Ricardo J. Bordallo Governor's Complex - Adelup Energy Audit

9/7/2012

Investment Grade Assessment for the Ricardo J. Bordallo Governor's Complex - Adelup

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EXECUTIVE SUMMARY

A detailed energy audit and analysis was completed for the Ricardo J. Bordallo Governor's Complex - Adelup (RJBGOVT) to provide opportunities for energy conservation and savings for appropriate Energy Conservation Measures (ECMs). The results of the analysis and input provide substantial savings and are summarized in the following table:

TABLE 1 – AUDIT RESULTS SUMMARY

Ricardo J. Bordallo Governor's Complex - Adelup Project Summary			
ECM Description	**Annual Savings ($)**	**Project Price ($M)**	**Simple Payback (yrs)**
Lighting Retrofit	$ 10,969.89	$ 253,543.70	23.1
Mechanical Retrofit	$ 42,636.87	$ 624,039.00	14.6
Architectural Retrofit	$ 4,966.09	$ 480,060.00	96.7
Plumbing Retrofit	$ 4,346.77	$ 27,865.00	6.4
Total Project Pricing	$ 62,919.62	$ 1,385,507.70	22.0

The table above shows that the proposed appropriate Priority Level projects will yield a savings of about $63,000 per year and will have about a 22 year payback. The following table summarizes the utility impacts for the proposed appropriate Priority Level measures:

TABLE 2 – UTILITY SUMMARY

Summary of Utility Savings	
Description	**Value**
Current Annual Consumption (KWH)	733,400
Post Retrofit Consumption (KWH)	520,710
% Savings	29%
Current Annual Consumption (Kgal)	1,746
Post Retrofit Consumption (Kgal)	1,471
% Savings	16%
Current Total Annual Cost	$ 226,867
Post Retrofit Annual Cost	$ 163,947
% Cost Savings	28%

This shows that the implementation of the measures will result in a 29% decrease in energy consumption, a 16% decrease in water consumption, and an overall 28% decrease in cost. It should be noted that the cost reduction is based on the blended energy cost approach and may not be reflective of actual cost reductions. Also the cost reduction shown is based on the utility data provided and does not account for other rate modifications that are not included in the data used for the analysis or future rate increases.

ENERGY AUDIT METHODOLOGY

For any energy audit, there must be a specific methodology used that incorporates standard recognized engineering methods and calculations. For this facility, the approach was developed to ensure the savings calculations were reflective of the proposed improvements. This approach was followed to ensure the savings estimates included in Table 1 – Audit Results Summary are as accurate as possible. The following sections cover the methodologies used for this audit.

Lighting

Lighting is typically a primary driver for energy retrofit projects. With this facility, the existing lighting system is made up of a variety of typical fluorescent interior lighting. For purposes of establishing the base load and post-retrofit values, a detailed lighting audit approach was utilized. This method uses a line-by-line audit for each facility with an estimated value for operating hours per fixture as an input to the existing baseline for energy consumption. The post-retrofit conditions are based on utilizing the manufacturer data for the proposed fixture with the same operating hours. Moreover, any occupancy sensor additions are evaluated based on a "typical" reduction in operating hours. As noted further in this report, all values for operating hours and savings with sensors are "stipulated" for purposes of the energy calculations.

Lighting for this audit was the first savings input. Since all measures inside facilities have "interactive" effects (effects on other systems and energy consumption), each and every proposed ECM must be run in a specific order so that the interactive effects are considered between measures. For example, interior lighting fixtures give off a certain amount of heat to the space – this heat must be removed during cooling conditions. With the proposed retrofit there is less heating load, therefore the HVAC (Heating Ventilation and Air Conditioning) system will consume less energy after the retrofit. This is the "interactive" effect between lighting and HVAC and must be accounted for in any audit.

Remaining Measures (HVAC/Envelope Improvements)

With the above inputs to the savings stream from spreadsheet calculations, the remaining measures for analysis include:

- HVAC System Improvements
    - High Efficiency Unit Replacement
    - Temperature Reset
    - Controls
- Building Envelope Improvements
    - Roof Coating
    - Window Film
    - Energy Saving Appliances

These are much more difficult to "estimate" using basic calculation methods. For this audit the methodology used a calibrated BIN methodology approach. The energy savings appliance savings were based on Department of Energy (DOE) recommendations for proposed replacement appliances in terms of annual energy savings in KWH.

