

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAI'I

In the Matter of the Application of
MAUI ELECTRIC COMPANY, LIMITED
For Approval to Recover Certain 2015 Plant
Addition Costs through the Rate Adjustment
Mechanism ("RAM") Above the RAM Cap

DOCKET NO. **2015-0376**

MAUI ELECTRIC APPLICATION
VERIFICATION
EXHIBITS I TO IX
AND
CERTIFICATE OF SERVICE

PUBLIC UTILITIES
COMMISSION

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FILED

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MAUI ELECTRIC APPLICATION

TO THE HONORABLE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAI‘I:

In accordance with Order No. 32735 in Docket No. 2013-0141, MAUI ELECTRIC COMPANY, LIMITED, (“Maui Electric” or the “Company”) requests Commission approval to recover the revenue requirements associated with 2015 plant additions in the amount of \$4,299,000 and other associated costs for a transmission and distribution (“T&D”) and generation plant reliability Major Baseline Project¹ through the Rate Adjustment Mechanism (“RAM”) above the 2015 RAM Cap.

¹ Major Baseline Project” is any baseline project(s) subject to review and approval by the Commission for recovery through the RAM above the applicable RAM Cap. These projects may include groupings under a programmatic approach to categorize and consolidate related baseline projects for consideration. For example, multiple baseline projects that serve a related purpose or are part of a specific program may be consolidated as a Major Baseline Project for purposes of application and review. A “baseline project” is a capital project with capital expenditures net of customer contributions of \$2.5 million or less and is not subject to Rule 2.3.g.2. of General Order No. 7.

I. OVERVIEW

As discussed more fully below, Order No. 32735 (“Order”) modified the RAM mechanism to limit the amount of unapproved capital project net plant additions that can be automatically incorporated into effective rates through the RAM. Recovery of revenues above the RAM Cap (through the RAM) is permissible, but only upon prior approval by the Commission. As directed by the Commission, the Hawaiian Electric Companies (“Companies”) have proposed standards and guidelines to govern applications for recovery of revenues above the RAM Cap. This Application is consistent with those standards and guidelines.

The 18 projects for which recovery is requested in this Application constitute a Major Baseline Project and reflect the Company’s focus on system preservation and keeping the power grids operating. The projects included in this Application better enable the Company to maintain or improve the level of system preservation. By undertaking these projects, the Company is taking prudent steps to avoid unnecessary and potentially expensive corrective actions in addressing system faults and interruptions in service.

Transition and Adjustment

As described in Section VII below, as of the date of this filing, the Company forecasts that the amount of net plant additions that could be recovered under the RAM Cap, adjusted for ADIT, would be \$27,403,000 (“RAM Cap Amount”).

The Order marked a change in the recovery of capital program costs and required the Company to revisit its 2015 capital program. Following the Commission’s issue of Order No. 32735, the Company performed an extensive review of its 2015 capital program. As a result, the Company reprioritized its plans to strike a balance between working within the parameters of Order No. 32735 to maintain the Company’s financial integrity and associated

customer bill impacts versus achieving in 2015 rather than postponing the benefits anticipated from the projects included in its 2015 capital expenditures budget.

At the time Order No. 32735 was issued on March 31, 2015, the Company had already placed into service capital project and program work valued at approximately \$6,900,000, or roughly 25% of the amount recoverable under the 2015 RAM Cap Amount for Maui Electric. In May 2015, the Company began a detailed review of the individual projects and programs scheduled for the remaining months of 2015 and to finalize its reprioritization plan. The significant focus of the Company review was to validate the reasonableness of work categorized as “must do” in 2015 and assessing risks and consequences if certain work was not completed in 2015.

The result of the Company’s review was a reprioritized capital work plan that was reduced compared to its original 2015 Budget of approximately \$45,800,000. The Company’s May 2015 updated outlook for 2015 annual plant additions, at \$30,800,000, was approximately \$15,000,000 lower than the 2015 Budget and \$11,300,000 lower than its April 2015 updated outlook. The 2015 project list provided in “Exhibit III: Maui Electric 2015 Plant Additions” identifies work totaling approximately \$31,794,000, which is slightly higher than the \$30,800,000 May 2015 updated outlook and reflects changes identified since the May review, but still above the RAM Cap Amount.

The System Reliability, System Security, and Generation Reliability Projects

The approval requested in this Application is for recovery of 2015 plant additions and other associated costs for 18 baseline projects, all of which directly affect either system reliability or generation reliability. These baseline projects consist of the following:

- *T&D system reliability projects.* These T&D projects primarily upgrade and help stabilize Maui Electric’s transmission system during fault conditions. These 12 T&D

projects total \$2,869,000 in net plant additions. As explained Section IX below, Maui Electric’s System Security Study supports the completion of the protective relay and circuit breaker replacement and communications addition projects included in this application.

- *Generation Plant (Generation) reliability improvement projects.* These Generation projects primarily replace or upgrade failing equipment and structures at the Company’s power plants. These six projects total \$1,430,000 in net plant additions.

All projects included in this Application for recovery above the RAM Cap are either already completed or will be completed as of December 31, 2015.

Monthly Bill Impacts

The approximate rate (cents/kWh) and customer bill impacts (based on a typical 500 kWh monthly residential bill) for recovery of Project costs above the RAM Cap are as follows and also shown in Exhibit II, page 4:

	2016	2017
Rate Impact (cents/kWh)	0.0558¢	0.0538¢
Bill Impact (\$/month)	\$0.28	\$0.27

Rationale for Completing Projects in 2015

Maui Electric is implementing these projects to replace equipment that has clearly physically deteriorated, whose ability to perform as expected has become highly suspect and unreliable, or whose capabilities no longer meet system needs. The Company arrived at this determination through visual inspection, through identified diminished capabilities, and through system studies, as discussed in Exhibits IV, V, and VIII.

Thus, the Company needed to replace or upgrade these equipment as best fit each situation. In some instances, the Company upgraded equipment to improve performance, reliability, stability, and security of the system, and to improve the ability to more reliably integrate renewable energy into the power grid. (None of the projects, however, connect or integrate renewable energy). Exhibit IV and Exhibit V explain each of the projects to be recovered above the RAM Cap, and the rationale for how the projects improved the overall performance of the power grid.

The Major Baseline Project Work Is Reasonable and Prudent

Order No. 32735 was clear that recovery above the RAM Cap would only be allowed for investments that are prudent, reasonable, and in the customer's interest. The projects in this Application are designed in accordance with best practices and have been or will be performed on a cost competitive basis. Construction contractors, when necessary, are also procured through competitive practices.

- *Prudent:* In all projects, the Company has acted prudently, with care, with professional expertise, and with consideration for both a near-term and long-term perspective for maintaining system reliability.
- *Reasonable:* It is reasonable to undertake each of the projects in the Application. The Company determined each project is necessary either through visual inspection, identifiable diminished capabilities, or system studies. In addition, the Company's project costs are based on competitive alternatives for construction and vendor alliances to procure the needed equipment and materials.
- *Provide customer value:* In "Exhibit IV: Transmission and Distribution System Reliability Project Descriptions" and in "Exhibit V: Generation Plant Reliability

Improvement Project Descriptions,” the Company articulates and enumerates the customer benefits provided by each of the projects in this Application.

- *Enhance the affordability of energy services:* “Exhibit II: Revenue Requirement and Bill Impact” details the modest effect that these projects have on a customer’s typical monthly bill. In 2016, this impact would be 28¢.
- *Not explicitly or implicitly included in otherwise effective utility target revenues or other effective means of revenue recovery:* None of the projects in this Application have been included in otherwise effective utility target revenues or other effective means of revenue recovery.

Revised Planning for 2015 and Future Years

Maui Electric adjusted its annual project planning and its related capital budget for 2015 after it received Order No. 32735 on March 31, 2015. As such, these adjustments will cause 2015 to be a transition year while the Company adjusts to the requirements set forth in the Order. With the Order, the Company needed to determine which projects originally planned for 2015 could be completed in 2015 for recovery under the RAM Cap, and which could prudently be rescheduled for subsequent years.

For 2015, it made sense to continue certain projects, mainly because postponing them would have increased their cost, forced already-purchased equipment to remain uninstalled and lie dormant, or have an adverse effect on the system.

By the time the Order was issued on March 31, 2015, the Company had already started and, in some cases, completed projects. Other projects were ongoing from previous years and were scheduled to be completed in 2015. Still other projects were far enough along in the planning process that the Company deemed it prudent to continue with these projects in 2015.

In prior years under the previous RAM mechanism, the Company would not have required prior approval for recovery of these 18 projects sought here through the RAM. Under the unique circumstances of this transition period, the Company did its best to adjust to and align to the new mechanism without having had a lead time to plan for and make these adjustments. It was reasonable to continue certain work that was already in flight and is in the best interest of customers. Further, on a project-by-project basis, it is more cost effective to complete projects that are substantially in progress than to stop and then restart the project in a future year.

The Company is not cancelling any project due to the RAM Cap—all projects have been well considered and are necessary but it has delayed some projects initially scheduled for 2015 until 2016 or later. Postponing these projects will not affect short-term reliability nor have an adverse effect on the Company's customers. All of these projects must, at some point, be started and completed as all affect long-term system reliability. The Company has assessed risk and determined that these projects could prudently be postponed until 2016 or later. Postponement, however, increases the urgency, and has the potential to increase the exposure to system events possibly having large scale impacts on the Company's customers. Postponing these projects also potentially increases costs for 2016 and beyond (in part, because postponed projects may cost more to complete in the future). This is a situation that the Company continually assesses.

II. APPLICANT

Maui Electric, whose principal place of business and whose administrative offices are located at 210 West Kamehameha Avenue, Kahului, Hawai'i, is a corporation duly organized under the laws of the Territory of Hawai'i on or about April 28, 1921, and now exists under and by virtue of the laws of the State of Hawai'i. Maui Electric is an operating public utility engaged in the production, purchase, transmission, distribution, and sale of electricity on the island of Maui; the production, purchase, transmission, distribution, and sale of electricity on the island of

Moloka‘i; and the production, purchase, distribution, and sale of electricity on the island of Lana‘i.

III. CORRESPONDENCE

Correspondence and communications in regard to this Application should be addressed to Dean K. Matsuura, Manager, Regulatory Rate Proceedings, whose business address is Hawaiian Electric Company, P.O. Box 2750, Honolulu, Hawai‘i 96840-0001.

IV. STATUTORY PROVISION OR AUTHORITY

Maui Electric requests the approval in this Application pursuant to Order No. 32735, in Docket No. 2013-0141; Sections 269-6 and 269-16 of the Hawai‘i Revised Statutes; Section 6-61-74 of the Rules of Practice and Procedure before the Public Utilities Commission, Title 6, Chapter 61 of the Hawai‘i Administrative Rules (“HAR”).

V. EXHIBITS

The following exhibits are provided in support of this Application:

- Exhibit I - Companies’ Response to the Consumer Advocate’s Comments on the Proposed Above RAM Cap Standards and Guidelines
- Exhibit II - Cost Impact Calculations
- Exhibit III - Company Project List Above and Under the RAM Cap
- Exhibit IV - T&D Project Descriptions
- Exhibit V - Generation Project Descriptions
- Exhibit VI - T&D Project Costs
- Exhibit VII - Generation Project Costs
- Exhibit VIII - System Security Study
- Exhibit IX - Maui Electric RAM Cap Target Calculation

VI. BACKGROUND- ORDER NO. 32735

In its Final Decision and Order, issued on August 31, 2010, in Docket No. 2008-0274, the Commission approved, with modifications, the decoupling mechanism proposed jointly by the Hawaiian Electric Companies and the Consumer Advocate. The decoupling mechanism included two main components: (1) a sales decoupling mechanism (Revenue Balancing Account or “RBA”) which provided for revenue adjustments (increases or decreases) between rate cases to account for the difference between target revenues² and the revenues actually received by the utility, and (2) the RAM which compensated the Companies for certain increases in expenses and plant additions between rate cases.

On May 31, 2013, the Commission opened an investigative docket (Docket No. 2013-0141) to review whether the decoupling mechanisms are functioning as intended, are fair to the Hawaiian Electric Companies and their customers, and are in the public interest.

On March 31, 2015, the Commission issued Order No. 32735 in Docket No. 2013-0141. Among other things, the Order limited the amount of unapproved capital project net plant additions that automatically can be incorporated into effective rates through the RAM (i.e., RAM Revenue Adjustment) for a particular RAM period.³ However, the Commission stated:

This Order does not deprive the HECO Companies of the opportunity to recover any prudently incurred expenditures or limit orderly recovery for necessary expanded capital programs. Instead, the Order limits the amount of unapproved capital project expenditures that can automatically be incorporated into effective rates through the RAM without timely prior regulatory review.⁴

² As defined in the RBA Provision.

³ Order No. 32735 at 81. The “RAM Revenue Adjustment” is the revenue requirement calculated for a particular calendar year, to be flowed through the RAM for recovery through the RBA Rate Adjustment. The “RAM period” is defined as the calendar year containing the Annual Evaluation Date (i.e., the date the Company files its annual decoupling transmittal). It is also the calendar year upon which the RAM Revenue Adjustment is based and calculated.

⁴ Order No. 32735 at 7.

The Commission also “remained mindful of cautions expressed by the parties regarding the possible consequences of implementing caps or limits on RAM revenue recovery” and recognized the Companies’ “needs to finance necessary capital investments[.]” while sharing concerns expressed by the Companies that increasing the revenue requirement by inflation alone is unlikely to provide the Companies with sufficient revenue to invest as needed to meet Hawai‘i’s goals while also providing the Companies a fair opportunity to earn their cost of capital.⁵ Thus, the Commission provided that:

The Companies may apply to the Commission for approval of recovery of revenues for Major Projects through the RAM above the RAM cap, outside of the RAM through the REIP, or other adjustment mechanism. Approval for such recovery will be made on a case by case basis. Any such application shall identify and support the specific means and extent of proposed cost recovery.

