,340)
Total Non Fuel Revenues	$ 85,791	$ 97,739	$ 124,808	$ 131,698	$ 130,809	$ 117,756
Expenses						
Labor	$ 34,172	$ 37,976	$ 33,493	$ 39,918	$ 29,105	$ 45,280
Production Costs (Non Fuel)						
Rebuilds	11,084	-	-	-	-	-
Other	5,559	5,570	5,768	5,494	3,679	12,270
Subotal	$ 16,643	$ 5,570	$ 5,768	$ 5,494	$ 3,679	$ 12,270
Distribution	3,410	4,562	6,637	5,366	3,460	15,733
Administration	9,883	8,344	8,585	7,461	7,315	8,863
Other	25,466	5,022	50,572	3,359	3,681	3,312
Less Other Revenues	(2,852)	(2,286)	(11,646)	(3,817)	(12,481)	(7,783)
Total Non Fuel Expense	$ 86,722	$ 59,187	$ 93,410	$ 57,781	$ 34,758	$ 77,675
Net	$ (931)	$ 38,552	$ 31,399	$ 73,917	$ 96,051	$ 40,081

OBSERVATIONS

GENERATING LOSSES

As noted earlier, generating losses are quite high and have averaged approximately 24 percent since 2009. While higher losses are expected for smaller systems such as MPEC, historical losses are still relatively high. When investigating losses on a monthly basis (Figure 5), losses are quite seasonal with higher losses during the off-peak months. Furthermore, the higher generating requirements during the summer months skews the annual average toward those months, and losses during the winter months can be 30 percent or higher.

Losses for small utilities in Alaska were investigated and are summarized in Figure 6. For most of these small communities, population is not seasonal. However due to the large difference in daylight hours and ambient temperatures, energy consumption is seasonal with the majority of the usage during the winter months. Therefore, utilities with approximately 130 meters (similar to MPEC) may be a valid comparison, and annual losses in the 10 – 15 percent range could be expected. It is noted, however, that loads of these utilities probably do not drop as low as MPEC loads during the winter.

Figure 5
Monthly Losses: 2009 - 2014
(Percent of Total Generation)

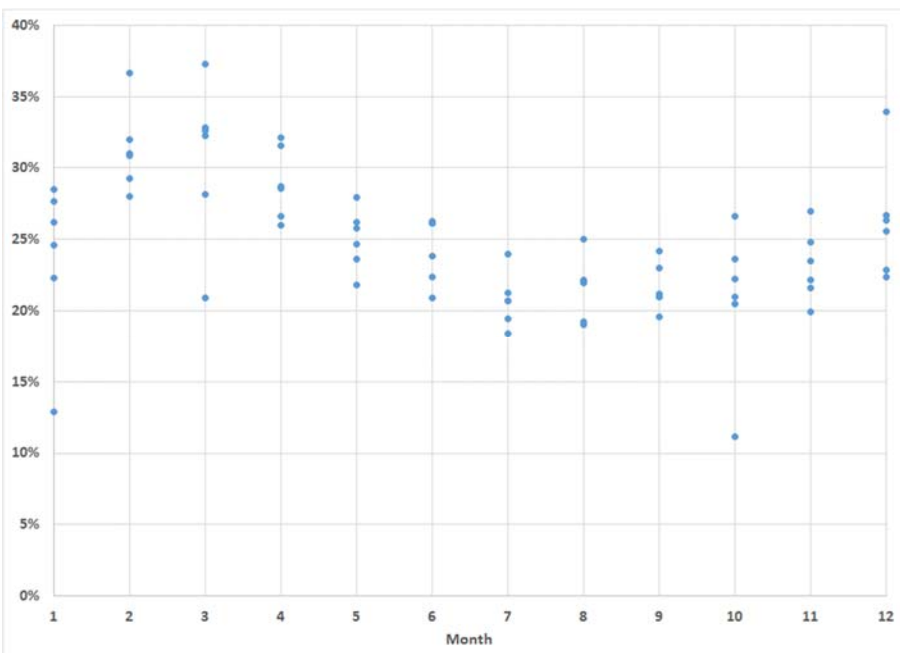
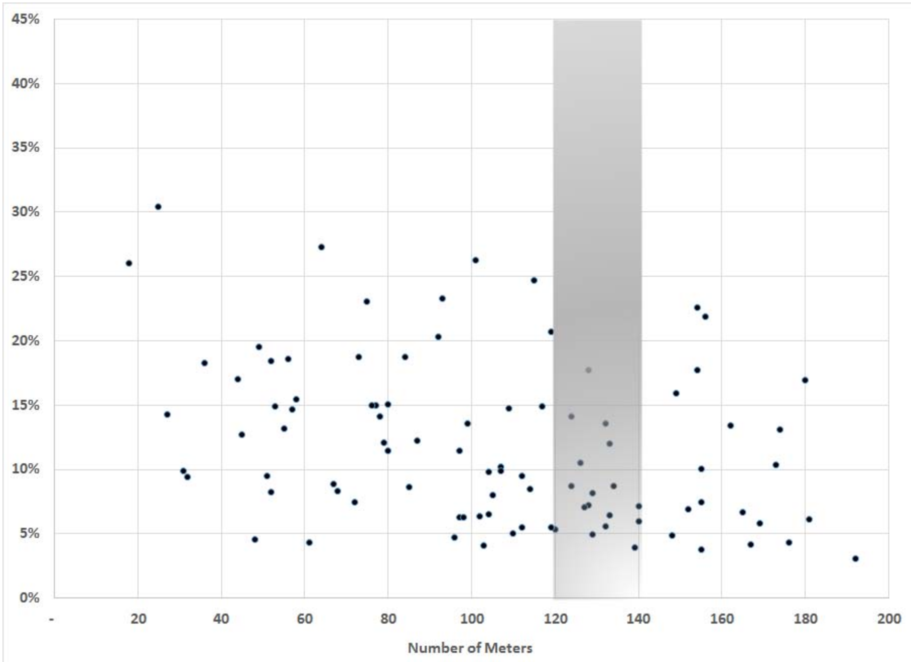


Figure 6
Annual Losses – Select Alaska Utilities
(Percent of Total Generation)



It is beyond the scope of this report to specifically identify the cause of MPEC's high losses. Nonetheless, several potential causes are identified as follows.