- Water System Improvements
    - New low flow urinals, water closets, and lavatories
    - Flow restrictors for faucets
    - New low flow shower heads

For the water savings a similar approach to the lighting system savings estimates was utilized. A detailed audit was provided outlining the appropriate fixtures for replacement. A spreadsheet was developed to analyze current consumption and proposed consumption with replacement or retrofit fixtures. The analysis also included an assessment of the "baseline" consumption against billing data to ensure the calculations were conservative.

BIN Modeling

A standard method of establishing baseline and savings conditions for HVAC and Building Envelope measures is to utilize a BIN model. The BIN methodology uses a "normalized" temperature file available from a variety of sources. These temperatures are in "bins" of 5-degree increments. Both the wet bulb and dry bulb temperatures are contained in the appropriate files. The inputs to the BIN analysis include an estimate of the existing building envelope (walls, roof, doors, windows), the existing internal loads (lighting and end-use), and the existing HVAC system inputs (type, efficiency, schedule, and temperature settings). For this methodology, the BIN analysis produces a reasonable result, provided:

- The model must be calibrated to utility data
- The model must be calibrated to the lighting audit

The building was calibrated based on the IPMVP (International Performance Measurement and Verification Protocol) which required Mean Bias Error (MBE) and Coefficient of Variance (COV) on an annual consumption (kWh) basis. Once the model was calibrated to the utility data and existing lighting loads, the following sequence was run to establish not only the proposed ECM savings, but also to ensure interactive effects were considered:

1. Lighting Retrofit (model recalibrated to new lighting audit results)
2. HVAC System Improvements
3. Building Envelope Improvements

Noted herein, these are all interactive with the HVAC system and modification or change in the recommended and included ECMs herein affect the savings for each and every other measure. So if any recommendations are changed, each model savings run must be recalibrated and rerun to determine accurate projections for savings.

ENERGY AUDIT PROCESS

In order to arrive at meaningful results, a detailed process was followed, which ensures that the data input represented accurate information necessary for the analysis tools utilized. This process can be summarized in the following steps:

1. Data Acquisition: The necessary input data was obtained over a period of time from a variety of source including consulting firms, personnel input and provided information, drawings or other available documentation, and field assessment of a variety of components and systems. In addition utility data was acquired for approximately two years for the facility.
2. Data Assessment: Once acquired, the data was assessed and reviewed. This is a critical step to ensure that the data collection process is complete and comprehensive. This step also provides a basis for looking at necessary adjustments to data analysis based on existing field assessment conditions.
3. Data Analysis: Probably the most intensive portion is the entire analysis for each facility. This process is broken down further herein, but provides a defendable basis for each of the ECMs considered.
4. Project Assessment: Inputting project cost as well as overall project economic criteria is another critical step. For this audit, this process included obtaining firm pricing, assessment of necessary savings goals and objectives, and assessing overall program goals (such as total available funding).
5. Project Review: Another critical step is the review process. Because as detailed herein any change in selected measures affects all the analysis, it is important that the review process clearly state the recommended measures. For this audit all recommended ECMs are included as detailed in the order of input. Modifications or changes in any one measure may severely affect the energy savings for other measures.
6. Project Roll Up: This step provides a summary by measure and a total summary for the facility.

The conclusion of the audit is the report and subsequent implementation of strategies, intended to provide the necessary savings for the project as summarized herein. The information in this report provides Ricardo J. Bordallo Governor's Complex - Adelup the tools and inputs necessary to achieve the savings as outlined.

FACILITIES COVERED

This audit covers the Ricardo J. Bordallo Governor's Complex - Adelup. The facility is approximately 39,500 square feet in total area and is used for a variety of governmental operation functions.

PERSISTENCE OF SAVINGS

Table 1 – Audit Results Summary shows the expected savings from implementation of recommended ECMs. However, persistence of these savings is an important consideration. Persistence is the ability of the project to maintain the savings stream over a period of time. Since this project shows roughly a 22-year payback, it is very important that the savings be maintained over a minimum 22-year period. In many instances, projects include new equipment and settings but are not maintained over the life of the project. Studies have shown that as much as half of the savings can be lost without diligence in understanding and maintaining energy awareness throughout the affected facilities. For these recommendations, the following list details some of these critical considerations:

- Proper installation and application. As part of the overall implementation, it is recommended that Ricardo J. Bordallo Governor's Complex - Adelup utilize a third-party commissioning process to ensure the equipment is installed and set to proper operating conditions to achieve the energy savings.
- Equipment maintenance. Application of the manufacturer recommendations for any and all equipment installed is required to maintain savings. This includes routine maintenance and changing all appropriate filters to ensure the savings can be maintained.
- Proper long-term operation. Without maintenance of the temperature and schedule recommendations, savings will be reduced over time. This is usually a very critical item and especially for this project, since the recommendations are primarily for programmable thermostats. Several studies have indicated that programmable thermostats, when not maintained properly, are subject to loss of more than 50% of the energy savings over time.
- Measurement and Verification. Included in this report is recommended practices recognized by the IPMVP documentation as necessary Measurement and Verification (M&V) for the proposed measures. The persistence of savings should include addressing long-term verification of each and every proposed ECM. Also, it is highly recommended that all M&V be conducted by a Certified Measurement and Verification Professional (CMVP).

UTILITY ANALYSIS AND RATES

For this audit, utility analysis was completed for the facility based on data provided. The Guam Power Authority provides electric services to all facilities included herein, and the Guam Water Authority provides the water/sewer billing. This data was analyzed along with appropriate rate schedules to determine the best method of analysis for all ECMs. Because the current rates are a "tiered" structure where the rates vary with a variety of variable inputs, it was determined the most effective way to convert from unit savings to dollar savings was to utilize a "blended rate" approach. Based on the analysis, the average rate for all accounts covered under this audit was determined to be:

- $0.2797/KWH for electric consumption.
- $12.43/1000 gallons for water/sewer based on consumption.

Escalation was not included for analysis herein. This audit recognizes the "simple payback" method for economic analysis which only looks at project cost and annual savings. Based on this decision-making tool, introducing rate escalation is not necessary. This is the approach typically applied when the project is cash-funded.

Electric Utility Summary

The following summarize the electric utility analysis completed for this facility:

TABLE 3 – ELECTRIC UTILITY ANALYSIS DETAIL

Month	Avg KWH/Day	Days	KWH	KW	$
J	1,932.26	31	59,900	170	$ 15,273.80
F	2,053.57	28	57,500	159	$ 15,757.42
M	2,016.13	31	62,500	176	$ 17,888.51
A	2,170.00	30	65,100	186	$ 18,244.17
M	2,139.35	31	66,320	182	$ 18,508.27
J	2,130.32	30	63,910	178	$ 17,974.65
J	2,044.25	31	63,372	179	$ 18,926.06
A	2,006.99	31	62,217	175	$ 16,702.80
S	1,906.56	30	57,197	172	$ 16,948.42
O	1,904.52	31	59,040	170	$ 15,822.50
N	1,964.84	30	58,945	163	$ 16,777.56
D	1,851.61	31	57,400	159	$ 16,328.20
Totals		**365**	**733,400**	**186**	**$ 205,152.36**
Average $/KWH	$ 0.2797				