Eligibility for recovery above the RAM cap or by adjustment mechanism outside of the RAM will be restricted to revenues for projects that HECO, MECO, or HELCO demonstrate to be prudent and reasonable, to provide customer value, to enhance the affordability of energy services, and which are not explicitly or implicitly included in otherwise effective utility target revenues or other effective means of revenue recovery.⁶

The Commission stated the Companies may use a programmatic approach to categorizing and consolidating related baseline projects for consideration as Major Projects (“Major Baseline Projects”). Multiple baseline projects that serve a related purpose or are part of a specific program may be consolidated as a Major Project for purposes of application and review.⁷

The Commission further concluded that:

[U]se of the REIP alone, and even an expanded use as suggested by the Consumer Advocate, would not provide sufficient or appropriate means

⁵ Order No. 32735 at 85–87.

⁶ Order No. 32735 at 97-98.

⁷ Order No. 32735 at 98.

for recovering revenues for necessary projects that fall outside the scope of the REIP mechanism.⁸

Thus, the Commission directed the Companies and the Consumer Advocate to develop standards and guidelines for eligibility of projects and determination of the amount of eligible cost recovery above the RAM Cap or outside of the RAM mechanism through the REIP or other adjustment mechanism, but, notwithstanding this directive, the Companies may file an application for approval of a Major Project at any time consistent with this Order.⁹ The other parties were allowed to comment on the joint submitted standards and guidelines on or before June 30, 2015.¹⁰

A. Proposed Modified REIP and Above RAM Cap Standards and Guidelines

As directed, the Companies and the Consumer Advocate filed a *Joint Proposed Modified REIP Framework*, on June 15, 2015. The projects and programs eligible under the Joint Proposed Modified REIP Framework are to support investments in and advancement of: (a) renewable energy and clean energy initiatives, (b) energy choices for customers, (c) grid modernization technologies, (d) energy conservation and efficiency, and (e) other undertakings of strategic importance to electric industry transformation.¹¹

However, despite the Commission's conclusion (quoted above) that use of an expanded REIP alone (as suggested by the Consumer Advocate) would not provide sufficient or appropriate means for revenue recovery, the Consumer Advocate opposed the Companies' effort to create standards for recovery for baseline projects above the RAM Cap. Consequently, on June 15, 2015, the Companies alone filed a letter transmitting their *Standards and Guidelines for*

⁸ Order No. 32735 87–88.

⁹ Order No. 32735 at 114–115.

¹⁰ *Id.* at 115.

¹¹ See Joint Proposed Modified REIP Framework, Exhibit 1, page 4.

Eligibility of Projects for Cost Recovery through the RAM above the RAM Cap (“Above RAM Cap Standards and Guidelines”). These Standards are intended to apply to applications for recovery of investments for Major Baseline Projects primarily intended to promote safety and sustain, improve, and/or prevent deterioration of service reliability – costs that would not be eligible for recovery under the *Joint Proposed Modified REIP Framework/Standards and Guidelines*.

Rather than propose its own standards for Major Baseline Projects, the Consumer Advocate instead, on June 30, 2015, filed comments on the Companies’ Above RAM Cap Standards and Guidelines, (“Consumer Advocate’s Comments”).¹² Because Order No. 32735 did not provide for the Companies to respond to comments submitted by other parties, the Companies’ response to the Consumer Advocate’s Comments is respectfully provided in Exhibit I to this Application.

VII. APPLYING ORDER NO. 32735

A. Calculation of the 2015 RAM Cap Amount

Order No. 32735 specified that the RAM Revenue Adjustment for a given year will be the lesser of RAM Revenue Adjustment calculated according to the Original RAM Methodology¹³ or the RAM Cap. For 2015, the RAM Revenue Adjustment calculated according to the Original RAM Methodology was \$13,009,000 compared to the RAM Cap amount of

¹² Consumer Advocate’s Comments at 1.

¹³ “Original RAM Methodology” is the RAM methodology approved by the Commission and reflected in the Company’s Rate Adjustment Mechanism Provision tariff prior to the issuance of Order No. 32735.

\$11,751,000. Since the RAM Cap was the lesser of the two amounts, the \$11,751,000 was used as the RAM Revenue Adjustment for 2015.¹⁴

The RAM Cap is based on the total 2014 adjusted target revenue amount, adjusted for inflation. Therefore, the amended RAM does not produce separate calculated RAM amounts for O&M, rate base – return on investment, and depreciation and amortization and does not translate into a specific cap amount for net plant additions. However, footnote 4 on page 6 of Order No. 32735 stated the following:

With respect to recovery of revenues for capital projects, the amended RAM will thus allow continued automatic revenue recovery for capital project net plant additions in an amount effectively in rough approximation to the rate of depreciation and amortization on approved utility rate base, plus an increment of effective rate base indexed on general inflation. Beyond that, the amended RAM is intended to allow recovery of revenues for additional capital projects with prior approval by the commission.

Based on this concept, the 2015 RAM Cap allows for recovery of capital project net plant additions approximately equivalent to the 2015 depreciation and amortization expense of \$22,226,000.¹⁵

Notwithstanding this amount, the Company determined the amount of net plant additions it could recover under the RAM Cap given certain budget assumptions regarding 2015 O&M expenses and depreciation and amortization, which resulted in approximately \$27 million available for net plant additions for Maui Electric in 2015. See Exhibit IX, Attachment A. The Company further estimated that the amount of accumulated deferred income taxes (“ADIT”)

¹⁴ In accordance with Order No. 32866, adjustments were made for the impact of changes in on-cost clearing allocations and 2014 bonus tax depreciation in arriving at the Total 2015 RAM Revenue Adjustment Allowed of \$10,122,159, as shown in *Final Revised RBA Rate Adjustment*, Transmittal No. 15-05, filed June 3, 2015, Schedule A, page 1, line 4.

¹⁵ See *Final Revised RBA Rate Adjustment*, Transmittal No. 15-05, filed June 3, 2015, Schedules E and G. Depreciation and amortization of \$22,225,981 = total RAM depreciation/amortization of \$24,637,300 – vehicle depreciation of \$503,786 – CIAC amortization of \$1,907,533.

associated with the \$27 million net plant additions amount would be \$403,000. See Exhibit IX, Attachment B. Thus, the amount of net plant additions that could be recovered under the RAM Cap, adjusted for ADIT, would be \$27,403,000 (“RAM Cap Amount”). This amount is greater than the amount calculated using the Commission’s methodology in footnote 4 of Order No. 32735 by \$5.2 million (\$27,403,000 - \$22,226,000). Therefore, the RAM Cap Amount provides for conservative results as it reduces the amount of net plant additions that the Company seeks to recover above the RAM Cap and is a reasonable benchmark for determining which project investments would be recovered below and above the RAM Cap.

As shown on Exhibit III, Maui Electric estimates net plant additions for 2015 (using forecasted baseline plant additions rather than a five-year average) to be \$31,794,000.¹⁶ The amount of net plant additions that would be eligible for recovery above the 2015 RAM Cap would be approximately \$4,299,000.

B. Requesting Recovery Through the RAM Above the RAM Cap is Appropriate

In this Application, Maui Electric requests Commission authorization to recover the costs of the projects in this Application (“Projects”) through the Company’s RAM above the RAM Cap, only to the extent that such investment is not recovered under the RAM Cap. Order No. 32735 authorized the Hawaiian Electric Companies to commence the filing of such applications, stating that the Companies “may file an application for approval of a Major Project at any time consistent with this Order.”¹⁷ It allowed the Companies to use a programmatic

¹⁶ \$31,794,461 equals the sum of \$27,495,611 per Exhibit III, pages 1 to 3, plus \$4,298,849 per Exhibit III, page 4.

¹⁷ See Order No. 32735 at 114–115. The Commission authorized the Companies to commence the filing of these applications notwithstanding its directive for the Companies and the Consumer Advocate to develop standards and guidelines for eligibility of projects and determination of the amount of eligible cost recovery above the RAM Cap. As of the date of this application, the Above RAM Cap Standards and Guidelines are pending approval. The proposed Above the RAM Cap Standards and Guidelines are based on and incorporate the exact provisions of Order No. 32735. As demonstrated herein, this application fully complies with Order No. 32735,

approach to categorizing and consolidating related baseline projects for consideration as Major Projects (that is, Major Baseline Projects), and stated that multiple baseline projects that serve a related purpose or are part of a specific program may be consolidated as a Major Project for purposes of application and review. This application requests recovery of related baseline projects, which the Company is defining as a Major Baseline Project:

- Transmission and Distribution System Reliability projects
- Generation Plant Reliability Improvement projects

Order No. 32735 further states (at 89):

The Companies may apply to the commission for recovery of necessary and reasonable revenue requirements for any type of Major Project (including related baseline projects considered on a programmatic basis as Major Projects), to be implemented through the RAM, REIP, or other proposed mechanism if found to be reasonable and prudent.

The primary purpose of the T&D System Reliability projects and Generation Plant Reliability Improvement projects is to maintain the reliability of the Company's systems for its customers, and not to connect or integrate renewable energy onto the electrical grid. As such, the Company will not seek recovery of these costs under the REIP Framework as approved in the Decision and Order issued on December 30, 2009 in Docket No. 2007-0416 or the Joint Proposed Modified REIP Framework/Standards and Guidelines (currently pending before the Commission), filed on June 15, 2015 in Docket No. 2013-0141.

Further, to enable identification of projects covered under the RAM Cap (and, thus, not eligible for recovery above the RAM Cap), the Companies' Above RAM Cap Standards and

and therefore can be approved even in advance of the Commission's ruling on the Above RAM Cap Standards and Guidelines.

Guidelines propose to modify the capital expenditure reports the Companies currently file with the Commission.

In their annual five year capital expenditures budget reports, the Companies will prospectively list the baseline and, if applicable, major projects that are planned for recovery under the RAM Cap in an upcoming year. In the annual Capital Project Completion Reports, the Companies will retrospectively list the projects that were actually completed and recovered under the RAM Cap in the preceding year. These lists would enable the Consumer Advocate and the Commission to verify which projects are eligible for recovery through the RAM above the RAM Cap.

Maui Electric filed its updated 2015 capital expenditures budget report for the 2015-2019 period on February 13, 2015. Because the Company filed this report prior to the issuance of Order No. 32735 and the filing of the Companies' proposed Above RAM Cap Standards and Guidelines, the report did not include a listing of projects budgeted for recovery under the RAM Cap. Hence, to demonstrate that the T&D System Reliability and Generation Plant Reliability Improvement projects will not be recovered under the RAM Cap, the Company submits Exhibit III, pages 1 through 3, which provides a listing of projects scheduled to go into service in 2015 that will be recovered under the RAM Cap.¹⁸ None of the projects for which the Company is requesting recovery through the RAM above the RAM Cap in this Application and shown in Exhibit III, page 4, is in the listing in Exhibit III, pages 1 through 3.

¹⁸ The sum of the projects and programs identified in Exhibit III pages 1 to 3, at \$27,495,611, exceeds the estimated cap of \$27,403,000 by \$92,611. Maui Electric is not requesting Commission approval to recover the \$92,611 amount through the RAM above the RAM Cap.,

Maui Electric's determination of the specific projects and programs to be recovered under the RAM Cap and above the RAM Cap is discussed in Application Section IX, Reprioritization Process.

VIII. PROPOSED METHOD OF RECOVERY

If the Commission approves this Application, the Company will include the revenue requirements associated with the Major Baseline Project in the RAM in the annual decoupling tariff transmittals, beginning with the tariff transmittal following approval of this Application, and for each RAM period thereafter until the Commission approves the inclusion of the costs for this Major Baseline Project in the test year rate base in a Maui Electric rate case. For example, if the Company receives approval of this Application before March 31, 2016 (e.g., by March 15, 2016), it will include the 2015 Major Baseline Project costs that are placed in service by December 31, 2015 in the annual decoupling tariff transmittal to be filed on March 31, 2016 for the 2016 RAM period. If the Company receives approval of this Application after March 31, 2016 and before March 31, 2017, it will include the 2015 Major Baseline Project costs that are placed in service by December 31, 2016 in the annual decoupling tariff transmittal to be filed on March 31, 2017.

Recovery of the Project costs through the RAM above the RAM Cap will adhere to the principles in the proposed Above RAM Cap Standards and Guidelines as follows:¹⁹

- Cost Basis –The cost basis for the RAM calculation shall be the lower of actual cost or approved cost. (Since these Projects will go into service in 2015, the Company

¹⁹ See Exhibit A, Above RAM Cap Standards and Guidelines, at 4–5.

anticipates that it will have the actual costs by the time that it includes the Project costs in the RAM.)

- Rate Base Impact – The Rate Base Impact shall be limited to the changes to Plant in Service, Accumulated Depreciation, Accumulated Deferred Income Taxes, and Contributions in Aid of Construction (“CIAC”) impacts from the Projects. Rate Base impact shall be a two-point average of estimated values at December 31 of the Evaluation Period (year prior to the RAM Year) plus estimated values at December 31 of the RAM Year. Estimated values shall be calculated based on the lower of approved cost or actual cost of the Projects. The Company will keep separate records of these rate base items for the Projects for the purpose of calculating Additional RAM.
- Additional RAM – The components of Additional RAM shall be the Depreciation and Amortization RAM Adjustment and Rate Base RAM – Return on Investment Adjustment (at the pretax rate of return which includes related income taxes on the equity components of the Return on Investment rate approved by the Commission in the last issued Decision and Order in the Company’s most recent test year general rate case). In the forecast RAM year in service, Projects will recover only Rate Base RAM, and that will reflect only the plant addition, CIAC, and deferred taxes in only the end of year rate base, as it does now. In years subsequent to being placed in service, Projects will recover a full year of Depreciation RAM, and will recover a Rate Base RAM calculated on average rate base impact of Plant in Service, Accumulated Depreciation, Accumulated Deferred Income Taxes, and CIAC impacts from projects.