- *Metering point of generation.* There are several uses of power inside the powerhouse including pumping loads, fans, lights, and others. In many cases, generation is measured as it enters the distribution system, or net of these loads. If MPEC measures generation prior to the loads, losses will be higher. At the same time and as discussed in the next section, the place of measurement will affect fuel efficiency. Generation measured net of loads will result in a lower fuel efficiency (gallons / kilowatt-hour) than generation measured prior to loads.

  If MPEC measures generation as gross generation prior to powerhouse loads, it should meter such loads so that losses can be better tracked.[1]

- *Metering all users.* It has been reported that MPEC does not meter the municipal meters, and this would certainly add to losses. If this is the case, MPEC should meter and charge for those uses. While charging for power might simply represent a transfer of funds from one "pot" to another, it would better reflect usage and the true cost of power to the consumers.

[1] MPEC may meter these loads. However since the base energy rate applied to metered sales results in revenues approximately the same as revenues reported on the Annual Report, it is suspected the loads are not metered.

- *Over-sized or idle transformers.* Transformers are an integral part of the generation and distribution system and reduce voltage to appropriate levels. When energized, transformers use power, representing a loss on the system. As power flow increases though a transformer, losses (as a percent of input power) decrease, and efficiency increases. Efficiency may decrease at high amounts of energy input, but this degradation is limited. Given the seasonality of the MPEC load, this could represent a considerable source of losses. Harbors that provide power to vessels are also notorious for high losses since transformers can be idle for long periods of time.
- *Inaccurate meters.* Meters, especially the older, analog (electromechanical) type, can lose accuracy with age. For the analog type, inaccuracy is most often characterized by meter readings being less than actually delivered.
- *Meter multipliers.* For larger customers, the meter reading is a fraction of that actually delivered, and a constant multiplier is applied. It is not unheard of where the incorrect multiplier is applied to the meter reading.
- *Low power factor.* Without going into a detailed explanation, a power factor of unity (1.0) represents the ideal condition where a meter reading will represent the actual power delivered. As the power factor decreases, the meter reading will be less than the actual power delivered. Power factors less than 1.0 can be caused by a number of factors, the most common being inductive motors which are found on compressors and numerous tools, but low loads can also be a cause. Typically, power factor is not of concern for small utilities except when there is a customer with large motors. However due to the small loads during the off-peak season, power factor may be a problem if voltage must be increased.
- *Ground faults.* Faults in the system where voltage is leaking can also be a source of losses. Older systems can be prone to such faults through shifts in the ground and structures.

Other factors exist, and as noted, it is beyond the scope of this project to specifically identify the cause or causes. Losses are, however, quite high, and MPEC should investigate the causes. Cost savings from lowering losses are summarized in Table 3 on page 14.

GENERATING EFFICIENCY

Generating efficiency, in kilowatt-hours/gallon, should also be improved. At times, efficiency is measured using kilowatt-hours *generated* and other times using kilowatt-hours *sold*. In order to better differentiate between potential loss improvements and efficiency improvements, efficiency is based on kilowatt-hours *generated* for the MPEC system.

MPEC's generating efficiency has averaged 8.9 kilowatt-hours/gallon during the 2009-2014 period. As seen in Figure 7 on the following page, efficiency does not vary with season.

Figure 8 provides a summary of the generating efficiencies of the small Alaska utilities summarized earlier regarding losses. For utilities with 40 or less meters (such as MPEC during the winter), MPEC's generating efficiency is in the lower range of the sample. However as just noted, MPEC's efficiency does not vary by season, and a higher efficiency would be expected during the summer months.

Generating efficiency varies with the load placed on the generator, and efficiency decreases as the loading decreases. Older units typically have relatively steep efficiency curves where changes in efficiency is quite pronounced with changes in unit loading. New units have flatter curves and can operate at lower levels without the pronounced degradation in efficiency. These newer units, however, have relatively high minimum loading levels, with some not being able to operate at less than 50 percent of the maximum load.

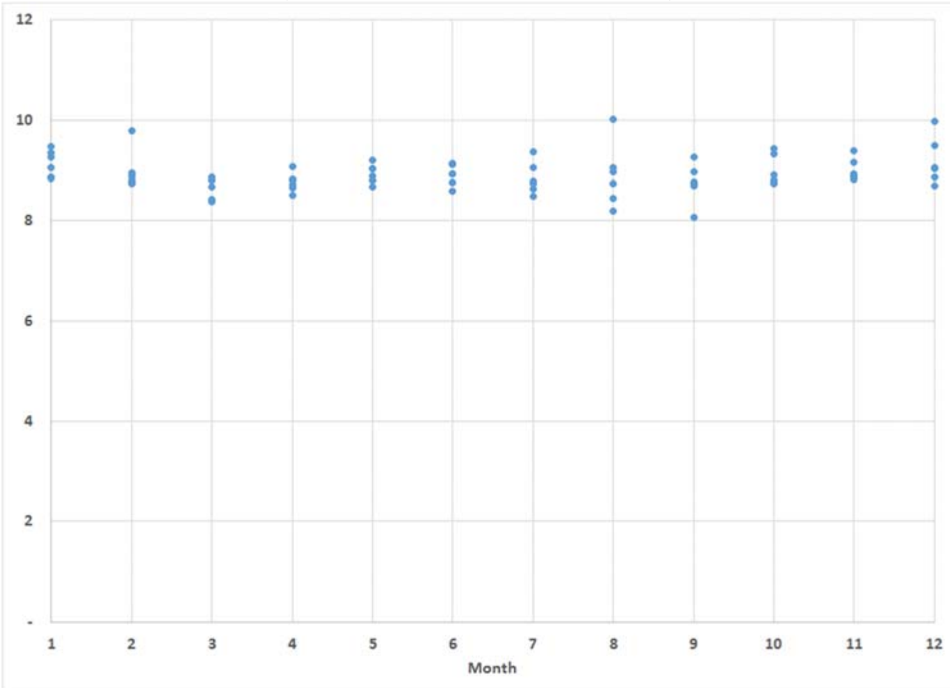
MPEC's low generating efficiency is undoubtedly caused, in part, by low loads. However, it may also be a function of old, worn equipment where maintenance has not been performed per manufacture specifications.