FIGURE 1 – RICARDO J. BORDALLO GOVERNOR'S COMPLEX - ADELUP ENERGY USAGE

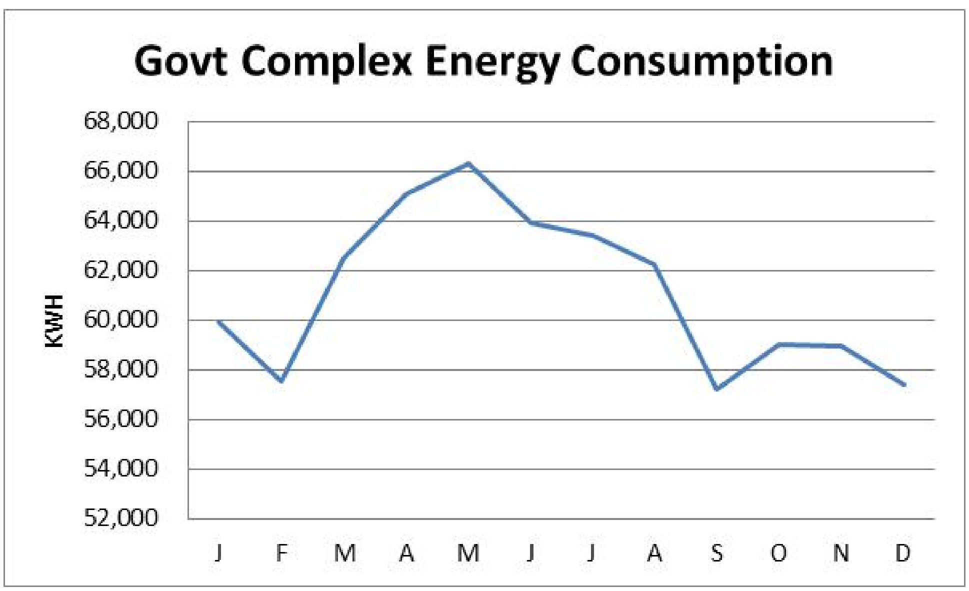
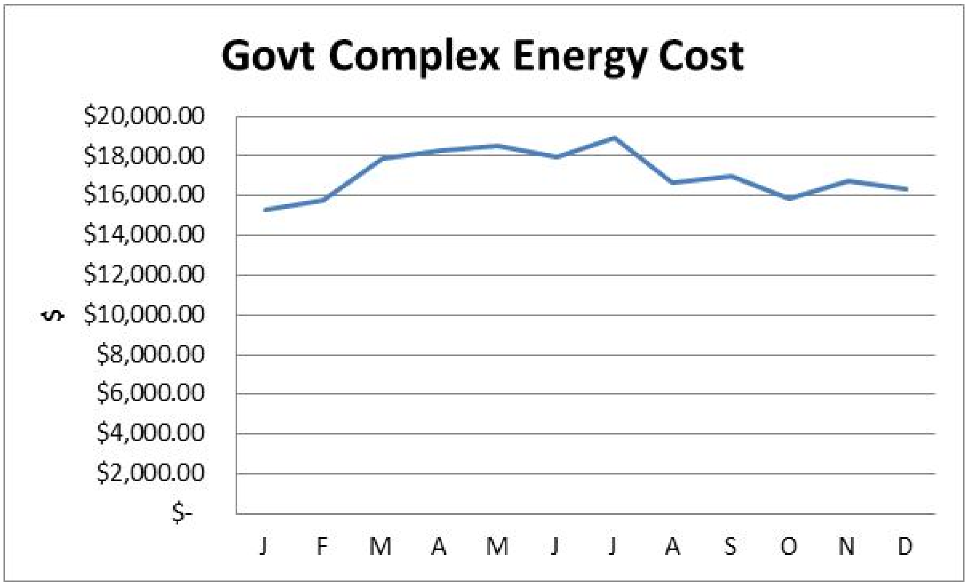


FIGURE 2 – RICARDO J. BORDALLO GOVERNOR'S COMPLEX - ADELUP ELECTRIC COST



Water Utility Summary

The following summarizes the water utility analysis completed for this facility.

TABLE 4 – WATER UTILITY ANALYSIS DETAIL

Month	Avg Kgal/day	Days	Kgal		$
J	6.97	31	216		2,570.93
F	9.26	28	259		3,337.13
M	12.25	31	380		4,785.75
A	6.28	30	189		2,283.50
M	2.91	31	90		1,092.91
J	3.47	30	104		1,285.03
J	4.18	31	130		1,624.10
A	6.23	31	193		2,235.40
S	1.61	30	48		714.00
O	1.34	31	42		534.25
N	1.41	30	42		550.37
D	1.74	31	54		701.07
Totals		**365**	**1,746**		**$ 21,714.41**