Because Order No. 32735, which modified the RAM, was issued on March 31, 2015, Maui Electric was unable to prepare and file an application for the 2015 Major Baseline Project

early enough to receive approval of the Projects for inclusion in the 2015 RAM above the RAM Cap. As explained in this Application, 2015 is therefore a transition year in which the Company is modifying its internal processes to comply and adjust to the provisions of Order No. 32735. If the Company were to receive approval of this Application by March 15, 2016, it would be able to include the 2015 Major Baseline Project costs in the next decoupling transmittal to be filed on March 31, 2016 for inclusion in the 2016 RAM.²⁰ However, it recognizes that the time period for review is limited and that the Commission and the Consumer Advocate have numerous utility matters to address during this period. If the Company is unable to receive approval in time to include the Major Baseline Project costs in the 2016 RAM, it would respectfully request that the Commission allow it to include the 2016 and 2017 revenue requirements for these Projects in the 2017 RAM.

A. Customer and Bill Impact

Based on the \$4,299,000 in plant additions to be recovered above the RAM Cap, the approximate customer and typical monthly bill impact of the Major Baseline Project for each year from 2015-2020 would be as follows:

T&D Projects	Customer Impact (Cents Per kWh)	Typical Monthly Bill Impact (Based on 500 kWh)
2015	0.0153¢	\$0.08
2016	0.0372¢	\$0.19
2017	0.0358¢	\$0.18
2018	0.0341¢	\$0.17
2019	0.0325¢	\$0.16
2020	0.0312¢	\$0.16

²⁰ As noted, after Order No. 32735 was issued, the Companies and the Consumer Advocate spent several weeks working on the modified REIP and discussing Hawaiian Electric's Above Ram Cap Standards and Guidelines. Those were filed on June 15, 2015.

Generation Projects	Customer Impact (Cents Per kWh)	Typical Monthly Bill Impact (Based on 500 kWh)
2015	0.0076¢	\$0.04
2016	0.0187¢	\$0.09
2017	0.0180¢	\$0.09
2018	0.0171¢	\$0.09
2019	0.0164¢	\$0.08
2020	0.0157¢	\$0.08

Please see “Exhibit II: Revenue Requirement and Bill Impact” for the calculations and work papers. Recovery through the RAM would continue until the project costs are included in base rates. The Company is not seeking to recover the 2015 revenue requirement for these projects and therefore the 2015 amounts represent recovery that the Company is foregoing.

B. Safeguards Are In Place To Protect Customers

To ensure the proper level of cost recovery and to protect customer interests, the Above the RAM Cap Standards and Guidelines propose certain safeguards such that if a Major Project or Major Baseline Project does not go into service by December 31 of the RAM period or if the Commission disallows all or a portion of the project costs in a subsequent rate case proceeding, the Company will credit customers with interest for the applicable amount through the RBA. The current Rate Adjustment Mechanism Provision tariff includes similar provisions for Major Capital Project and Baseline Capital Project Credits.²¹

The Commission stated in its Final Decision and Order, in Docket No. 2008-0274, that the credit mechanisms for Major Capital Projects and Baseline Capital Projects will result in just

²¹ The current Rate Adjustment Mechanism Provision tariff includes a cutoff date of September 30 for the installation of Major Projects.

and reasonable rates, and should be implemented in the RAM Provision tariff.²² In addition, the Company’s annual decoupling tariff transmittals are subject to an established review process in which the Commission and Consumer Advocate have the opportunity to review extensive, detailed work papers and information.

Another customer safeguard is the Earnings Sharing Revenue Credit (i.e., Earnings Sharing Mechanism) in the Company’s Rate Adjustment Provision tariff. In Docket No. 2008-0274, the Hawaiian Electric Companies and the Consumer Advocate proposed the Earnings Sharing Mechanism to ensure that the total amount of revenues being recovered through base rates, RBA/RAM adjustments and other surcharges does not contribute to excessive earnings by the utility, while retaining some incentive for management to seek cost reductions and productivity gains beyond what are recognized within the RAM formulas.²³ If an excess in earnings occurs, customers would be credited with the revenue equivalent of return on common equity (“ROE”) levels actually achieved within the earnings sharing grid below:

ROE at or below the Authorized ROE	Retained entirely by shareholders - no customer credits
First 100 basis points (one percent) over Authorized ROE	25% share credit to customers
Next 200 basis points (one to three percent) over Authorized ROE	50% share credit to customers
ROE exceeding 300 basis points (three percent) over Authorized ROE	90% share credit to customers

²² Final Decision and Order, Docket No. 2008-0274 at 108–110.

²³ Final Decision and Order, Docket No. 2008-0274, at 59.

All of the Parties in Docket No. 2008-0274 supported the Earnings Sharing Mechanism and the Commission ultimately ruled that the Earnings Sharing Mechanism will allow both the Hawaiian Electric Companies and their customers to benefit from any earnings experienced by the Hawaiian Electric Companies' shareholders above the authorized ROEs and will result in just and reasonable rates.²⁴

In its annual decoupling tariff transmittals, filed every March 31, the Company will keep separate records for the Major Projects and Major Baseline Projects approved by the Commission for cost recovery through the RAM above the RAM Cap and separate those projects from projects recovered under the RAM Cap or projects recovered through mechanisms outside the RAM. The Company plans to reflect such projects in the annual decoupling tariff transmittal templates in a manner similar to that of the "Exceptional and Other Matters" category that the Company reflects on Schedule K, K1, and K2 (K2 currently applicable for Hawaiian Electric only) of the 2015 annual decoupling tariff transmittals filed on June 3, 2015 and approved by the Commission.²⁵ The Company will separately track each Major Project and Major Baseline Project recovered through the RAM above the RAM Cap. Year 1 (year in which project is placed into service) will have an estimated ending balance not to exceed the Commission authorized amount, and the Year 1 revenue requirement will incorporate estimated applicable CIAC and accumulated deferred income taxes but not include depreciation or amortization.²⁶ The beginning balance of Year 2 will be trued-up to actuals, not to exceed the Commission authorized amount, and include an adjustment for accumulated deferred income taxes and accumulated depreciation and amortization. However, because this Application is part of the

²⁴ Final Decision and Order in Docket No. 2008-0274 at 107-108.

²⁵ Order No. 32883 issued June 8, 2015.

²⁶ The Companies start depreciation and amortization in the calendar year following the date the investment is placed in service.

first round of above RAM Cap applications following Order No. 32735 and will not be incorporated into the RAM until at least the year following the 2015 year of service, the plant balances for the Major Baseline Project in this Application will resemble the Year 2 plant balances described above.

IX. REPRIORITIZATION PROCESS

Without the relief requested in this Application, the Company anticipates that it will not have an opportunity to begin recovery of the costs for the Projects until its next general rate case. The Company established its 2015 capital program budget in 2014 under the then current recovery mechanisms. The Company was already executing its 2015 capital program when Order No. 32735 was issued. This situation makes 2015 a transition year requiring modification to its capital expenditure plans to comply with Order No. 32735.

Order No. 32735 noted the increase in the level of baseline projects that flowed through the RAM and concluded that the RAM should be modified to provide sufficient timely regulatory review and appropriate incentives for the Companies to contain these costs consistent with safe and reliable utility service and to prudently manage these costs.²⁷ Thus, following the issuance of Order No. 32735, the Company performed an extensive review of its 2015 capital program, mindful of the level of baseline projects and its impact on the cost to customers. As a result, the Company reprioritized its plans to strike a balance between working within the parameters of Order No. 32735 to maintain the Company's financial integrity and associated customer bill impacts versus achieving in 2015 rather than postponing the benefits anticipated from the projects included in its 2015 capital expenditures budget.²⁸

²⁷ Order No. 32735 at 3-4.

²⁸ Hawaiian Electric Companies Updated 2015 Capital Expenditures Budgets filed February 13, 2015.

At the time Order No. 32735 was issued on March 31, 2015, the Company had already placed into service capital project and program work valued at approximately \$6,900,000, or roughly 31% of 2015 annual depreciation and amortization of \$22,226,000, which, as described above, is a rough approximation of the recovery for capital projects provided by the revised RAM. In May 2015, the Company reviewed its 2015 capital work plans taking into consideration the implementation of the RAM Cap from Order No. 32735. In mid-May 2015, Maui Electric management met to complete its detailed review of the individual projects and programs scheduled for the remaining months of 2015 and to finalize its reprioritization plan. The significant steps of the Company's detailed review included the following:

- Identification of estimated 2015 RAM Cap target.
- Review of work already placed into service through April 30, 2015.
- Input from individual Maui Electric departments based on their reviews of their work plans.
- Categorization of capital work identified for the remaining months as follows:
 - Customer initiated projects and programs (typically the Company receives customer CIAC to offset some or all of the associated costs).
 - Programs other than customer programs (generally considered core work such as programs for replacement of overhead and underground facilities, and purchases of transformers).
 - "Must do" work predominantly characterized as:
 - Already in flight.
 - Safety related (public, specific customer, or Maui Electric personnel).

- Critical to maintaining reliable service (for example, the Lana‘i Caterpillar Controls Upgrade is a project critical to balancing load on the Lana‘i electrical grid).
- Work critical to maintaining reliable service whose customer benefits would not be prudent to postpone.
- Other remaining work.

The significant focuses of the Company review was to (1) validate the reasonableness of categorizing work in the “must do” vs. other remaining work categories; and (2) assess the projects in the other remaining work category as to risks and consequences if not completed in 2015.

The result of the Company’s review was a reprioritized capital work plan that was reduced compared to its original 2015 Budget of approximately \$45,800,000. The Company’s May 2015 updated outlook for 2015 annual plant additions, at \$30,800,000, was approximately \$15,000,000 lower than the 2015 Budget²⁹ and \$11,300,000 lower than its April 2015 updated outlook.

The Company also continues to actively manage its capital program with its monthly update and review processes, and makes adjustments to its capital work plan as circumstances warrant. The 2015 project list provided in “Exhibit III: Maui Electric 2015 Plant Additions” identifies work totaling approximately \$31,794,000,³⁰ which is slightly higher than the \$30,800,000 May 2015 updated outlook for 2015 annual plant additions and reflects changes identified since the May review.

²⁹ Not all of the \$15,000,000 decrease in the May 2015 update compared to the 2015 Budget was due to the Company’s re-prioritization efforts related to the RAM Cap. A portion of the decrease was the result of delays which occurred in the course of business as well as to revised project cost estimates.

³⁰ \$31,794,461 equal to sum of \$27,495,611 per Exhibit III, pages 1 to 3, plus \$4,298,849 per Exhibit III, page 4.

Even with extensive efforts to reprioritize and reduce its 2015 capital work plan and postpone some work to later years in being mindful of customer bill impacts, because of the timing of when Order No. 32735 was issued, the Company was not able to reduce its 2015 net plant additions fully to the level of the RAM Cap. Work on capital projects and programs was already in progress such that in mid-May, when the Company completed its detailed review of capital work scheduled for the remaining months of 2015 and finalized its reprioritization plan, the Company had already incurred costs totaling approximately \$1,122,000³¹ for 13 of the 18 projects identified for Above RAM Cap cost recovery, representing approximately 26% of the total \$4,299,000 requested for approval in this Application.³²

In determining the projects and programs to be recovered under the Company's RAM Cap, the Company first assumed that customer projects and programs, and programs other than capital programs would be recovered under the RAM Cap. The Company next identified the remaining individual projects to be recovered under the RAM Cap in a mostly chronological fashion such that, for the most part, these individual projects were completed and placed into service by August 2015. The August timeframe was chosen as that was approximately the time by which the Company's 2015 plant additions for customer projects and programs, other non-customer programs, and individual projects exceeded the annual 2015 RAM Cap. As shown in the Company's Project List (Exhibit III: Maui Electric 2015 Plant Additions), the Company's 2015 plant addition target is filled such that there will not be room under the 2015 RAM Cap to provide cost recovery for the subject Projects.

³¹ Total incurred of approximately \$1,122,000 as of mid-May 2015 consisting of approximately \$1,016,000 recorded in construction work in progress as of April 30, 2015, plus an additional \$106,000 of materials costs incurred in early May 2015 for one project.

³² Exhibit III, page 4.

In Order No. 32735, the Commission stated:

With respect to recovery of revenues for capital projects, the amended RAM will thus allow continued automatic revenue recovery for capital project net plant additions in an amount effectively in rough approximation to the rate of depreciation and amortization on approved utility rate base, plus an increment of effective rate base indexed on general inflation. Beyond that, the amended RAM is intended to allow recovery of revenues for additional capital projects with prior approval by the commission.³³

Thus, for 2015, it is necessary for Maui Electric to file this application for recovery of the revenue requirement associated with certain necessary reliability projects above the RAM Cap.

As stated in the Companies' response to PUC-IR-1 in Docket No. 2013-0141, filed on June 1, 2015, losses in recovery will never be made up for the period between the in-service date and the onset of recovery. The Companies can sustain such losses to a certain extent, but systematic delays that result in a material loss of recovery can harm the Companies' financial integrity and health. The Companies' ability to operate in a manner that ensures financial stability in the long term is important. Therefore, it is essential that the Companies are allowed to recover any prudently incurred expenditures for necessary capital projects and programs through the RAM above the RAM Cap in the annual decoupling tariff transmittals. This is consistent with the statutory requirement in Section 269-16 of the Hawai'i Revised Statutes which allows public utilities the opportunity to earn a fair return on their property used and useful for public utility purposes.

³³ Order No. 32735 at 82.