One of the problems that MPEC faces is the range of loads on its system. During the winter months, loads can drop to as low as 30 kilowatts whereas the peak load during the summer is approximately 130 kilowatts. Therefore, a new generator of 150 kilowatts in size could not be operated to meet loads during winter months.

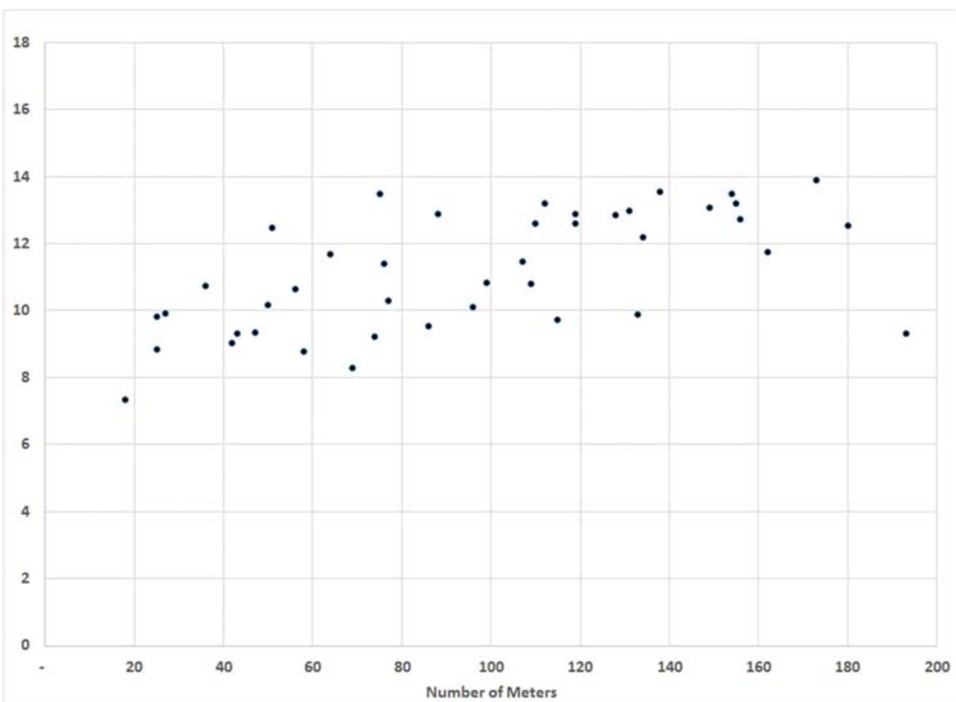
Another problem MPEC now faces is that new generating equipment must now meet Tier IV emission standards, and MPEC's low loads and reliance on diesel limits the options. At this time, MPEC is exploring solar generation coupled with a storage system. The sizing of the solar generation and system storage is critical since it could cause the generating efficiency of the diesel generators to degrade even more during the daylight hours. Furthermore, storage must be of sufficient size so that diesel generation can be shut off completely at night.

The savings in increased generating efficiency are summarized in Table 3 on page 14.

Figure 7
Monthly Generating Efficiency: 2009 - 2014
(Kilowatt-hours Generated / Gallon)



***F*igure 8**
Annual Generating Efficiency – Select Alaska Utilities
(Kilowatt-hours Generated / Gallon)



RATE STRUCTURE

MPEC's rate structure has allowed for a positive cash flow since 2010. However, there are several problems with the rates and expense reporting.

Base Fuel Charge. The present energy charge of $0.3045/kilowatt-hour is to pay for all non-fuel costs plus the first $1.00/gallon of fuel. Any fuel costs over $1.00/gallon are collected through the fuel cost adjustment. If generating efficiency varies, the mixing of units ($/gallon and $/kilowatt-hour) in the base rates can lead to over- or under-collection of fuel expenses.

Suppose for example a utility budgets and sets rates for $100,000 of non-fuel expenses and 250,000 kilowatt-hours of sales. In the example below, a base rate of $0.493/kilowatt-hour is derived using assumptions on losses and generating efficiency.

Rate Setting Assumptions			
Sales		250,000	kWh
Assumed Losses		10%	
Generation		277,778	kWh
Assumed Efficiency		12.0	kWh/gallon
Fuel		23,148	gallons
Base Fuel @ $1.00/gallon	$	23,148	
Rate Derivation			
Non Fuel Budget	$	100,000	
Base Fuel		23,148	
Total Base Rate Budget	$	123,148	
Base Rate	$	0.493	/kWh

Now assume that after the rate is set, losses are actually 12 percent, generating efficiency is 10 kilowatt-hours/gallon, and all other assumptions regarding sales and non-fuel costs were relatively close.

Sales		250,000	kWh
Actual Losses		12%	
Generation		284,091	kWh
Efficiency		10.0	kWh/gallon
Fuel		28,409	
Base Fuel @ $1.00/gallon	$	28,409	

Here, the actual revenues that must be collected in base rates for fuel is $28,409, but the rates were designed to collect $23,148. Thus, there would be a $5,261 shortfall in revenues.

For this reason, inclusion of fuel costs in the base rates should be based on dollars/kilowatt-hour and not dollars/gallon. Better still, all fuel costs should be collected through the fuel cost adjustment. This allows for full transparency, and a ratepayer can quickly see on a bill the amount going for fuel.