FIGURE 3 – RICARDO J. BORDALLO GOVERNOR'S COMPLEX - ADELUP WATER CONSUMPTION

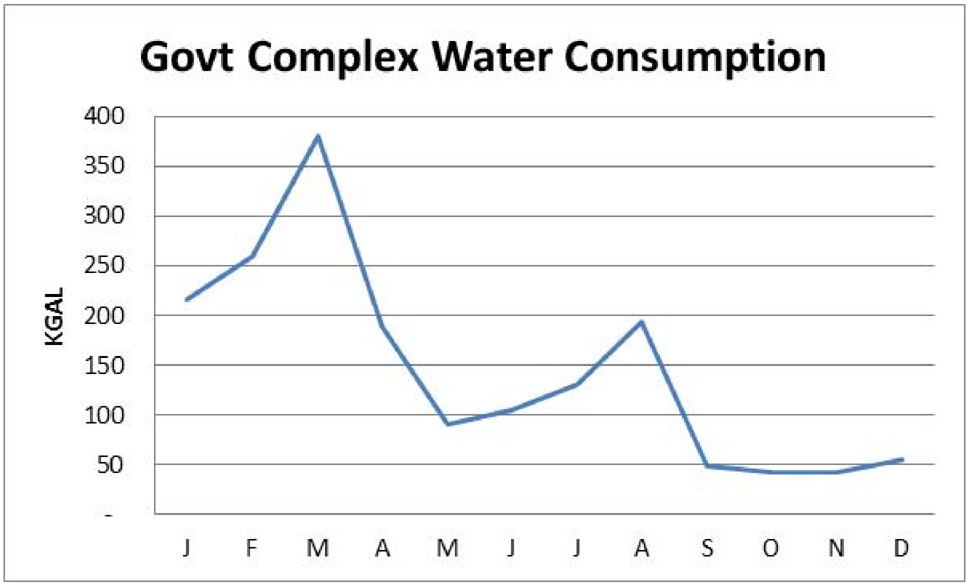
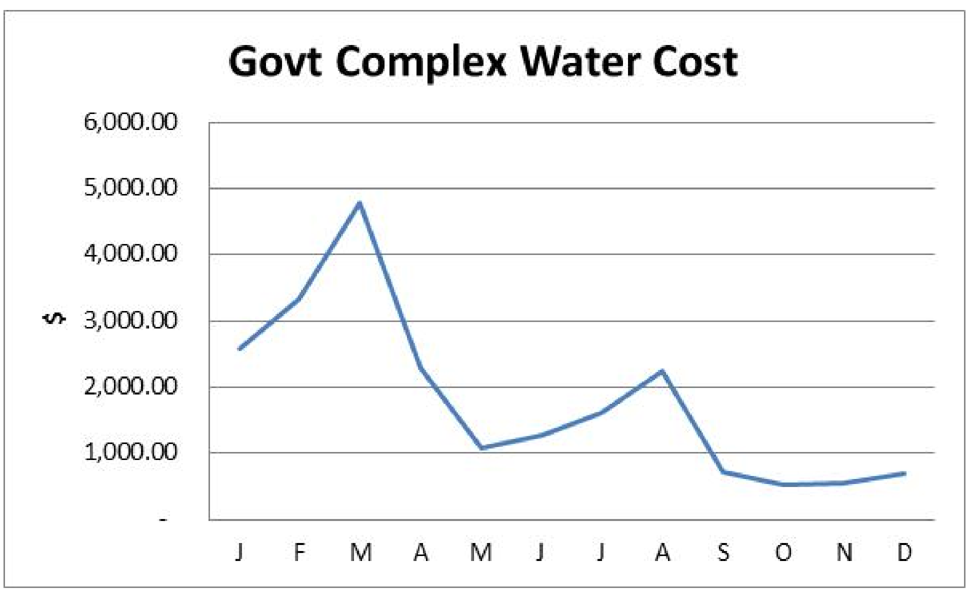


FIGURE 4 – RICARDO J. BORDALLO GOVERNOR'S COMPLEX - ADELUP WATER COST



ANALYSIS DETAILS

This section of the report identifies the results in more detail and provides the overall methodology used, specific to the department in question.

ECM Matrix

For this audit, the following ECM matrix provides a summary of the selected/recommended measures by facility.

TABLE 5 – ECM MATRIX

ECM Measure	Description
Lighting and Lighting Controls	Install more efficient lighting using 28 watt T-8 lamps wherever possible. Install appropriate LED exit signs and new CFL fixtures/lamps where identified.
Mechanical System Improvements	Install high efficiency units to replace existing units. Ensure appropriate operation by setting temperatures to appropriate identified levels, and setting schedules to conform with appropriate energy savings strategies. Energy Efficient Appliance Replacement where recommended.
Architectural System Improvements	Install reflective roof coating as identified. Install window film as identified.
Water Retrofit	Install or retrofit fixtures for low flow. This includes urinals, water closets, and lavatories. Install new low flow shower heads. Install flow restriction devices (aerators) at faucet locations.

Methodology of Analysis

As noted herein, the lighting was completed with a detailed audit and then used as a tool for calibration of the BIN model. The model results were used for all savings as these include all interactive effects.

- A calibrated BIN model was established.
- All proposed ECMs were run in indicated order after calibration of the baseline model (water not included)
- Savings were then calculated using the model and previous runs.
- Savings were converted to dollars using the utility analysis average rate.
- Water spreadsheet used for water savings and identified project electrical savings.