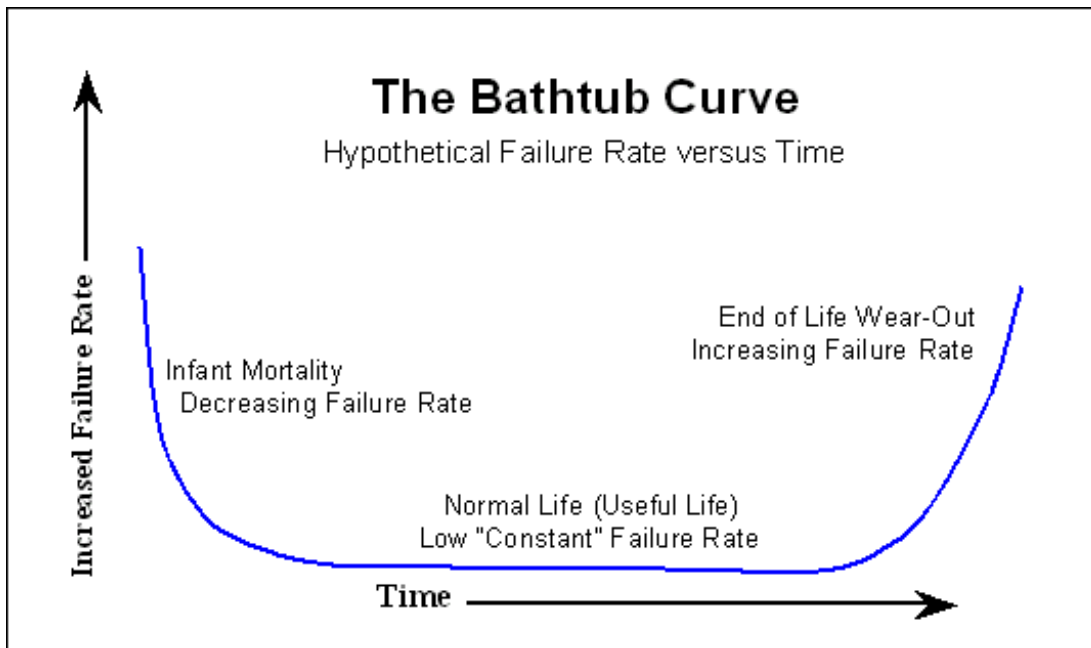
X. THE MAJOR BASELINE PROJECT IS REASONABLE AND PRUDENT

A. **Managing Assets Requires Increased Investment for the Maui Electric Grid**

In general, effectively managing assets provides for the proactive replacement of assets at or near the end of their “useful life.” This would result in sustained or improved service reliability, prevention of deteriorated performance, reasonable costs for asset replacement, the prevention of catastrophic failure, and the spreading of cost over a greater time span. Therefore, a critical element of a strategy for managing assets is to determine the appropriate time for ramping up proactive replacements of critical assets at or near the end of their useful lives. Major amounts of the electrical infrastructure on the Maui Electric power system were installed in the years following statehood when Hawai‘i experienced expansive growth in its economy. Many of the assets are 40-to-60 years old and are fast approaching their end of life.

Reliability specialists often describe the lifetime of a population of assets (or products) using a graphical representation called the “bathtub curve.” The bathtub curve consists of three periods: (1) infant mortality period with a decreasing failure rate followed; (2) a normal period, also known as the “useful life” with a low, relatively constant failure rate and concluding with; (3) a wear-out period that exhibits an increasing failure rate. The bathtub curve displayed in the figure below does not depict the failure rate of a single asset, but describes the relative failure rate of an entire population of assets over time. Some individual assets will fail relatively early (infant mortality failures), others will last until wear-out, and some will fail during the relatively long period (for example, 30 to 70 years for utility grid assets) typically called normal life. Failures during infant mortality are highly undesirable and are typically caused by defects and

errors in assembly or installation. Normal life failures are considered to be random cases of “stress exceeding strength.” Wear-out is a fact of life due to fatigue or depletion of materials.³⁴



In less technical terms, in the early life of an asset adhering to the bathtub curve, the failure rate is high but rapidly decreasing as defective assets are identified and addressed. In the mid-life of an asset, the failure rate is low and relatively constant. In the late life of the asset, the failure rate increases substantially, as age and wear take their toll on the asset.

In general, the 1960s to early 2000s are viewed as the period of normal life for electric grid infrastructure, and performance was characterized by relatively low failure rates associated with good reliability. During this period, programmatic replacement of assets was unnecessary. Instead, the infrastructure work was characterized by inspection and preventive maintenance, rejuvenation or life-extension investments, and corrective replacement of random failures. For many asset categories, the end-of-life is fast approaching and increasing failure rates are

³⁴ Wilkens, D. J., *Reliability, Hot Wire*, Issue 21, November 2002.

expected. Exhibits IV and V indicate the equipment being replaced is aged and is in need of replacement. In recognition of the situation, the Company finds it imprudent to rely on a “run-to-failure” maintenance strategy for managing the Company’s assets for the future. In particular, transmission line protection relays, circuit breakers, and reclosers have been identified as prime candidates for increased failure rates and a need for proactive replacement..

B. T&D Projects

The T&D projects primarily upgrade and address Maui Electric’s transmission system stability during fault conditions. Fault conditions occur when there is a short circuit on the transmission, distribution, or service conductor. This may happen when there is an extremely large load increase in a very short period of time. The T&D projects are primarily upgrading the Company’s 12kV, 23kV, and 69kV transmission systems. Examples of the type of work included in these projects are, but not limited to, upgrading existing protection relays, replacing oil circuit breakers with gas circuit breakers, replacing transmission switches, and replacing oil reclosers with vacuum reclosers. Failure to proactively address these issues may potentially lead to loss of stability on the system. This could result in more sustained and wide-spread outages, which could potentially lead to higher replacement and corrective costs for the Company.

Completing these T&D projects benefit the Company’s customers in a variety of ways. Replacing protective relays allows the Company to detect and isolate faults more quickly as well as more accurately detecting the location of the faults. These advances ensure that the Company only isolates the section of the system where the fault occurred and not any adjacent sections which would not need to be isolated thus reducing the number of customers who experience outages for any given system event.

Replacing old oil circuit breakers and oil reclosers incurs numerous advantages (such as a faster operating time and reduction of oil filled devices on the Company’s system). The older

equipment was filled with oil as its insulating medium but if one of these older devices fails due to age it is possible that they will ignite the oil which would damage adjacent equipment and increase the outage time to repair. By proactively removing these devices from the Company's system, the Company is helping to ensure that outage time is kept to a minimum during system events. The faster operating time of these devices also helps to ensure that the effects of a system event are seen by fewer customers as the fault doesn't have enough time to affect the system as a whole and is isolated to as small an area as possible.

These projects can be considered foundational since they have to do with replacement or upgrade of equipment that has reached the end of its service life or are related to identified safety issues within the system. The 12 baseline T&D projects and their net plant addition amounts are:

- M0001265: Pu'unene Substation Relay Replacement (\$266,141) (Completed in October 2015)
- M0001266: Kanaha Substation Relay Replacement (\$260,429) (Completed in October 2015)
- M0001918: MPP-PUK-PUU Communications Additions (\$293,350) (Estimated to be completed in December 2015)

These projects replace old electromechanical relays that have reached the end of their service life with new microprocessor based relays. The new relays and communication will allow for faster isolation of faults and provide greater system stability to Maui.

- M0001335: Kula Substation Circuit Breaker Replacement (\$271,675)

This project replaces an old oil-filled circuit breaker with a new SF6 gas filled circuit breaker as part of the Company's effort to remove oil filled equipment from the system.

This project will be completed in December 2015.

- M0001445: Haiku 23kV Transmission Line Switch (\$138,710)

This project replaced an old manual switch with a switch that could be controlled remotely allowing for reduced time in the isolation of faults on this segment of the 23kV transmission system and reducing customer outage times. This project was completed in September 2015.

- M0001708: Customer-Owned Switchgear Vault Installation (\$121,745)

This project replaces customer-owned switchgear. The existing vault was an old live-front type switchgear in an enclosed space and was not maintained by the customer who owned it. It presents a safety hazard whenever it is necessary to operate this switchgear. This project will be completed in November 2015.

- M0001894: Kanae Substation Reconstruction (\$282,784)

This project replaced equipment that is old and structures that were deteriorating to the point of collapse. This project was completed in September 2015.

- M0001919: Upcountry Recloser Replacement (\$208,231)

- M0001920: West Maui Recloser Replacement (\$167,406)

- M0001921: North Shore Recloser Replacement (\$161,688)

- M0001922: Central Maui Recloser Replacement (\$555,610)

These projects are replacing old oil filled reclosers with newer vacuum reclosers as part of the Company's effort to remove oil filled equipment from the system. These projects will be completed in November and December 2015.

- M0002063: Moloka‘i East End Regulators (E60) (\$141,252)

These regulators are being installed to mitigate some existing voltage issues on the east end of Moloka‘i. This project will be completed in December 2015.

“Exhibit IV: Transmission and Distribution System Reliability Project Descriptions” contains detailed project descriptions, customer impact, and customer benefits for these T&D projects. “Exhibit VI: Transmission & Distribution Project Costs” contains the cost breakdowns for the T&D projects.

System Security Study Impacts

Four T&D projects are directly relate to a recent system security study and the Company’s ability to clear faults from the system quickly (within 3 cycles). These projects are:

- M0001265: Pu‘unene Substation Relay Replacement
- M0001266: Kanaha Substation Relay Replacement
- M0001335: Kula Substation Circuit Breaker Replacement
- M0001918: MPP-PUK-PUU Communications Additions

To a lesser extent, four oil filled recloser replacement T&D projects are also related to the system security study. When these old devices fail, they delay fault clearing and cause instability issues (similar to the recloser that exploded in 2014). These T&D projects are:

- M0001919: Upcountry Recloser Replacement
- M0001920: West Maui Recloser Replacement
- M0001921: North Shore Recloser Replacement
- M0001922: Central Maui Recloser Replacement

Electric Power Systems Inc. (“EPS”) conducted the System Security Study, starting in 2013 and finished in 2014.³⁵ Maui Electric included this study as Appendix D in its Power Supply Improvement Plan (“PSIP”) filed with the Commission on August 28, 2014 in Docket No. 2011-0092. The System Security Study covered many subjects including frequency drop, voltage drop, needs for battery backup, minimum generation requirements, expected curtailment, and other system-related issues. Completion of the system upgrade projects listed above are part of the base case assumptions and requirements in the System Security Study to limit the under frequency load shedding (“UFLS”) due to unit and line outages.

The System Security Study looked at the years 2015, 2016, 2017, 2023, and 2030. These years were chosen due to the large changes that occur during these years, including additions of renewable energy (2015, 2016, 2017), peak load (2023), and additions of new generation units and changes in system loads (2030). The boundary conditions were identified by configuring the generation dispatches to stress the system to determine the stability and contingency reserve requirements for the system. In general, the study used the year 2023 to assess the system for the years 2018–2023 and used 2030 to assess the system for the years 2024–2030 due to the load and generation forecasts for those time periods.

Maui Electric utilizes an automatic load shed scheme to help return stability to the system during low frequency events. The scheme is split into four different stages that are activated whenever system frequency reaches preset levels. The further down the frequency progresses, the more stages will need to be tripped to shed enough load to return the frequency to its nominal point of 60 hertz.

³⁵ There is a study each for Maui, Lana‘i and Moloka‘i. In this application, the Company refers to these studies collectively as the “System Security Study.” The Company has included these studies in Exhibit VIII of this application.

The number of customers affected by each stage are approximately:

- Stage 1: 650
- Stage 2: 7400
- Stage 3: 7300
- Stage 4: 4700

With the increasing number of customers involved with each stage of load shedding, Maui Electric strongly desires to keep the number of stages tripped to a minimum.

The reduction in system inertia and system response due to displacement of conventional generation units by variable energy will result in a less robust power system. This can potentially increase the amount of stages of the UFLS scheme that will activate for unit trips and result in lower critical clearing times for all transmission and sub-transmission faults. In fact, as a base assumption for all of the scenarios and sensitivities conducted, the study assumed that the transmission system had already been upgraded with dual primary, communications-assisted relaying installed on all of the transmission system and that all N-1 faults are cleared in less than 9–11 cycles. Even with this assumption in place, the system was still unstable enough to require stage one load shedding in some situations in the years up to 2017, and stage 2 load shedding for the subsequent years through 2030 without the addition of a substantial BESS system. The situations that require load shedding vary based on which large units are baseloaded, the weather at the time, how much PV trips off when the frequency reaches 59.3 Hz, and whether or not a BESS is present on the system—all of which were covered in the System Security Study. Even with all the variables though, the load shedding mostly occurs when one of the Company's largest generating units trips offline.

Since the study came out in 2014, Maui Electric set up a plan to upgrade the Company's protective relaying on its transmission facilities and to upgrade the 69kV circuit breakers in order

to meet the expected fault clearing time of 9–11 cycles. As stated in the study: “Historically, a fault could be present on the system for 18–21 cycles (0.30–0.35 seconds) in almost all systems. Today, for faults that exist longer than 9–11 cycles (0.15–0.18 seconds), the faults can result in a total system collapse... Critical clearing times less than 18 cycles require the use of communications assisted relaying on all transmission terminals”.

Currently the fault clearing time is determined by two factors: the time it takes the protective relays to detect the fault and send a signal to the breakers; and the time it takes the signal to be received and the breaker to operate. Realizing this, Maui Electric has planned for the replacement of all old oil-filled circuit breakers in its transmission system with newer SF6 style circuit breakers as well as upgrades to its protective relaying. To best protect against faults and their currently extended clearing time, the Company has planned to have the most exposed system components upgraded first and proceed from there in decreasing order of probability of fault occurrence. This order was based on the exposed areas to possible faults. The three general different areas covered by the protective relaying were: transmission lines, substation buses, and substation transformers. The protective relaying monitors all these different areas for faults and then utilizes the circuit breakers to isolate the problematic area from the rest of the grid.

The exposed area of a transmission line stretches for many miles and goes through areas covered in trees (which are prone to falling over) and poles (which can be hit by vehicles) so it was determined to be at the highest risk. The protection upgrades for the transmission lines also require communication upgrades to some parts of the system so that the protective devices on both ends of the lines can communicate with each other. This communication is vital to using the fastest types of protection and to prevent unnecessary tripping.

The substation buses cover a much smaller area limited to the interior of the substation themselves and were determined to be the mid-level of risk. Though faults on substation buses have a potential to affect more customers in a non-failure scenario than transmission line faults, they occur much less frequently. It was this relative frequency that determined the lower risk level since, as a whole, of greater concern was the longer duration faults causing a system-wide failure so the local customer impacts are superseded by the overall survival of the grid.