Amortization/Depreciation. MPEC incurred a net operating loss in 2009 due in part to an engine overhaul being expensed. Overhauls are typically performed on a multi-year schedule, and MPEC might consider amortizing these and other similar expenses over an appropriate period. While the cash is required in the year performed, amortizing the expense leads to better rate stability if the adequacy of rates are investigated on a frequent basis.

MPEC may also wish to consider including depreciation of existing assets in its expenses and revenue requirements when setting rates. This will allow for providing the necessary capital when replacing or improving existing assets.

If depreciation is not included, MPEC should include a provision for capital improvements in its revenue requirements that will fund repairs and replacements that are not debt funded.

POTENTIAL COST SAVINGS

The potential improvements identified in this report will impact the amount of fuel consumed. Therefore, the financial feasibility will depend not only on the improvement achieved but the future cost of generating fuel and sales. During the 2009 – 2014 period, MPEC's fuel cost ranged from $1.92 - $4.05/gallon, and the cost at the end of 2014 was $3.22/gallon. In the table below, savings are shown for a variety of improvement levels as well as fuel costs. For this analysis, the sensitivity of savings to alternative sales levels has not been tested. Obviously with less sales, the annual savings (in dollars) will decrease. However, the dollars/kilowatt-hour savings will remain the same as that shown in the table.

Table 3
Potential Cost Savings

Sales (kWh)	Losses	Generation (kWh)	Efficiency (kWh gen/ gallon)	Fuel Usage (gallons)	Fuel Cost			Savings from "Base Case"	
					$/gallon	Annual	$/kWh	Annual	$/kWh
		Fuel Cost = $3.00/gallon							
230,000	25.0%	306,667	8.75	35,048	3.00	$105,143	$ 0.457		
230,000	20.0%	287,500	8.75	32,857	3.00	98,571	0.429	$ 6,571	$ 0.029
230,000	25.0%	306,667	10.75	28,527	3.00	85,581	0.372	19,561	0.085
230,000	20.0%	287,500	10.75	26,744	3.00	80,233	0.349	24,910	0.108
		Fuel Cost = $3.25/gallon							
230,000	25.0%	306,667	8.75	35,048	3.25	$113,905	$ 0.495		
230,000	20.0%	287,500	8.75	32,857	3.25	106,786	0.464	$ 7,119	$ 0.031
230,000	25.0%	306,667	10.75	28,527	3.25	92,713	0.403	21,192	0.092
230,000	20.0%	287,500	10.75	26,744	3.25	86,919	0.378	26,986	0.117
		Fuel Cost = $3.50/gallon							
230,000	25.0%	306,667	8.75	35,048	3.50	$122,667	$ 0.533		
230,000	20.0%	287,500	8.75	32,857	3.50	115,000	0.500	$ 7,667	$ 0.033
230,000	25.0%	306,667	10.75	28,527	3.50	99,845	0.434	22,822	0.099
230,000	20.0%	287,500	10.75	26,744	3.50	93,605	0.407	29,062	0.126
		Fuel Cost = $4.00/gallon							
230,000	25.0%	306,667	8.75	35,048	4.00	$140,190	$ 0.610		
230,000	20.0%	287,500	8.75	32,857	4.00	131,429	0.571	$ 8,762	$ 0.038
230,000	25.0%	306,667	10.75	28,527	4.00	114,109	0.496	26,082	0.113
230,000	20.0%	287,500	10.75	26,744	4.00	106,977	0.465	33,214	0.144

Remedies for the high losses and low generating efficiency may be as simple as implementing administrative changes (*i.e.,* metering all customers, etc.). However, it is suspected that some remedies will require expenditures for technical inspections as well as capital improvements.

The question then becomes what level of expenditure can be supported? In the preceding table, increasing generating efficiency from 8.75 to 10.75 kilowatt-hours/gallon at an average fuel cost of $3.50/gallon will result in annual savings of approximately $21,192/year. At an interest rate of 5.5 percent, this would support a 20-year loan of $253,000.

Once specific improvements are defined with costs and targeted improvements, the financial feasibility can then be assessed to show the impact on ratepayers.

GOING FORWARD – RECOMMENDATIONS

This report has been based on a review of certain documents and spreadsheets provided by the Island Institute regarding MPEC operations. Personal discussions with MPEC personnel or a site visit have not been conducted. Consequently, the observations made and discussed in this report may be easily explained by some unknown factor. Furthermore, the following recommendations are made at a relatively high level and can be refined as investigations continue.

1. Investigate the cause of losses. This review may be best started by MPEC personnel simply reviewing the possible causes listed in this report and identifying those that can be remedied administratively. If these do not reduce losses to an acceptable level, then an on-site inspection by technical consultants should be conducted.
2. Continue with its investigations of PV and storage. However, the MPEC system should be modeled with hourly loads to better assess expected overall generating efficiency. With this and capital and operating cost estimates, the impact on rates can be assessed.
3. Rates should be modified to have all fuel costs collected in the fuel cost adjustment instead of part being collected in the base energy charge.
4. Set rates to collect amounts for on-going capital improvements not funded with debt. This may require MPEC personnel to develop a five-year capital improvement plan which identifies improvements that must be accomplished and their respective costs. A rates program is now being established to assist MPEC with this recommendation.
5. Ensure that its tariffs include adequate penalties to discourage seasonal customers from disconnecting in the winter and re-connecting in the summer. Simply enacting a tariff that imposes the avoided monthly customer charges if re-connected within 12 months from the disconnection works well with other utilities with significant seasonal customers.

With the reduction in prices of solar and other types of alternative generation, "roof-top" generation installed by customers has increased dramatically over the past several years. In many places, net metering has been imposed by regulatory commissions where the customer "banks" excess generation with the utility and uses it later. While this is not an issue for large utilities, it can have significant impacts on rates for small utilities such as MPEC.