BIN Model Calibration

The BIN method was used for this facility. The following table summarizes the calibration of this model to the utility data.

TABLE 6 – BIN MODEL CALIBRATION RESULTS

Month	Bin Analysis KWH	Utility KWH	MBE	RSME Month	A Month	COV
J	50,560	59,900	16%	0.01	0.08	16%
F	44,871	57,500	22%	0.02	0.08	22%
M	53,466	62,500	14%	0.01	0.09	14%
A	52,660	65,100	19%	0.02	0.09	19%
M	58,337	66,320	12%	0.01	0.09	12%
J	59,807	63,910	6%	0.01	0.09	6%
J	62,468	63,372	1%	0.00	0.09	1%
A	64,627	62,217	-4%	0.00	0.08	4%
S	62,429	57,197	-9%	0.01	0.08	9%
O	61,921	59,040	-5%	0.00	0.08	5%
N	55,673	58,945	6%	0.00	0.08	6%
D	52,894	57,400	8%	0.01	0.08	8%
Total	679,713	733,400	7%	0.07	1.00	7%

	MBE:	Mean Bias Error -- IPMVP Allows 20% MBE
	RSME	Root Square Mean Error Per Month
	A Month	Average monthly utility contribution
	COV	Coeficient of Variance -- IPMVP Allows 20% COV
	Error	Lighting Error -- Must maintain below 20% between Audit and BIN

Lighting Load -- No End Use:		259,515
Lighting Audit		274,854
MBE		6%

The IPMVP requirements are a 20% MBE and 20% COV. This model calibrates very well to the utility data and calibrates within IPMVP requirements to the lighting audit data.

Results

The BIN model was then run to determine each ECM's savings in kWh. The first run (lighting) was recalibrated to match the lighting audit savings, then the other runs were completed. The following table provides the summary output for this facility. The full BIN analysis is included in the Technical Appendix.

TABLE 7 – SAVINGS SUMMARY FROM BIN ANALYSIS

- Lighting Measure

Measure Savings										
	Lighting		End Use		HVAC		Fans		Total	
Month	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH)	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH
J	4.35	3,232.68	-	-	0.13	94.83	-	-	4.48	3,327.51
F	4.35	2,919.84	-	-	0.13	79.54	-	-	4.48	2,999.38
M	4.35	3,232.68	-	-	0.13	96.44	-	-	4.48	3,329.12
A	4.35	3,128.40	-	-	0.13	96.67	-	-	4.48	3,225.07
M	4.35	3,232.68	-	-	0.13	100.27	-	-	4.48	3,332.95
J	4.35	3,128.40	-	-	0.13	97.04	-	-	4.48	3,225.44
J	4.35	3,232.68	-	-	0.13	100.27	-	-	4.48	3,332.95
A	4.35	3,232.68	-	-	0.13	100.27	-	-	4.48	3,332.95
S	4.35	3,128.40	-	-	0.13	97.04	-	-	4.48	3,225.44
O	4.35	3,232.68	-	-	0.13	100.27	-	-	4.48	3,332.95
N	4.35	3,128.40	-	-	0.13	96.29	-	-	4.48	3,224.69
D	4.35	3,232.68	-	-	0.13	95.20	-	-	4.48	3,327.88
Total		38,062		-		1,154		-		39,216

- Mechanical Measure

Measure Savings Summary										
	Lighting		End Use		HVAC		Fans		Total	
Month	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH)	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH
J	-	-	-	-	25.51	8,442.23	-	-	25.51	8,442.23
F	-	-	-	-	25.70	7,068.16	-	-	25.70	7,068.16
M	-	-	-	-	25.46	10,307.03	-	-	25.46	10,307.03
A	-	-	-	-	31.03	10,720.08	-	-	31.03	10,720.08
M	-	-	-	-	32.34	13,474.39	-	-	32.34	13,474.39
J	-	-	-	-	32.18	14,985.82	-	-	32.18	14,985.82
J	-	-	-	-	32.47	15,856.70	-	-	32.47	15,856.70
A	-	-	-	-	32.62	17,070.89	-	-	32.62	17,070.89
S	-	-	-	-	32.31	16,457.02	-	-	32.31	16,457.02
O	-	-	-	-	32.38	15,567.42	-	-	32.38	15,567.42
N	-	-	-	-	33.51	12,608.66	-	-	33.51	12,608.66
D	-	-	-	-	25.65	9,864.37	-	-	25.65	9,864.37
Total		-		-		152,423		-		152,423