The substation transformers have an even lower risk of fault and were deemed to be the lowest risk level, and therefore will have their protective relaying replaced last. It is important to note that these risk levels are relative only when comparing the three protected areas discussed here, and that they all need to be replaced to meet the requirements of the study.

Maui Electric has already completed some of these upgrades, but needs to continue to push these upgrades to maintain system security and system stability in the future.

C. Generation Projects

Maui Electric is responsible for reliable service to its customers while continuing to integrate some of the highest levels of variable renewable generation in the nation. One of the keys to successfully achieving these two objectives is having generation that has been properly maintained and can be called on to respond as the situation requires. Maui Electric works diligently to maintain its 27 generating units on Maui, nine generating units on Lana‘i, and ten units on Moloka‘i. In order to maintain a reliable adequate supply of power to Maui, Lana‘i, and Moloka‘i, the replacement of parts and upgrades identified in this Application to the Company’s power plants are essential.

The Generation projects are primarily to replace and/or upgrade failing equipment and structures at the Company’s power plants. Examples of the types of work included in these projects are, but are not limited to, replacement and upgrade various equipment and controls in

the Company's generation units, replacement of a generator, and upgrading lube oil filter housings in generating units.

The six baseline generation projects and their net plant addition amounts are:

- M0001736: M14/16 Inverter/Battery Charger System (\$445,549)

This project upgrades the inverter/battery charger on M14-16 so that they can perform satisfactorily. This project will be completed in December 2015.

- M0001757: Lana'i Caterpillar Controls Upgrade (\$467,045)

Installing upgraded controls on Caterpillar generating units 7 and 8 will standardize the unit start sequence times and provide tighter governor controls. This project was completed in October 2015.

- M0001954: M11 Replacement Lube/Oil Filter Housing (\$171,343)

- M0001955: M10 Replacement Lube/Oil Filter Housing (\$159,196)

This project replaced the obsolete K-1 lube oil filters with a new K-8 filters on the M 10 and M11 units thereby standardizing the filters with other similar generating units. These projects were completed in September 2015.

- M0001981: Hana 1 Generator Replacement (\$100,949)

This project replaced the Hana 1 Generator (15 years past its recommended life cycle) because tests showed its windings were weakening increasing the possibility of an abrupt failure. This project was completed in June 2015.

- M0002062: E-Cell EDI Module Stacks Replacement (\$85,745)

This project replaced the E-Cell EDI modules because they had deteriorated to less than 60% efficiency, undermining their ability to eliminate hazardous materials from water provided to the boiler feeders. This project was completed in September 2015.

“Exhibit V: Generation Plant Reliability Improvement Project Descriptions” contains similar information for the generation projects. “Exhibit VII: Generation Plant Project Costs” contains the cost breakdowns for the generation projects.

XI. CONCLUSION

Based on the foregoing, the Company requests Commission approval to recover the revenue requirements associated with 2015 plant additions and other associated costs for the Major Baseline Project described herein through the RAM above the 2015 RAM Cap. Furthermore, if the Company is unable to receive approval in time to include the Project costs in the 2016 RAM, it respectfully requests that the Commission allow it to include the 2016 and 2017 revenue requirements for these Projects in the 2017 RAM.

DATED: Honolulu, Hawai‘i, October 30, 2015.



Tayne S. Y. Sekimura
Financial Vice President
MAUI ELECTRIC COMPANY, LIMITED

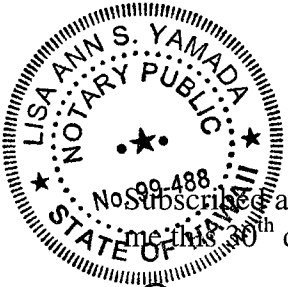
VERIFICATION

STATE OF HAWAII)
) ss.
CITY AND COUNTY OF HONOLULU)

Tayne S. Y. Sekimura, being first duly sworn, deposes and says: That she is Financial Vice President of Maui Electric Company, Limited; Applicant in the above proceeding; that she makes this verification for and on behalf of Maui Electric and is authorized so to do; that she has read the foregoing Application, and knows the contents thereof; and that the same are true of her own knowledge except as to matters stated on information or belief, and that as to those matters she believes them to be true.

Tayne S. Y. Sekimura

Tayne S. Y. Sekimura

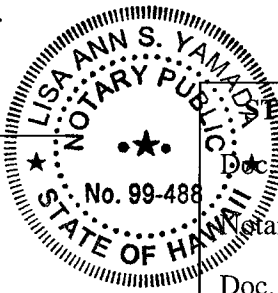


Subscribed and sworn to before
me this 30th day of October 2015.

[Signature]

LISA ANN S. YAMADA
Notary Public, First Circuit,
State of Hawai'i

My Commission expires 10-10-2019



STATE OF HAWAII NOTARY CERTIFICATION	
Doc Date: <u>10-30-15</u>	# of pages <u>242</u>
Notary Name: <u>LISA ANN S. YAMADA</u> First Circuit	
Doc. Description: <u>MEMO Appl. verif. Exh.</u>	
<u>of cert. of svc.</u>	
<i>[Signature]</i>	<u>10-30-15</u>

Hawaiian Electric Companies Response to Consumer Advocate's¹ Comments on
Companies' Proposed Standards and Guidelines for Recovery of Costs above the RAM Cap

INTRODUCTION

On March 31, 2015, the Commission issued Order No. 32735 ("Order") in Docket No. 2013-0141, which ordered certain modifications to the Hawaiian Electric Companies² Rate Adjustment Mechanism ("RAM"). The Order also directed the following:

The Companies and Consumer Advocate shall develop standards and guidelines for eligibility of projects and determination of the amount of eligible cost recovery above the RAM Cap or outside of the RAM mechanism through the REIP or other adjustment mechanism and shall present these to the Commission for approval on or before June 15, 2015. The other parties may file comments to this filing on or before June 30, 2015.³

On June 15, 2015, the Consumer Advocate and the Companies filed their *Joint Proposed Modified REIP Framework/Standards and Guidelines* ("Modified REIP Framework").

On the same day, the Companies alone filed their proposed *Standards and Guidelines for Eligibility of Projects for Cost Recovery through the RAM above the RAM Cap* ("Above RAM Cap Standards and Guidelines").⁴ The Above RAM Cap Standards and Guidelines apply to Major Projects or Major Baseline Projects that are not recovered under the RAM Cap, including those that are not eligible for recovery through the REIP, such as traditional and/or routine plant additions needed to maintain the reliability and service quality of the Companies' electrical services to their customers.⁵ In their transmittal letter, the Companies explained that:

Unfortunately, . . .the Consumer Advocate and the Companies were unable to agree on standards and guidelines for recovery through the RAM above the RAM Cap. On May 21, 2015, the Companies submitted to the Consumer Advocate proposed Standards and Guidelines for recovery of project costs through the RAM above the RAM Cap in a form substantially similar to Exhibit A hereto. Although [the] parties met on several occasions to discuss these and REIP

¹ The "Consumer Advocate" is the Division of Consumer Advocacy of the Department of Commerce and Consumer Affairs.

² The "Hawaiian Electric Companies" or "Companies" are Hawaiian Electric Company, Inc., Maui Electric Company, Limited and Hawai'i Electric Light Company, Inc.

³ Order at 114. "REIP" stands for Renewable Energy Infrastructure Program.

⁴ Hawaiian Electric Companies Letter, Exhibit A, filed on June 15, 2015, in Docket No. 2013-0141.

⁵ The Above RAM Cap Standards and Guidelines define "Major Project" as "any capital project subject to review and approval under the Commission's General Order No. 7" and "Major Baseline Project" as "any baseline project(s) subject to review and approval by the Commission for recovery through the RAM above the applicable RAM Cap. These projects may include groupings under a programmatic approach to categorize and consolidate related baseline projects for consideration. For example, multiple baseline projects that serve a related purpose or are part of a specific program may be consolidated as a Major Baseline Project for purposes of application and review. Major Baseline Projects do not include baseline projects for which recovery has been approved under the REIP surcharge."

proposed standards and guidelines, and corresponded in between, agreement was not reached on the above RAM Cap Standards and Guidelines.

The Consumer Advocate did not provide any written comments or suggested modifications for the draft proposed Above RAM Cap Standards and Guidelines that the Companies submitted to the Consumer Advocate for discussion, nor did it submit a separate filing of its own on June 15, 2015 either to address the Companies' proposed Above RAM Cap Standards and Guidelines or to submit its own standards and guidelines on recovery of project costs through the RAM above the RAM Cap.

However, on June 30, 2015, the Consumer Advocate filed *Comments in Response to Hawaiian Electric Companies Proposed Standards and Guidelines for Cost Recovery through the RAM above the RAM CAP* ("Comments") in Docket No. 2013-0141. The Consumer Advocate acknowledged that the Order did not expressly require or allow it to file the Comments.⁶ There was no procedural step in Docket No. 2013-0141 allowing the Companies to respond to the Comments. Thus, they do so here.

THE CONSUMER ADVOCATE'S POSITION IS INCONSISTENT WITH ORDER NO. 32735

In its Comments, the Consumer Advocate essentially contended that (a) the purpose of the RAM Cap is to reduce capital additions by limiting the Companies' ability to recover those costs through the RAM; and (b) the Companies' Above RAM Cap Standards and Guidelines would render the Cap meaningless by allowing unrestrained recovery of any capital expenditures above the Cap. Instead, the Consumer Advocate argued that only recovery for projects qualifying under the modified REIP mechanism should be allowed above the RAM Cap.⁷ The Companies disagree.

Order No. 32735 does not prohibit the type of capital expenditures (including baseline plant additions) that may be recovered above the RAM Cap. Nor does it establish an arbitrary or absolute limit on recovery above the Cap. Rather, the Order explicitly states that "[t]he amendments to the RAM are not designed to limit the Companies' recovery of necessary and reasonable revenue requirements[,]"⁸ and "[t]his Order does not deprive the HECO Companies of the opportunity to recover any prudently incurred expenditures or limit orderly recovery for necessary expanded capital programs. Instead, the Order limits the amount of unapproved capital project expenditures that can automatically be incorporated into effective rates through

⁶ Consumer Advocate Comments at 1.

⁷ Consumer Advocate Comments at 2-4.

⁸ Order at 80.

the RAM without timely prior regulatory review.”⁹ Of course, the Companies have to establish that any proposed recovery above the RAM Cap is just and reasonable.¹⁰

THE CONSUMER ADVOCATE’S POSITION COULD PRODUCE UNDESIRABLE RESULTS

Implicit in the Consumer Advocate’s opposition to the Above RAM Cap Standards and Guidelines is a notion that if there are plant additions for non-REIP purposes that require above the RAM Cap recovery, the Companies should forgo recovery of that investment until the next rate case. Such a position is contrary to the conceptual framework and purpose of the decoupling mechanism to avoid rate cases and to establish a mandatory rate case cycle to accomplish this, which the Consumer Advocate itself has supported.

The rationale that in the years prior to decoupling, the Companies made plant investments between rate cases but did not need to receive recovery for that investment until the next rate case, and therefore can do so now, no longer applies. First, in those days electric sales were growing and the revenues generated from those sales mitigated the need to increase rates to recover increased plant investment. However, even in those days, the Companies found it necessary to file applications for general rate increases.¹¹ In addition, sales have been decreasing since 2008 (since 2005 on Oahu) due to energy conservation, energy efficiency measures and the growing use of customer-sited distributed generation. Both the Commission and the Consumer Advocate recognized this and the resulting need for both sales decoupling (through the Revenue Balancing Account or “RBA”) and the RAM.¹²

⁹ Order at 7. Order No. 32735 further states: “The intent and purpose of the commission's amendments to the RAM are to: (a) maintain the current functions of the RAM to provide timely recovery of appropriate revenues between general rate cases; (b) ensure that sizeable capital expenditures are examined by timely review prior to automatic inclusion in effective rates through the RAM, (c) avoid adding further complexity to the decoupling mechanisms; and (d) fundamentally ensure that the RAM results in rates that are just and reasonable.” [cite]

¹⁰ The Companies do not intend to apply to recover deferred expenses through the RAM above the RAM Cap. The Standards and Guidelines state the Companies would only be able to recover the costs of major and baseline capital projects through the RAM above the RAM Cap.

¹¹ From 1990 to the implementation of decoupling in 2011, Hawaiian Electric filed for general rate increases for test years 1990, 1992, 1994, 1995, 2005, 2007, 2009 and 2011. Maui Electric filed rate cases for test years in 1993, 1996, 1997, 1999, 2007, 2010, and 2012. Hawai‘i Electric Light filed rate cases for test years in 1990, 1992, 1994, 1996, 2000, 2006 and 2010.

¹² For example, in its Final Decision and Order in Docket No. 2008-0274 (at 70-72), the Commission stated the following:

...The Consumer Advocate has added that the HECO Companies have agreed to bear a host of new efforts and costs to help achieve energy independence for the State, and that sales growth between rate cases can no longer be used by the HECO Companies to "pay for" these increased costs without needing frequent rate cases. [Footnote 143 – See Consumer Advocate Operating Brief at 8.] Thus, the proponents of the Amended Joint Proposal assert that the RAM is an essential tool to maintain the HECO Companies' financial integrity, while allowing them to achieve the State's energy objectives...

...As addressed above, Hawaii's objectives are clearly to wean itself off of fossil fuels. To accomplish this, as noted by the Consumer Advocate, the HECO Companies must undertake substantial new and costly commitments that are aimed primarily at implementing expanded wind and other clean energy technologies and at extensive energy efficiency measures. This is a substantial departure from the HECO Companies'

One of the primary reasons to implement decoupling was to reduce the frequency of rate cases. Traditional cost-of-service rate cases are costly to process, both in terms of the time and resources required by all of those involved in the cases (the utilities, the Consumer Advocate, and the Commission), as well as the cost in dollars.¹³

Frequent rate cases by the three Hawaiian Electric Companies would be a costly distraction for the Commission, the Consumer Advocate, and the Hawaiian Electric Companies at a time when a number of clean energy initiatives and other utility proceedings are before the Commission.