Take, for example, an extreme case where a customer installs a PV system that generates 750 kilowatt-hours during the month. Further assume that the customer uses 750 kilowatt-hours per month, but much of that is during the evening hours when the PV system is not generating. With net metering, the customer would pay only the monthly customer charge and nothing else, even though the utility must provide energy to the meter during certain hours.

To most ratepayers not familiar with utility cost structures, this does not appear to be all that bad. But utility costs, including MPEC, are for the most part fixed in nature. The only truly variable costs are fuel and perhaps some lube oil and maintenance costs if generators can actually be shut down due to the alternative generation. These fixed costs must now be spread over fewer sales, and the remaining customers end up "picking up the bill." Just the loss of four customers could add approximately $0.01/kilowatt-hour to the bills of the remaining customers.

Again, the increase to other ratepayers if negligible on large systems, but it can quickly have an impact on small systems such as MPEC. Therefore, it is recommended that MPEC enact tariff provisions (if it has not already done so) to protect all ratepayers. Net metering should not be implemented, and excess generation should be sold to the utility at the utility's avoided fuel cost.

MONHEGAN PLANTATION POWER DISTRICT

OVERVIEW AND SYSTEM DESCRIPTION

INTRODUCTION

Monhegan Plantation Power District ("MPPD") is a municipal electric utility providing service to the businesses and residents of Monhegan Island, a small, 500+-acre island approximately ten miles from Port Clyde, Maine. Approximately 65 - 70 people live on Monhegan Island year round with the summer population increasing to approximately 250.

Transportation to Monhegan Island is limited. Access to the island is via scheduled boat services that run several times a day during the summer but very limited during the winter. The island is electrically isolated from the mainland.

MPPD CUSTOMERS AND ENERGY SALES

Data regarding the number of MPPD customers is not available. Energy sales for 2010 – 2014 are summarized in Figures 9 and 10.

Figure 9
Annual Energy Sales
(kilowatt-hours)

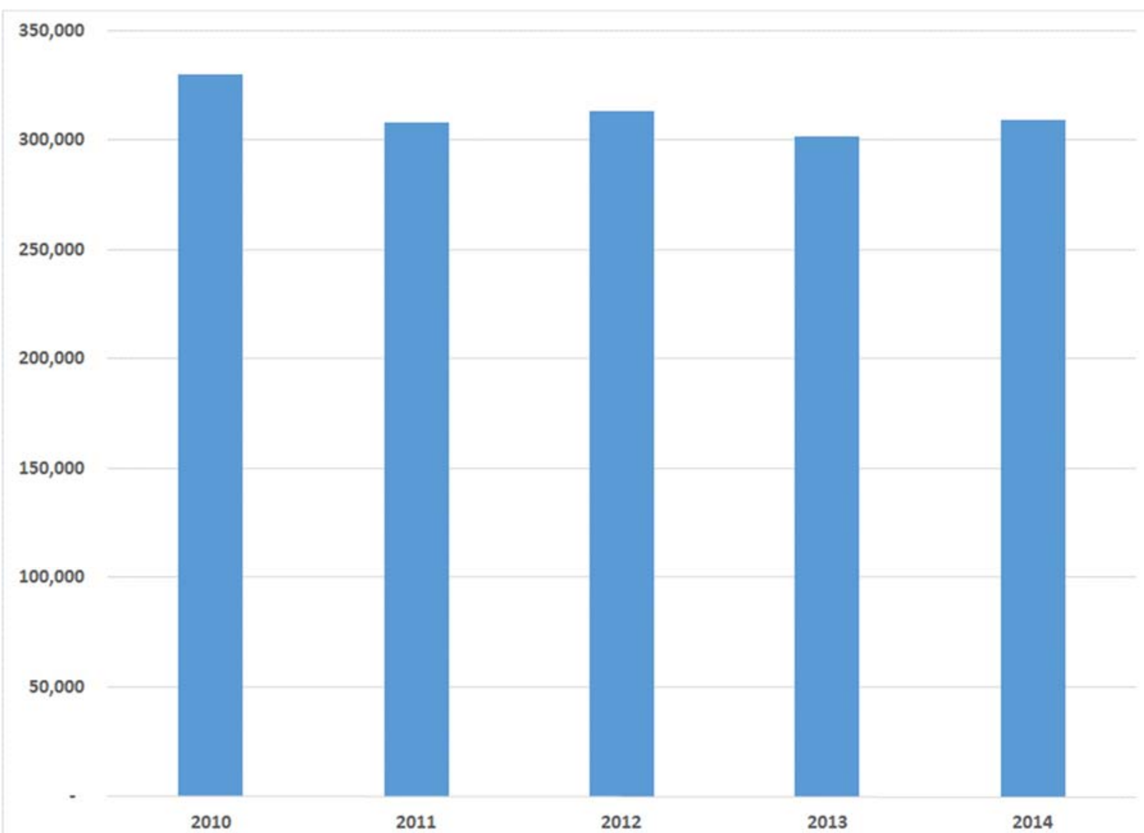
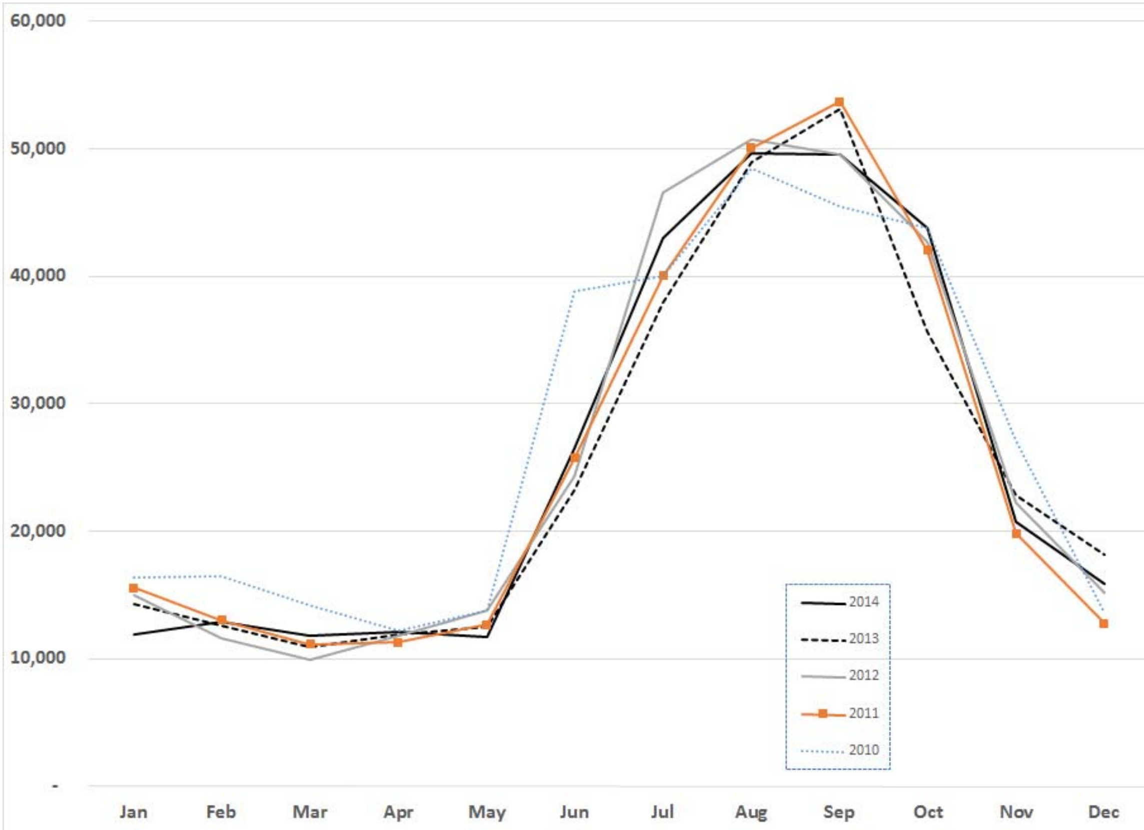