- Architectural Measure

Measure Savings Summary										
	Lighting		End Use		HVAC		Fans		Total	
Month	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH)	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH	Demand (KW)	Energy (KWH
J	-	-	-	1,429.96	0.15	23.34	-	-	0.15	1,453.30
F	-	-	-	1,429.96	0.15	18.16	-	-	0.15	1,448.12
M	-	-	-	1,429.96	0.15	30.31	-	-	0.15	1,460.28
A	-	-	-	1,429.96	0.22	34.34	-	-	0.22	1,464.30
M	-	-	-	1,429.96	0.22	49.79	-	-	0.22	1,479.75
J	-	-	-	1,429.96	0.22	65.87	-	-	0.22	1,495.83
J	-	-	-	1,429.96	0.22	70.89	-	-	0.22	1,500.85
A	-	-	-	1,429.96	0.22	83.76	-	-	0.22	1,513.72
S	-	-	-	1,429.96	0.22	80.70	-	-	0.22	1,510.67
O	-	-	-	1,429.96	0.22	67.47	-	-	0.22	1,497.43
N	-	-	-	1,429.96	0.22	40.12	-	-	0.22	1,470.08
D	-	-	-	1,429.96	0.15	28.99	-	-	0.15	1,458.95
Total		-		17,160		594		-		17,753

Water Savings

The water project used a spreadsheet approach to determine the appropriate inputs for savings analysis. This included an assessment of the number of operations or minutes per use per day and the total usage for the entire year. The following table summarizes this approach and results.

TABLE 8 – WATER AUDIT DETAIL

Water Savings Summary				
Pre Kgal	Post Kgal	Savings (Kgal)	Rate ($/Kgal)	Annual Savings ($)
453	178	275.39	$ 12.43	$ 3,424.27

Consumption Check against Billing	
Utility Annual Consumption (Kgal)	1,746.35
Audit Annual Consumption (Kgal)	453.15
% of total Consumption accounted for:	26%

Electric Savings Summary					
Description	Pre KWH	Post KWH	Savings (KWH)	Rate ($/KWH)	Annual Savings ($)
Hot Water	-	-	2,884	$ 0.2797	$ 806.69
Water Heater	6,352.00	5,938.00	414	$ 0.2797	$ 115.81
Total for Water Projects			3,298		$ 922.50

Total Water Project Savings ($/yr)	**$ 4,346.77**
Water Project Pricing ($)	**$ 27,865.00**
Simple Payback (yrs)	**6.41**

In addition to the retrofit, the audit analysis included identification of energy savings. This is due to less hot water consumption for faucets as well as proposed replacement of water heaters with new more efficient electric water heating equipment. The following table summarizes this analysis.

TABLE 9 – HOT WATER SAVINGS FROM RETROFIT

Total Hot Water Savings	23,603	Gal
Incoming Water Temp	70	Deg F
Hot Water Temp	120	Deg F
MBTU Savings	9,842.59	
Propane -- MTBU per Gal	-	
Propane Savings -- Gallons	-	
Electric -- BTU/KWH	3.413	
Electric Savings (KWH)	2,883.85	KWH

TABLE 10 – WATER HEATER REPLACEMENT SAVINGS

Water Heater (FEMP Heater Calculator)		
Water Heater (FEMP Heater Calculator)		
Estimated Gallons Per Day Usage		80
Old Water Heater (KWH/yr)		6,352
Best Available (KWH/Yr)		5,938
Savings (KWH/yr)		414
Rate ($/KWH)		$ 0.30
Annual Savings		$ 124.78

MEASUREMENT AND VERIFICATION

With any audit, the process of M&V (Measurement and Verification) must be considered in the overall savings stream for assurances that the analysis, installation, and commissioning processes produce an actual savings stream as projected. For this audit it is probably more important to ensure savings as the inputs and data were provided by separate entities for analysis. The following sections detail recommended strategies for implementation of M&V within recognized protocols.

Lighting Systems

It is recommended that IPMVP Option A be used for these improvements. It is recommended that pre and post wattage be measured on an approved sample size and that the operating hours be stipulated as accurate.

For occupancy sensors it is recommended that these be confirmed as operational by utilization of a third party commissioning process.