From a customer standpoint, the overall impact on prices should generally be the same, whether price increases result from decoupling (with recovery through the RAM and the REIP above the RAM Cap) or from rate cases. However, decoupling does include the potential to reduce a utility's cost of common equity (from what it would have been without decoupling), and to reduce rate case costs. These cost reductions would result in somewhat lower rates with decoupling, at least in the long run.

In its statement of position in Schedule A of Docket No. 2013-0141, the Consumer Advocate stated that: "The RAM is intended to serve as a substitute for formal annual rate cases, and the accounting for recorded net plant in service, plus projected net Major and Baseline Additions, less recorded and projected Accumulated Depreciation and Amortization, Contributions in Aid of Construction ('CIAC') and Accumulated Deferred Income Taxes ('ADIT'), ensures a result that is consistent with normal rate case accounting for Rate Base changes."¹⁴

The Consumer Advocate also stated that "it is reasonably likely that more frequent rate case filings by the HECO Companies will, over time, produce higher rate increases for consumers than will the more conservative annual increases under current RAM provisions."¹⁵ Further, the Consumer Advocate stated that it does not support further complication of the already complex triennial rate cases that are filed by each of the three Hawaiian Electric Companies in an effort to attempt to set just and reasonable rates based upon hypothetical inflation indices, subjectively determined multi-year utility financial forecasts or other inherently uncertain and controversial approaches.¹⁶

Thus, if the Companies are forced to file rate cases more frequent than the three-year cycle or the proposed four-year rate case moratorium, much of the benefit of the decoupling mechanism will be lost.

traditional role as energy supplier, where the HECO Companies could rely on increasing sales volumes to recover costs and earn a fair return on investments. Under these changed circumstances, the commission finds that the traditional regulatory framework will not work effectively to allow the HECO Companies to meet the RPS, as enhanced by Act 155, and other State energy mandates by 2030, and that decoupling, including the RAM, is necessary to align the HECO Companies' financial incentives with the State's energy policy.

¹³ See Hawaiian Electric Companies' Opening Brief at 16-20 and 65-68.

¹⁴ See Consumer Advocate's SOP, page 17.

¹⁵ See Consumer Advocate's SOP, footnote 16, page 22.

¹⁶ See Consumer Advocate's SOP, page 23.

THE COMPANIES ARE WILLING TO WORK WITH THE CONSUMER ADVOCATE TO IDENTIFY THE TYPES OF INFORMATION NEEDED TO SUPPORT PROJECT APPLICATIONS

The Consumer Advocate Comments state that the Above RAM Cap Standards and Guidelines do not specify minimum filing requirements or the scope or timing of additional information that would be required to support above the RAM Cap recovery, or the submission of any business case or cost/benefit analyses.

Because the recovery through the RAM above the RAM Cap could potentially apply to a broad range of project types, the Companies, by design, did not specify minimum filing requirements or specific types of information that they would file for these applications. The types of information that would be needed to support a particular project will depend on the scope, size and complexity of the project itself. Large and complex projects like the ERP/EAM, Schofield Generating Unit or Smart Grid projects would require more sophisticated support than routine projects, such as to replace degraded poles or lines, for which business cases and cost/benefit analyses should be unnecessary. However, if readily available, an asset management strategy, outage information history, customer complaints history or industry best practices, could be used to justify routine baseline projects. It might be argued that such analyses should be required for all projects but there is a substantial cost for over-studying the need for projects. The Companies would have to acquire more resources to conduct these analyses, it would reduce efficiency and increase the lead time to prepare for and implement projects.

It is noteworthy that there are no minimum filing requirements for General Order No. 7 projects.¹⁷ The Companies have filed General Order No. 7 project applications since at least the 1960s. The Companies have worked informally with the Consumer Advocate to identify the types of information that the Consumer Advocate needs to conduct its review of the project applications. Likewise for applications for Major Baseline Projects, the Companies were willing at the time of development of the Above RAM Cap Standards and Guidelines and continue to be more than willing to work with the Consumer Advocate on identifying what kinds of information they should file to support their applications.¹⁸ However, as stated above, the Companies would not be willing to submit detailed business case and cost/benefit analyses for all types of projects.

THE USE OF PROJECT LISTS TO DEMONSTRATE WHAT PROJECTS ARE BELOW THE RAM CAP IS A WORKABLE PROCESS AND IS COMPLETELY DIFFERENT FROM THE COMPANIES' RAM PROPOSAL IN DOCKET NO. 2013-0141

The Consumer Advocate Comments state that the modified annual reporting process in the Above RAM Cap Standards and Guidelines is similar to the expanded reporting of capital projects recommended by Companies in Docket No. 2013-0141 as a potential modification to the

¹⁷ General Order No. 7 projects are projects with capital costs in excess of \$2.5 million and for which Commission approval is required in accordance with Rule 2.3.g.2. of General Order No. 7.

¹⁸ See Order No. 32735 at 98. The Order states the following: "The Companies may use a programmatic approach to categorizing and consolidating related baseline projects for consideration as Major Projects. For example, multiple baseline projects that serve a related purpose or are part of a specific program may be consolidated as a Major Project for purposes of application and review." The Companies refer to such projects as "Major Baseline Projects."

rate base RAM, which would require extensive advance Commission review and approvals. This is not the case. The modified annual reporting in the proposed Above RAM Cap Standards and Guidelines calls for the annual capital expenditures budget reports filed by the beginning of the year to identify the Major Projects and Major Baseline Projects that the Companies project will be covered under the RAM Cap, and for the capital project completion reports filed at the beginning of the following year to identify the Major Projects and Major Baseline projects that were actually completed and recovered under the RAM Cap in the preceding year. The purpose of the modified annual reporting is to demonstrate what projects are covered under the RAM Cap and what projects are not. The Above RAM Cap Standards and Guidelines do not call for the Commission to approve this reporting. The Companies would need to demonstrate that a particular project is not covered under the RAM Cap to justify the need to recover project costs above the RAM Cap regardless of whether the recovery mechanism is the REIP surcharge or the RAM. The Modified REIP Framework does not address what will determine whether a particular REIP project is above or below the RAM Cap. The Companies plan to use the modified annual reporting to support both the recovery of projects through the REIP and RAM above the RAM Cap applications.

The Consumer Advocate Comments argue that the use of the language in footnote 4 on page 6 of Order No. 32735 (i.e., “With respect to recovery of revenues for capital projects, the amended RAM will thus allow continued automatic revenue recovery for capital project net plant additions in an amount effectively in rough approximation to the rate of depreciation and amortization on approved utility rate base, plus an increment of effective rate base indexed on general inflation. Beyond that, the amended RAM is intended to allow recovery of revenues for additional capital projects with prior approval by the commission”) to estimate the amount of plant additions recovered under the RAM Cap in any give RAM period is “inherently inaccurate and also fails to consider the continuous growth in the Hawaiian Electric Companies’ Accumulated Deferred Income Taxes (‘ADIT’) as a significant source of funding for net plant additions.”¹⁹ The Companies acknowledge that it will be difficult to determine a precise amount of plant additions that would be recovered under the RAM Cap since the RAM Cap was designed to apply to total target revenues and not specifically to a rate base RAM or plant addition amount. However, that should not prevent the parties from working towards a solution that would make the Commission’s RAM modifications workable. For its intended purpose, an estimate of the amount of plant additions that would be recovered under the RAM Cap would be sufficient. Also, the Companies were aware of the Consumer Advocate’s desire to consider the impacts of ADIT. As a result, the modified annual reporting will reflect the impact of ADIT on the identification of projects covered under the RAM Cap.

IN THEIR ANNUAL RAM FILINGS, THE COMPANIES WILL BE ABLE TO SEPARATELY PRESENT PROJECTS THAT ARE RECOVERED ABOVE THE RAM CAP

The Consumer Advocate Comments allege that the inclusion of above the RAM Cap projects in the annual decoupling filings will complicate the calculations and presentation of that filing, and that the Above RAM Cap Standards and Guidelines are silent with respect to how future RAM filings would be modified to accommodate the above the cap projects. In the Companies’ view it is not necessary for the Above RAM Cap Standards and Guidelines to specify how they will

¹⁹ Consumer Advocate Comments at 5.

modify future RAM filings to incorporate the impacts of projects recovered through the RAM above the RAM Cap. The details on changes to the annual decoupling filings can be handled separately between the Companies and the Consumer Advocate, as they have always been. Nevertheless, the transmittal letter dated June 15, 2015 for the proposed Above RAM Cap Standards and Guidelines explained how the Companies plan to reflect these projects in the decoupling filing templates and how the calculations and presentation will be affected.²⁰ Likewise, these templates would also have to reflect the impacts of the projects that are recovered through the REIP surcharge above the RAM Cap. The Modified REIP Framework does not address how the templates would be modified to accommodate the REIP projects.

CONCLUSION

The Hawaiian Electric Companies have a genuine desire to make the processes to implement the modifications to the RAM work. They have every incentive to make the process efficient for the Commission, the Consumer Advocate and themselves. The Companies invite the Consumer Advocate to provide input and will seriously consider any suggestions or recommendations that the Consumer Advocate might offer.

²⁰ See *Hawaiian Electric Companies Standards and Guidelines for Eligibility of Projects for Cost Recovery through the RAM above the RAM Cap*, filed June 15, 2015, Docket No. 2013-0141 at 3.

MECO Above the Cap Revenue Requirement - Bill Impact
Summary

		1 - T&D				T&D			
		Total - T&D				Trans: Station Equipment - Over 69kV			
Year	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	
1 2015	165,208	1,080,584	0.0153	\$ 0.08	45,802	1,080,584	0.0042	\$ 0.02	
2 2016	395,868	1,064,908	0.0372	\$ 0.19	104,490	1,064,908	0.0098	\$ 0.05	
3 2017	381,283	1,064,140	0.0358	\$ 0.18	100,225	1,064,140	0.0094	\$ 0.05	
4 2018	367,516	1,079,331	0.0341	\$ 0.17	96,288	1,079,331	0.0089	\$ 0.04	
5 2019	354,498	1,089,838	0.0325	\$ 0.16	92,645	1,089,838	0.0085	\$ 0.04	
6 2020	342,168	1,097,226	0.0312	\$ 0.16	89,269	1,097,226	0.0081	\$ 0.04	
7 2021	330,414	1,097,458	0.0301	\$ 0.15	86,080	1,097,458	0.0078	\$ 0.04	
8 2022	319,080	1,101,722	0.0290	\$ 0.14	82,952	1,101,722	0.0075	\$ 0.04	
9 2023	307,945	1,110,255	0.0277	\$ 0.14	79,821	1,110,255	0.0072	\$ 0.04	
10 2024	296,839	1,121,162	0.0265	\$ 0.13	76,691	1,121,162	0.0068	\$ 0.03	
Total	3,260,820				854,262				
NPV @	2,778,787		3.00%		728,623				
NPV @	2,335,389		6.51%		612,990				
NPV @	1,827,504		12.00%		480,437				

		2 - Production				2 - Production			
		Total - Production				Steam and Other - Misc Power Plant Equipment			
Year	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	
1 2015	82,448	1,080,584	0.0076	\$ 0.04	4,944	1,080,584	0.0005	\$ 0.00	
2 2016	198,676	1,064,908	0.0187	\$ 0.09	14,539	1,064,908	0.0014	\$ 0.01	
3 2017	191,719	1,064,140	0.0180	\$ 0.09	13,945	1,064,140	0.0013	\$ 0.01	
4 2018	185,102	1,079,331	0.0171	\$ 0.09	13,372	1,079,331	0.0012	\$ 0.01	
5 2019	178,798	1,089,838	0.0164	\$ 0.08	12,817	1,089,838	0.0012	\$ 0.01	
6 2020	172,785	1,097,226	0.0157	\$ 0.08	12,280	1,097,226	0.0011	\$ 0.01	
7 2021	167,040	1,097,458	0.0152	\$ 0.08	11,758	1,097,458	0.0011	\$ 0.01	
8 2022	161,543	1,101,722	0.0147	\$ 0.07	11,252	1,101,722	0.0010	\$ 0.01	
9 2023	156,186	1,110,255	0.0141	\$ 0.07	10,754	1,110,255	0.0010	\$ 0.00	
10 2024	150,848	1,121,162	0.0135	\$ 0.07	10,257	1,121,162	0.0009	\$ 0.00	
Total	1,645,144				115,919				
NPV @	1,401,456		3.00%		98,805				
NPV @	1,177,365		6.51%		83,045				
NPV @	920,784		12.00%		64,967				

Notes:

- Sales Forecast from Forecasting Division. Sales Forecast is the May 2015 Forecast and subject to change for updates as part of the Company's 2016 budget process.