Figure 10
Monthly Energy Sales
(kilowatt-hours)



MPPD's sales decreased between 2010 and 2011 but have remained relatively constant since then. On a monthly basis, sales are very seasonal with nearly 70 percent consumed during the June – October period.

MPPD GENERATING EFFICIENCY

Since MPPD is electrically isolated from the mainland grid, it must rely exclusively on its own generation to meet power requirements. Currently, diesel generation is the sole source of power.

Generating fuel is not reported on an "as-used" basis but rather the quantity purchased. Thus, monthly and annual fuel efficiencies can only be estimated, although annual efficiency should be relatively close to actual, especially if multi-year periods are used. Gross generation is not reported, and therefore generating efficiency must be investigated on a kilowatt-hours (sold)/gallon basis.

Since gross generation is not available, system losses cannot be calculated.

MPPD's generating efficiency appears to be in the 9.5 – 11 kilowatt-hours (sold)/gallon range, and it is suspected that the summer efficiency is higher.

Table 4
Annual Generating Efficiency
(Kilowatt-hours (sold) / Gallon)

	2010	2011	2012	2013	2014
Kilowatt-hour Sales (kWh)	330,186	307,778	313,221	301,967	309,479
Gallons of Fuel Purchased	31,088	32,338	31,290	27,592	31,200
kWh (sold)/gallon	10.62	9.52	10.01	10.94	9.92

RATES AND COST STRUCTURE

Based on the information provided, it appears MPPD charges a flat $0.70/kilowatt-hour without a fixed monthly customer charge. Further, the rate does not appear to fluctuate with the price of fuel.

Net income and net cash flows were provided by MPPD, and from this, expenses can be estimated. In the following table, Revenues from Sales is equal to the reported annual energy sales (in kilowatt-hours) multiplied by the energy rate of $0.70/kilowatt-hour. Net Income is that provided by MPPD. Fuel expenses represent the estimated cost of the fuel purchases and not the amount that would be expenses on an accrual basis. Nevertheless, it should be relatively close on an annual basis. For 2010 – 2012, net cash flow includes the effect of depreciation expenses but not for the later years. It is also noted that net Cash Flow includes transfers to and from a line of credit.

Table 5
Financial Operations

	2010	2011	2012	2013	2014
Revenues from Sales	$ 231,130	$ 215,445	$ 219,255	$ 211,377	$ 216,635
Less Net Income	59,555	(5,123)	27,939	39,318	3,809
Expenses	$ 171,575	$ 220,568	$ 191,316	$ 172,059	$ 212,826
Less Fuel Costs	84,337	114,157	113,203	100,208	107,952
Non Fuel Expenses	$ 87,239	$ 106,411	$ 78,113	$ 71,851	$ 104,874
Net Cash Flow	$ 6,868	$ (15,733)	$ 26,720	$ (6,589)	$ (5,173)
$/kWh					
Fuel	$ 0.255	$ 0.371	$ 0.361	$ 0.332	$ 0.349
Non-Fuel	$ 0.264	$ 0.346	$ 0.249	$ 0.238	$ 0.339