HVAC Improvements

It is recommended that the model data be confirmed through a third party commissioning process. Because the model was calibrated the confirmation of field installation and operation is critical to the process. In addition the following should be fully commissioned and inspected:

- Full commissioning of all settings and unit operation.
- Inspection and confirmation of all SEER ratings for new HVAC equipment.
- Any other commissioning of equipment including package units and split systems.

Water Systems

It is recommended that IPMVP Option A be used for these improvements. It is recommended that pre and post flow or flush rates for an appropriate sample size be measured and that the other variables be stipulated.

Building Envelope Improvements

Because measurement of savings for these is virtually impossible, it is recommended a full inspection be completed for all these recommended improvements.

M&V Report and Qualifications

The Ricardo J. Bordallo Governor's Complex - Adelup should require a full M&V report and this should be completed by a CMVP (Certified Measurement and Verification Professional) and CBCP (Certified Building Commissioning Professional). This entity or person should also be in the energy engineering field with necessary experience in M&V for these systems.

SUMMARY AND CONCLUSIONS

Based on the input and analysis contained herein the Ricardo J. Bordallo Governor's Complex - Adelup will realize substantial energy and energy cost savings by implementation of the recommendations herein.

TECHNICAL APPENDIX

Attached to this report is a full technical appendix containing all calculations, modeling, and input to the savings shown in the report. This appendix is provided in order to fully review the audit findings.

SUMMARY OF TABLES

SUMMARY OF FIGURES

GLOSSARY FOR AUDIT REPORT TERMS AND ACRONYMS

The following list provides a summary of terms and acronyms that are used in this report and are related to the overall energy analysis for this audit.

ECM
: Energy Conservation Measure – this term is typically applied to a proposed measure intended to reduce or conserve energy.

IGA
: Investment Grade Analysis or Audit – An audit where the analysis and conclusions are completed using good engineering analysis and which can be presented to any financial institution for financial consideration.

IPMVP
: International Performance Measurement and Verification Protocol – This is an internationally recognized publication that details the necessary methods for measurement and verification of energy savings projects.

BIN Modeling Method
: A method used to simulate building energy consumption by using "temperature BINS" to relate overall conditions to building consumption.

T-8
: An energy efficient fluorescent lighting system.

T-12
: An older less efficient fluorescent lighting system

HID
: High Intensity Discharge – A type of lighting fixture, usually located outside that uses a very high voltage to provide light. These are typically High Pressure Sodium, Mercury Vapor, or Metal Halide fixtures.

Roof Coating
: A material or membrane placed over existing roofing material intended to reduce heat infiltration into a building envelope.

Building Envelope
: The definition of the shell of a building including roof, walls, windows, and doors.

Window Coating or Window Film
: A material placed over existing windows intended to reduce heat infiltration into a building envelope.

HVAC
: Heating Ventilating and Air Conditioning – A term referring to any heating or air conditioning system.

Split Unit
: An air conditioning unit that has two components often located in two different locations.

Package Unit
: An air conditioning unit that has all components located inside one package including heating and air conditioning.

RTU
: Roof Top Unit – An air conditioning unit designed for installation on a roof.

Programmable Thermostats
: A thermostat installed in a space that can be programmed with a schedule and temperature set points for occupied and unoccupied periods.

M&V
Measurement and Verification – A process recognized by the International Performance Measurement and Verification Protocol that provides assurance techniques for measurement and verification of savings from ECMs.

CMVP
Certified Measurement and Verification Professional – A Professional in the energy industry certified to complete M&V using accepted protocols.

M&V Plan
Measurement and Verification Plan – A required section of any Investment Grade audit that specifies the method and measurements that will be made to verify savings for an energy project.

GPA
Guam Power Authority – The electric utility for facilities included herein.

GWA
Guam Water Authority – The water/sewer provider for facilities included herein.

Rate Schedules
Specific rate information for facilities.

End Use
An analysis of building consumption that breaks out the annual consumption into end-uses such as lighting, HVAC, other.

Simple Payback
A method to compare projects and ECMs using the project cost and annual savings. The "simple payback" is the project cost divided by the annual savings, which represents the number of years that it will take the savings to pay for the investment.

ECM Matrix
A matrix that defines which ECMs (Energy Conservation Measures) are selected for specific facilities.

Rate Escalation
The rate at which energy rates are escalated to account for future energy costs. This is required when the project must present a cash flow for financing or other purposes over a specific time frame.