I&D			I&D			I&D					
Trans: Station Equipment - Under 69kV			Trans: OH Conductors and Devices			Distr: UG Conductors and Devices					
Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh
7,998	1,080,584	0.0007	\$ 0.00	9,323	1,080,584	0.0009	\$ 0.00	7,020	1,080,584	0.0006	\$ 0.00
18,308	1,064,908	0.0017	\$ 0.01	21,063	1,064,908	0.0020	\$ 0.01	16,234	1,064,908	0.0015	\$ 0.01
17,698	1,064,140	0.0017	\$ 0.01	20,371	1,064,140	0.0019	\$ 0.01	15,688	1,064,140	0.0015	\$ 0.01
17,121	1,079,331	0.0016	\$ 0.01	19,717	1,079,331	0.0018	\$ 0.01	15,170	1,079,331	0.0014	\$ 0.01
16,575	1,089,838	0.0015	\$ 0.01	19,099	1,089,838	0.0018	\$ 0.01	14,679	1,089,838	0.0013	\$ 0.01
16,056	1,097,226	0.0015	\$ 0.01	18,514	1,097,226	0.0017	\$ 0.01	14,213	1,097,226	0.0013	\$ 0.01
15,564	1,097,458	0.0014	\$ 0.01	17,958	1,097,458	0.0016	\$ 0.01	13,770	1,097,458	0.0013	\$ 0.01
15,096	1,101,722	0.0014	\$ 0.01	17,431	1,101,722	0.0016	\$ 0.01	13,348	1,101,722	0.0012	\$ 0.01
14,641	1,110,255	0.0013	\$ 0.01	16,920	1,110,255	0.0015	\$ 0.01	12,938	1,110,255	0.0012	\$ 0.01
14,188	1,121,162	0.0013	\$ 0.01	16,411	1,121,162	0.0015	\$ 0.01	12,529	1,121,162	0.0011	\$ 0.01
153,247				176,808				135,589			
130,526				150,588				115,490			
109,641				126,489				97,013			
85,740				98,912				75,866			

2 - Production			2 - Production			2 - Production					
Other - Accessory Electric Equipment			Other - Prime Movers			Other - Generators					
Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh
52,623	1,080,584	0.0049	\$ 0.02	19,060	1,080,584	0.0018	\$ 0.01	5,821	1,080,584	0.0005	\$ 0.00
125,767	1,064,908	0.0118	\$ 0.06	44,458	1,064,908	0.0042	\$ 0.02	13,912	1,064,908	0.0013	\$ 0.01
121,397	1,064,140	0.0114	\$ 0.06	42,949	1,064,140	0.0040	\$ 0.02	13,429	1,064,140	0.0013	\$ 0.01
117,243	1,079,331	0.0109	\$ 0.05	41,518	1,079,331	0.0038	\$ 0.02	12,969	1,079,331	0.0012	\$ 0.01
113,290	1,089,838	0.0104	\$ 0.05	40,160	1,089,838	0.0037	\$ 0.02	12,532	1,089,838	0.0011	\$ 0.01
109,521	1,097,226	0.0100	\$ 0.05	38,868	1,097,226	0.0035	\$ 0.02	12,115	1,097,226	0.0011	\$ 0.01
105,925	1,097,458	0.0097	\$ 0.05	37,640	1,097,458	0.0034	\$ 0.02	11,717	1,097,458	0.0011	\$ 0.01
102,487	1,101,722	0.0093	\$ 0.05	36,468	1,101,722	0.0033	\$ 0.02	11,337	1,101,722	0.0010	\$ 0.01
99,137	1,110,255	0.0089	\$ 0.04	35,328	1,110,255	0.0032	\$ 0.02	10,966	1,110,255	0.0010	\$ 0.00
95,800	1,121,162	0.0085	\$ 0.04	34,194	1,121,162	0.0030	\$ 0.02	10,597	1,121,162	0.0009	\$ 0.00
1,043,189				370,641				115,395			
888,644				315,708				98,300			
746,535				265,205				82,580			
583,836				207,398				64,583			

T&D				T&D				T&D			
Distr: OH Conductors and Devices				Distr: Structures and Improvements				Communication Equipment			
Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast ¹ (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh	Revenue Requirement	Sales Forecast (MWh)	Cents Per kWh	Typical Mo. Bill 500 kWh
61,843	1,080,584	0.0057	\$ 0.03	16,306	1,080,584	0.0015	\$ 0.01	16,915	1,080,584	0.0016	\$ 0.01
141,901	1,064,908	0.0133	\$ 0.07	38,275	1,064,908	0.0036	\$ 0.02	55,596	1,064,908	0.0052	\$ 0.03
137,163	1,064,140	0.0129	\$ 0.06	36,968	1,064,140	0.0035	\$ 0.02	53,170	1,064,140	0.0050	\$ 0.02
132,679	1,079,331	0.0123	\$ 0.06	35,727	1,079,331	0.0033	\$ 0.02	50,814	1,079,331	0.0047	\$ 0.02
128,430	1,089,838	0.0118	\$ 0.06	34,549	1,089,838	0.0032	\$ 0.02	48,521	1,089,838	0.0045	\$ 0.02
124,399	1,097,226	0.0113	\$ 0.06	33,428	1,097,226	0.0030	\$ 0.02	46,289	1,097,226	0.0042	\$ 0.02
120,570	1,097,458	0.0110	\$ 0.05	32,361	1,097,458	0.0029	\$ 0.01	44,111	1,097,458	0.0040	\$ 0.02
116,927	1,101,722	0.0106	\$ 0.05	31,342	1,101,722	0.0028	\$ 0.01	41,984	1,101,722	0.0038	\$ 0.02
113,388	1,110,255	0.0102	\$ 0.05	30,351	1,110,255	0.0027	\$ 0.01	39,886	1,110,255	0.0036	\$ 0.02
109,863	1,121,162	0.0098	\$ 0.05	29,364	1,121,162	0.0026	\$ 0.01	37,792	1,121,162	0.0034	\$ 0.02
1,187,163				318,672				435,079			
1,011,160				271,446				370,953			
849,371				228,027				311,858			
664,215				178,326				244,008			

**MECO Above the Cap Revenue Requirement - Bill Impact
Summary**

		MECO			
<u>Year</u>		MECO	Sales Forecast ¹ <u>(MWh)</u>	Cents <u>Per kWh</u>	Typical Mo. Bill <u>500 kwh</u>
1	2015	247,656	1,080,584	0.0229	0.11
2	2016	594,544	1,064,908	0.0558	0.28
3	2017	573,002	1,064,140	0.0538	0.27
4	2018	552,618	1,079,331	0.0512	0.26
5	2019	533,296	1,089,838	0.0489	0.24
6	2020	514,953	1,097,226	0.0469	0.23
7	2021	497,454	1,097,458	0.0453	0.23
8	2022	480,624	1,101,722	0.0436	0.22
9	2023	464,131	1,110,255	0.0418	0.21
10	2024	447,687	1,121,162	0.0399	0.20
	Total	4,905,965			
	NPV @ 3.00%	4,180,243			
	NPV @ 6.51%	3,512,754			
	NPV @ 12.00%	2,748,288			

Notes:

1. Sales Forecast from Forecasting Division. Sales Forecast is the May 2015 Forecast and subject to change for updates as part of the Company's 2016 budget process.

MECO Above the Cap Revenue Requirement - Bill Impact
Revenue Requirements Model
Assumptions

Manual Input

TY 2011 Cost of Capital Assumptions

	Weight	Rate	Weighted Average	Alter-Tax Weighted Average	Weighted Average Revenue Requirement	Weighted Average Gross-up for Income Taxes
Short Term Debt	1.23%	1.25%	0.02%	0.01%	0.017%	0.02%
Long Term Debt (Taxable Debt)	38.44%	5.06%	1.95%	1.19%	2.135%	1.95%
Hybrids	2.30%	7.32%	0.17%	0.10%	0.185%	0.17%
Preferred Stock	1.17%	8.25%	0.10%	0.10%	0.173%	0.16%
Common Stock	56.86%	9.00%	5.12%	5.12%	9.194%	8.38%
	100.00%		7.34%	6.514%	11.703%	10.663%

Tax Assumptions

Federal Income Tax Rate	35.00%
State Income Tax Rate	6.40%
	38.91%

State Investment Tax Credit (ITC)

State ITC Basis	4.00%
State ITC Amortization Period	48

Public Service Company Tax

PUC Fee	5.885%
Franchise Tax	0.500%
Composite Revenue Tax Rate	2.500%
	8.865%

Project Assumptions

	1.09751
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1 - T&D						
Trans. Station Equipment - Over.	Trans. Station Equipment - Under.	Transmission		Distribution		General Communication Equipment
		Trans. OH Conductors and Devices	Distr. UG Conductors and Devices	Distr. OH Conductors and Devices	Distr. Structures and Improvements	
\$ 798,245	\$ 138,710	\$ 161,688	\$ 121,745	\$ 1,072,500	\$ 282,784	\$ 293,350

Capital Investment Plant Add Date 2015

59	59	65	55	58	50	15
15	20	20	20	20	20	20
30	30	30	30	30	30	30

Depreciation

Average Useful Life	45
MACRS Tax Life ("Tax Life")	20
Tax Class Life ("Class Life")	30

O&M

\$ -

Escalation Rate

0.0%

2 - Production					
Steam and Other - Misc. Power Plant Equipment	Other - Accessory Equipment	Other - Prime Movers	Other - Generators	Production	
				Electric Equipment	Other - Generators
\$ 85,745	\$ 912,584	\$ 330,539	\$ 100,949		

20	45	52	45
20	20	20	20
30	30	30	30

Table with 29 columns and multiple rows of financial data. Headers include 'MECO Above the Cap Revenue Requirement', 'Revenue Requirements Model - Calculated', 'Manual Input', 'O&M Escalation Rate', 'Paint Asset Depreciation', 'Book Depreciation', 'Tax Depreciation Rates (Straight Line)', 'Revenue Bond Financing Tax Basis (SL)', 'Tax Depreciation Rates (MACRS)', 'Non-Ref. Financed Tax Basis (MACRS)', 'Accumulated Tax Depreciation', 'State Investment Tax Credit (ITC)', 'State ITC Amortization Rate', 'Accumulated Amortization', 'Deferred Tax Asset (Liability)', 'Deferred Tax Base', 'Deferred Taxes - Federal', 'Deferred Taxes - State excluding credit', 'Change in Deferred Taxes', 'Accumulated Deferred Taxes', 'Change in Deferred ITC', 'Rate Base and Financing', 'Investment, (Rate Base)', 'Gross Plant', 'Accumulated Depreciation', 'Accumulated Deferred Taxes', 'Ending Net Investment', 'Average Net Investment', 'Average Financing', 'Short Term Debt', 'Long Term Debt (Revenue Bonds)', 'Taxable Debt', 'Preferred Stock', 'Common Equity', 'Total Financing', 'Return on Investment', 'Short Term Debt (Taxable Debt)', 'Hybrids', 'Total Interest Expense', 'Preferred Dividends', 'Net Income on Common', 'Income Taxes', 'Income Before Prof Dividends', 'Income Before Taxes (Including ITC)', 'Income Before Taxes (excluding ITC)', 'Federal Income Tax', 'State Income Tax', 'State Investment Tax Credit', 'Total State Tax', 'Total Taxes', 'Revenue Requirement Calculation', 'Revenue Requirement Factors', 'Revenue Requirement', 'Revenue Taxes', 'Income Before Depr, Int, Inc Tax', 'Depreciation Expense', 'Interest Expense'. Each row contains numerical values across all 29 columns.

MECO Above the Cap Revenue Requirement												
Revenue Requirements Model - Calculated												
	2068	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	
	54	55	57	58	59	60	61	62	63	64	65	
											Total	
Manual Input												
O&M												
Escalation Rate												
O&M												
Plant Asset Depreciation												
Book Depreciation												
Book Depreciation Rates	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	0.000%	0.000%	0.000%	0.000%	0.000%	
Depreciation Expense	13,763	13,763	13,763	13,763	13,763	13,763	0.000%	0.000%	0.000%	0.000%	0.000%	
Accumulated Depreciation	729,431	736,956	770,719	794,482	798,245	798,245	798,245	798,245	798,245	798,245	798,245	
Tax Depreciation												
Tax Depreciation Rates (Straight Line)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
Revenue Bond Financed Tax Basis (SL)												
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
NonRFB Financed Tax Basis (MACRS)												
Tax Depreciation												
Accumulated Tax Depreciation	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	
State Investment Tax Credit (ITC)												
Book												
State ITC Amortization Rate	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
Amortization of State ITC												
Accumulated Amortization												
Deferred ITC												
Tax												
Deferred Tax Calculation												
Book Accumulated Depreciation	729,431	756,956	770,719	794,482	798,245	798,245	798,245	798,245	798,245	798,245	798,245	
Tax Accumulated Depreciation	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	
Book/Tax Acc. Depr. Difference	(68,814)	(41,289)	(27,526)	(13,763)	-	-	-	-	-	-	-	
Deferred ITC												
Net Deferred Tax Asset (Liability)	(26,775)	(21,420)	(10,710)	(5,355)	-	-	-	-	-	-	-	
Deferred Tax Base	(13,763)	(13,763)	(13,763)	(13,763)	(13,763)	-	-	-	-	-	-	
Deferred Taxes - Federal	(4,527)	(4,527)	(4,527)	(4,527)	(4,527)	-	-	-	-	-	-	
Deferred Taxes - State excluding credit	(828)	(828)	(828)	(828)	(828)	-	-	-	-	-	-	
Change in Deferred Taxes	(5,355)	(5,355)	(5,355)	(5,355)	(5,355)	-	-	-	-	-	-	
Accumulated Deferred Taxes	26,775	21,420	10,710	5,355	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
Change in Deferred ITC												
Rate Base and Financing												
Investment (Rate Base)												
Gross Plant	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	798,245	
Accumulated Depreciation	729,431	756,956	770,719	794,482	798,245	798,245	798,245	798,245	798,245	798,245	798,245	
Accumulated Deferred Taxes	26,775	21,420	10,710	5,355	(0)	(0)	(0)	(0)	(0)	(0)	(0)	
Accumulated Deferred ITC	42,039	33,631	25,223	16,816	8,408	0	0	0	0	0	0	
Ending Net Investment	46,243	37,835	29,427	21,019	12,612	4,204	0	0	0	0	0	
Average Net Investment												
Average Financing												
Short Term Debt	569	465	362	259	155	0	0	0	0	0	0	
Long Term Debt (Revenue Bonds)	17,775	14,543	11,312	8,080	4,848	1,616	0	0	0	0	0	
Taxable Debt	1,065	872	678	494	291	97	0	0	0	0	0	
Preferred Stock	539	441	343	245	147	49	0	0	0	0	0	
Common Equity	26,294	21,513	16,733	11,952	7,171	2,360	0	0	0	0	0	
Total Financing	46,243	37,835	29,427	21,019	12,612	4,204	0	0	0	0	0	
Return on Investment												
Short Term Debt	7	6	5	3	2	1	0	0	0	0	0	
Short Term Debt (Taxable Debt)	899	572	409	245	82	0	0	0	0	0	0	
Hybrids	78	64	50	35	21	7	0	0	0	0	0	
Total Interest Expense	985	806	627	448	269	90	0	0	0	0	0	
Preferred Dividends	44	36	28	20	12	4	0	0	0	0	0	
Net Income on Common	2,366	1,936	1,506	1,076	645	215	0	0	0	0	0	
Income Taxes												
Income Before Pref Dividends	2,411	1,973	1,534	1,096	658	219	0	0	0	0	0	
Income Before Taxes (including ITC)	3,947	3,229	2,511	1,794	359	0	0	0	0	0	0	
Investment Tax Credit												
Income Before Taxes (excluding ITC)	3,947	3,229	2,511	1,794	359	0	0	0	0	0	0	
Federal Income Tax	1,298	1,062	826	590	354	118	0	0	0	0	0	
State Income Tax	237	194	151	108	65	22	0	0	0	0	0	
State Investment Tax Credit	237	194	151	108	65	22	0	0	0	0	0	
Total State Tax	1,536	1,256	977	698	419	140	0	0	0	0	0	
Total Taxes												
Revenue Requirement Calculation												
Revenue Requirement Factors	0.0257	0.0245	0.0232	0.0220	0.0195	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Revenue Requirement	20,517	19,533	18,549	17,565	16,581	15,597	0	0	0	0	0	
Revenue Taxes	1,823	1,735	1,648	1,561	1,473	1,386	0	0	0	0	0	
Income Before Degr. Int. Inc Tax	18,694	17,797	16,901	16,004	15,108	14,211	0	0	0	0	0	
Depreciation Expense	13,763	13,763	13,763	13,763	13,763	13,763	0	0	0	0	0	
O&M												
Interest Expense	985	806	627	448	269	90	0	0	0	0	0	