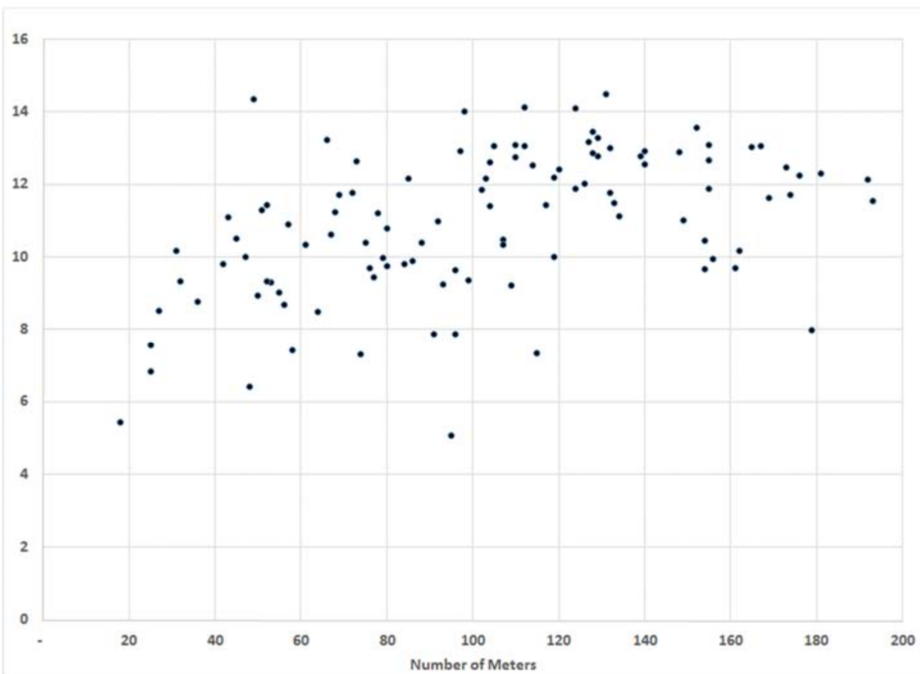
OBSERVATIONS

GENERATING EFFICIENCY

Generating efficiency was estimated to be in the 9.5 – 11 kilowatt-hours (sold)/gallon range and is thought to be somewhat seasonal with a higher efficiency in the summer and lower in the winter. Since efficiency is measured using energy sales, levels will be less than that if measured using gross generation (prior to losses).

A sampling of generating efficiency achieved by small Alaska utilities that rely exclusively on diesel generation is shown in the following figure. MPPD's level is well within the range to be expected. Because of this, it is suspected that MPPD's losses are also within the range to be expected.

Figure 11
Annual Generating Efficiency – Select Alaska Utilities
(Kilowatt-hours Sold / Gallon)



RATE STRUCTURE

Simply put, a utility's rates must provide for adequate net cash flow over a multi-year period. The term "adequate" is somewhat relative, but in general adequacy should be measured by:

1. Provide for operating and non-operating expenses that are cash in nature on an on-going basis.
2. Provide for principal payments on long-term and short-term debt.
3. Provide for a capital replacement program to pay for on-going capital expenditures that are not debt funded.

There is always an inherent inaccuracy in projections of budgets and sales, and cash surpluses on hand should be adequate to provide for the above-mentioned items if expenses are higher or sales are lower than expected. This, in turn, will provide for better access to debt.

MPPD's current rate structure of $0.70/kilowatt-hour for all costs does not do this. Net cash flow during 2010 – 2014 was negative in three of those five years. Several changes to rates are recommended.

Base Fuel Charge. Fuel costs have and will vary on a monthly basis. Consequently, utilities typically recover all or part of their fuel and purchased power costs via a separate fuel cost adjustment ("FCA") charge that is separate from the base energy charge. In recent years, the utilities have transitioned toward including all the fuel costs in the FCA to allow the ratepayer to better understand the nature of the costs.

In order to provide some rate stability, FCA's are set using projections of costs and efficiencies over a multi-month period (quarterly or semi-annual). During the period, a balancing account is set up to track actual expenditures versus projected, and the over (under) collection is subtracted from (added to) the rate established the next period.

It is therefore recommended that MPPD modify its rates to recover all fuel costs via an FCA.

Rate Structure. With the exception of fuel, most costs of a utility generating its own power are fixed and do not depend on sales. Certain generating expenses, such as lube oil and overhaul costs, depend to some extent on sales; but these, too, may have a portion that are fixed in nature. Utilities, therefore, establish rate structures that include a fixed charge per month regardless of the energy usage (the customer charge) with the remaining costs recovered through a base energy charge and the FCA. (Large customers are sometimes assessed a demand charge based on their peak usage during a month, but this is ignored for MPPD.)

It is beyond the scope of this project to provide a complete overview of rate making and the classification of costs; but of these fixed costs, some can be considered customer-related with others being demand-related (those attributable to the monthly or annual peak demand). Regulatory commissions generally do not allow costs other than that classified as customer-related to be recovered through the customer charge.

It is strongly recommended that MPPD modify its rate structure to include both a fixed customer charge (in dollars/month), a base energy charge (in dollars/kilowatt-hour), and an FCA as previously described. The fixed customer charge will help cash flows during the winter months as well as provide revenue stability for MPPD and rate stability for its ratepayers. The calculation of MPPD's customer-related costs is well beyond the scope of this analysis, and it is recommended that its customer charge be set commensurate with that of Matinicus or other nearby small utilities. Once the customer charge is established, the base energy charge can then be set commensurate with expected customer charge revenues, non-fuel expenses, and other cash requirements.

Since sales are very seasonal, MPPD may have a number of accounts that use very minimal amounts of power during the winter months. Inclusion of a fixed customer charge may cause these customers to disconnect from the system during the winter and re-connect during the summer. This defeats the purpose of the fixed customer charge, and utilities generally set tariffs so that any customer re-connecting within a 12-month period must pay the customer charge avoided during the time of disconnect.

Although rates are generally set for the entire year (with the exception of the FCA), MPPD may wish to investigate the implementation of a seasonal rate where rates are lower during the winter and higher during the summer. Monthly cash flows must be considered, but a seasonal rate such as this can help residents that live the entire year on the island (although to the detriment of summer residents).

Revenue Requirements. As discussed previously, revenue requirements used in setting rates should include expenses as well as provisions for on-going capital expenditures and a margin to build up cash reserves in the event expenses are greater than expected or sales less than expected. In order to better access lending markets for system improvements, MPPD must set its rates accordingly. It is recommended that an annual or a two-year budget be established with rates set around the budget.

GOING FORWARD – RECOMMENDATIONS

This report has been based on a review of limited data and spreadsheets provided by the Island Institute regarding MPPD operations. Personal discussions with MPPD personnel or a site visit have not been conducted.

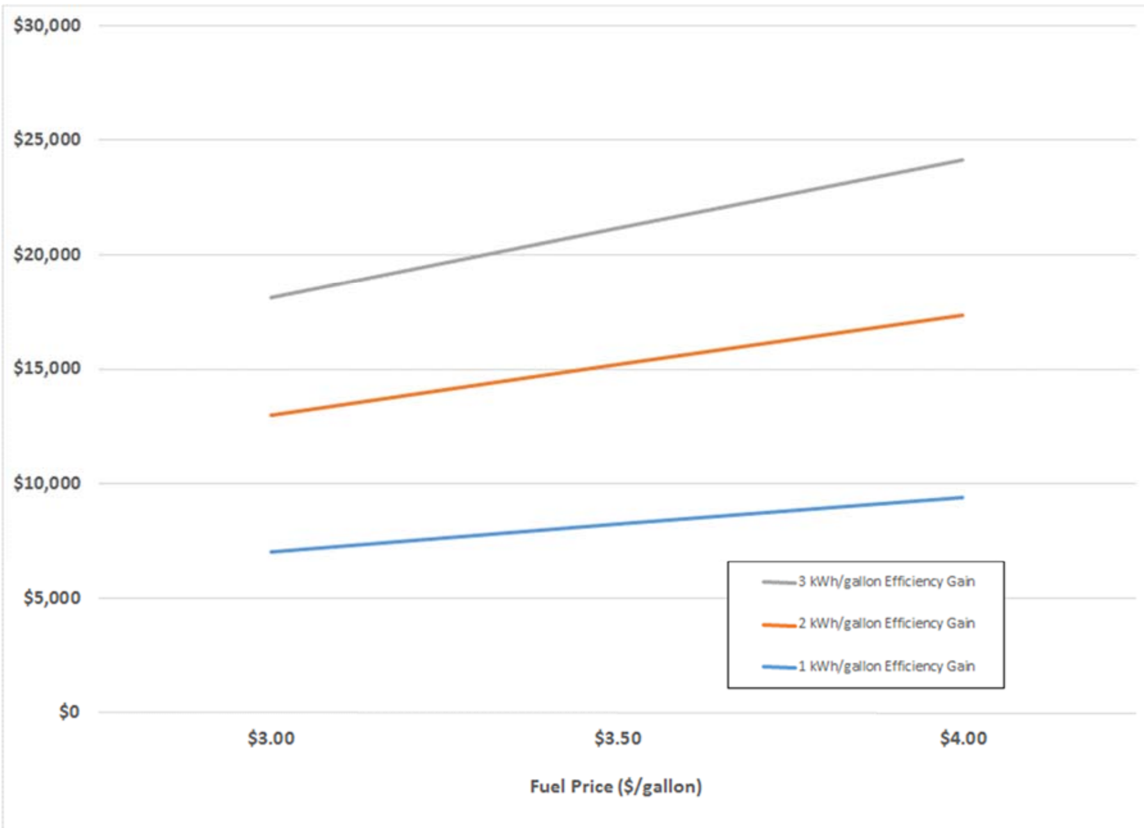
1. Set rates to include a Fuel Cost Adjustment. Simply including fuel costs in a base energy charge poses too much risk for a small utility such as MPPD. The FCA can be forward looking but should include a Balancing Account to allow for over- and under-collections.
2. Set rates to include a fixed monthly customer charge. The rate might be, but does not have to, close to the Matinicus customer charge or that of nearby small utilities. The inclusion of a fixed monthly charge will help with cash flow during the winter months. (See Attachment 1 for a sampling of small utility rates in Maine.)
3. Ensure that the tariff includes provisions for re-connect fees are adequate to keep summer customers from disconnecting during the winter.
4. Set rates to collect amounts for on-going operations as well as capital improvements not funded with debt. This may require MPPD personnel to develop a five-year capital improvement plan which identifies improvements that must be accomplished and their respective costs.
5. Ensure that its tariffs include adequate penalties to discourage seasonal customers from disconnecting in the winter and re-connecting in the summer. Simply enacting a tariff that imposes the avoided monthly customer charges if re-connected within 12 months from the disconnection works well with other utilities with significant seasonal customers.

With the reduction in prices of solar and other types of alternative generation, "roof-top" generation installed by customers has increased dramatically over the past several years. In many places, net metering has been imposed by regulatory commissions where the customer "banks" excess generation with the utility and uses it later. While this is not an issue for large utilities, it can have significant impacts on rates for small utilities such as MPPD.

Similar to Matinicus, it is estimated that the loss of merely four customers to self generation would increase the rate to others by approximately $0.01/kilowatt-hour.

MPPD is now investigating the merits of micro-turbines. Since generating efficiency of existing resources are in the range of expectations, the inclusion of micro-turbines must be modeled with hourly load data to adequately assess the expected gains in efficiency. Savings in fuel costs will be dependent on the efficiency gains as well as the cost of fuel. The table on the following page provides a summary of the annual savings for a range of efficiencies and fuel costs. *It is important to note that generating efficiencies are stated by the manufacture in kilowatt-hours (<u>generated</u>)/gallon, and not based on kilowatt-hours (<u>sold</u>). Therefore, the efficiencies stated for MPPD in this report should be <u>increased</u> by 8 – 10 percent to account for measurements prior to station use and losses.*

Figure 12
Annual Fuel Savings
(Base = 11 kWh/gallon; 310,000 kWh sales/year)



ATTACHMENT 1

Maine Island Utility Delivery Rates

	Customer Charge $/month	Delivery Charge $/kWh	
Fox Islands (Residential Rate)			
Year Round Customers	15.00	0.12911	
Peak Season Customers	40.00	0.07116	
Isle Au Haut	16.00	0.32000	
Matinicus	25.00	0.30450	Includes first $1.00/gallon of fuel costs
Monhegan	-	0.70000	Includes all fuel costs
Swans Island	46.48	0.12343	
Swans Island Frenchboro	48.26	0.15917	