MECO Above the Cap Revenue Requirement - Bill Impact		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Revenue Requirements Model - Calculations		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Manual Input																		
O&M Escalation Rate																		
O&M																		
Plant Asset Depreciation																		
Book Depreciation																		
Book Depreciation Rates	0.000%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%	1.724%
Accumulated Depreciation		2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392
Tax Depreciation		4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783	4,783
Tax Depreciation Rates (Straight Line)	30	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financial Tax Basis (S/L)	20	3.750%	5.715%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%	6.177%
NonRB Financial Tax Basis (MACRS)	100.0%	5.202	10.013	10.013	9.262	7.924	7.331	6.780	6.272	6.189	6.188	6.188	6.188	6.189	6.188	6.188	6.188	6.188
Accumulated Tax Depreciation	5.202	15,215	33,045	24,477	33,045	40,989	48,300	55,080	61,353	67,542	73,730	79,919	86,107	92,295	98,484	104,673	110,861	117,050
State Investment Tax Credit (ITC)																		
State ITC Amortization Rate	0.000%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Accumulated Amortization	4.00%																	
Deferred ITC																		
Tax																		
Deferred Tax Calculation																		
Book Accumulated Depreciation		2,392	4,783	7,175	9,566	11,958	14,349	16,741	19,132	21,524	23,915	26,307	28,699	31,090	33,482	35,873	38,265	
Tax Accumulated Depreciation	5.202	15,215	33,045	24,477	33,045	40,989	48,300	55,080	61,353	67,542	73,730	79,919	86,107	92,295	98,484	104,673	110,861	
Deferred Tax (Tax - Book)	(2.024)	(4,890)	(10,966)	(12,219)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)
Net Deferred Tax Asset (Liability)	(2.024)	(4,890)	(10,966)	(12,219)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)	(12,870)
Deferred Tax Base	5.202	7,622	6,870	6,177	5,533	4,939	4,345	3,751	3,157	2,562	1,968	1,374	780	186	59	0	0	0
Deferred Taxes - Federal	1.711	2,507	2,260	2,032	1,820	1,625	1,444	1,277	1,120	968	820	677	538	394	246	94	0	0
Deferred Taxes - State excluding credit	3.124	2,866	2,613	2,372	2,143	1,922	1,708	1,501	1,298	1,096	894	692	490	288	82	0	0	0
Change in Deferred Taxes	2.024	2,866	2,613	2,403	2,153	1,922	1,708	1,501	1,298	1,096	894	692	490	288	82	0	0	0
Accumulated Deferred Taxes	2.024	4,980	7,663	10,066	12,219	14,141	15,848	17,356	18,836	20,313	21,791	23,268	24,746	26,223	27,700	29,178	30,655	
Change in Deferred ITC																		
Rate Base and Financing																		
Investment (Rate Base)																		
Gross Plant	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	
Accumulated Depreciation		2,392	4,783	7,175	9,566	11,958	14,349	16,741	19,132	21,524	23,915	26,307	28,699	31,090	33,482	35,873	38,265	
Accumulated Deferred Taxes	2.024	4,980	7,663	10,066	12,219	14,141	15,848	17,356	18,836	20,313	21,791	23,268	24,746	26,223	27,700	29,178	30,655	
Ending Net Investment	136,686	131,329	126,264	121,469	116,925	112,611	108,512	104,611	100,902	97,378	94,043	90,886	87,897	85,064	82,385	79,851	77,458	
Average Net Investment	68,343	134,007	128,796	123,867	119,187	114,768	110,562	106,561	102,676	98,907	95,254	91,710	88,274	84,944	81,712	78,576	75,533	
Average Financing																		
Short Term Debt (Revenue Bonds)	641	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	1,548	
Hybrids	26,270	51,611	49,509	47,513	45,518	43,522	41,527	39,532	37,537	35,542	33,547	31,552	29,557	27,562	25,567	23,572	21,577	
Preferred Stock	1,575	3,088	2,968	2,854	2,746	2,644	2,547	2,455	2,368	2,287	2,211	2,141	2,076	2,015	1,959	1,907	1,857	
Common Equity	38,860	76,198	73,235	70,432	67,776	65,268	62,866	60,522	58,322	56,262	54,335	52,540	50,876	49,343	47,942	46,674	45,539	
Total Financing	68,343	134,007	128,796	123,867	119,187	114,768	110,562	106,561	102,676	98,907	95,254	91,710	88,274	84,944	81,712	78,576	75,533	
Return on Investment																		
Short Term Debt	1.25%	11	21	20	19	18	17	16	16	16	15	15	14	13	13	12	12	
Long Term Debt (Taxable Debt)	5.06%	1,329	2,606	2,505	2,409	2,318	2,232	2,150	2,073	1,997	1,922	1,847	1,771	1,696	1,621	1,546	1,470	
Hybrids	7.32%	115	226	217	209	201	196	190	180	173	167	161	154	147	141	134	127	
Total Interest Expense	1.485%	1,455	2,853	2,742	2,637	2,538	2,443	2,354	2,269	2,186	2,104	2,021	1,939	1,857	1,774	1,692	1,609	
Preferred Dividends	9.25%	66	129	119	110	104	98	92	86	80	74	68	63	58	53	48	43	
Net Income on Common	9.09%	3,497	6,859	6,591	6,339	6,100	5,873	5,656	5,453	5,254	5,059	4,868	4,681	4,498	4,319	4,144	3,972	
Income Taxes																		
Income Before Prof Dividends	3,563	6,987	6,715	6,458	6,215	5,984	5,764	5,556	5,353	5,151	4,950	4,750	4,546	4,345	4,143	3,941	3,739	
Income Before Taxes (including ITC)	5,833	11,437	10,962	10,571	10,173	9,795	9,436	9,094	8,763	8,433	8,102	7,772	7,442	7,112	6,782	6,451	6,121	
Investment Tax Credit																		
Federal Income Taxes (excluding ITC)	5,833	11,437	10,962	10,571	10,173	9,795	9,436	9,094	8,763	8,433	8,102	7,772	7,442	7,112	6,782	6,451	6,121	
State Income Tax	351	688	661	636	612	589	568	547	527	507	487	468	448	428	408	388	368	
State Investment Tax Credit	351	688	661	636	612	589	568	547	527	507	487	468	448	428	408	388	368	
Total Taxes	2,269	4,450	4,277	4,113	3,958	3,811	3,671	3,539	3,410	3,281	3,151	3,021	2,892	2,763	2,633	2,504	2,374	
Revenue Requirement Calculation																		
Revenue Requirement Factors	0.0577	0.1320	0.1276	0.1234	0.1195	0.1158	0.1122	0.1088	0.1056	0.1023	0.0990	0.0958	0.0925	0.0892	0.0860	0.0827	0.0794	
Revenue Requirement	7,998	18,308	17,698	17,121	16,575	16,056	15,564	15,096	14,641	14,198	13,766	13,344	12,932	12,530	12,138	11,756	11,384	
Revenue Taxes	7,288	16,681	16,126	15,600	15,102	14,630	14,181	13,755	13,340	12,932	12,515	12,103	11,690	11,278	10,866	10,454	10,042	
Depreciation Expense	-	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	
Interest Expense	1,455	2,853	2,742	2,637	2,538	2,443	2,354	2,269	2,186	2,104	2,021	1,939	1,857	1,774	1,692	1,609	1,527	

REC-0 Above the Cap Revenue Requirer																			
Revenue Requirements Model - Calculated																			
	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
Manual Input																			
O&M Escalation Rate																			
O&M																			
Plant Asset Depreciation																			
Book Depreciation	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%
Depreciation Rates	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392
Escalation Expense	40,656	43,048	45,439	47,831	50,223	52,614	55,006	57,397	59,789	62,180	64,572	66,963	69,355	71,747	74,138	76,530	78,921	81,313	83,705
Accumulated Depreciation																			
Tax Depreciation																			
Tax Depreciation Rate (Straight Line)	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%	3,333%
Revenue Bond Financed Tax Basis (SL)	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%	4,461%
Tax Depreciation Rates (MACRS)	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188	6,188
Non-Bond Financed Tax Basis (MACRS)	123,238	129,427	135,615	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Accumulated Tax Depreciation																			
State Investment Tax Credit (ITC)																			
Book																			
State ITC Amortization Rate	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%	2.063%
Amortization of State ITC																			
Accumulated Amortization																			
Deferred ITC																			
Tax																			
Deferred Tax Calculation																			
Book Accumulated Depreciation	40,656	43,048	45,439	47,831	50,223	52,614	55,006	57,397	59,789	62,180	64,572	66,963	69,355	71,747	74,138	76,530	78,921	81,313	83,705
Tax Accumulated Depreciation	123,238	129,427	135,615	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Book/Tax Acc Depr Difference	(82,582)	(86,380)	(90,176)	(90,879)	(88,487)	(86,096)	(83,704)	(81,313)	(78,921)	(76,530)	(74,138)	(71,747)	(69,355)	(66,963)	(64,572)	(62,180)	(59,789)	(57,397)	(54,997)
Deferred ITC																			
Net Deferred Tax Asset (Liability)	(32,122)	(33,610)	(35,097)	(35,581)	(34,420)	(33,260)	(32,100)	(31,039)	(30,708)	(29,777)	(28,847)	(27,916)	(26,986)	(26,055)	(25,125)	(24,194)	(23,264)	(22,333)	(21,403)
Deferred Tax Base	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796	3,796
Deferred Taxes - Federal	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249	1,249
Deferred Taxes - State excluding credit	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228	228
Change in Deferred Taxes	1,477	1,478	1,477	1,478	1,477	1,478	1,477	1,478	1,477	1,478	1,477	1,478	1,477	1,478	1,477	1,478	1,477	1,478	1,477
Accumulated Deferred Taxes	32,132	33,610	35,097	35,581	34,420	33,260	32,100	31,039	30,708	29,777	28,847	27,916	26,986	26,055	25,125	24,194	23,264	22,333	21,403
Rate Base and Financing																			
Investment (Rate Base)	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Cost Plant	40,656	43,048	45,439	47,831	50,223	52,614	55,006	57,397	59,789	62,180	64,572	66,963	69,355	71,747	74,138	76,530	78,921	81,313	83,705
Accumulated Depreciation	32,132	33,610	35,097	35,581	34,420	33,260	32,100	31,039	30,708	29,777	28,847	27,916	26,986	26,055	25,125	24,194	23,264	22,333	21,403
Accumulated Deferred Taxes																			
Ending Net Investment	68,921	62,052	58,193	55,916	54,057	52,596	51,135	49,674	48,213	46,752	45,291	43,830	42,369	40,908	39,447	37,986	36,525	35,064	33,603
Average Net Investment	67,855	63,987	60,118	58,051	57,188	53,327	51,866	50,405	48,944	47,483	46,022	44,561	43,100	41,639	40,178	38,717	37,256	35,795	34,334
Revenue Requirements Calculation																			
Short Term Debt	40	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Long Term Debt (Taxable Debt)	1,320	1,245	1,169	1,096	1,023	950	879	808	737	666	595	524	453	382	311	240	169	98	27
Hypothetical	114	103	92	81	70	60	50	40	30	20	10	0	0	0	0	0	0	0	0
Total Interest Expense	1,445	1,362	1,280	1,210	1,166	1,104	1,024	944	864	784	704	624	544	464	384	304	224	144	64
Preferred Dividends	65	62	58	55	51	48	44	40	37	34	30	27	24	20	17	14	10	7	4
Net Income on Common	3,472	3,274	3,077	2,909	2,804	2,729	2,654	2,579	2,505	2,430	2,355	2,280	2,205	2,131	2,056	1,981	1,907	1,832	1,757
Income Taxes																			
Income Before Pref Dividends	3,538	3,336	3,134	2,964	2,858	2,780	2,704	2,628	2,552	2,476	2,399	2,323	2,247	2,171	2,095	2,019	1,942	1,866	1,790
Income Before Taxes (Including ITC)	5,791	5,461	5,131	4,852	4,676	4,551	4,426	4,302	4,177	4,052	3,928	3,803	3,678	3,553	3,428	3,303	3,178	3,053	2,928
Income Before Tax (excluding ITC)	5,791	5,461	5,131	4,852	4,676	4,551	4,426	4,302	4,177	4,052	3,928	3,803	3,678	3,553	3,428	3,303	3,178	3,053	2,928
Federal Income Tax	1,905	1,796	1,688	1,586	1,538	1,497	1,456	1,415	1,374	1,333	1,292	1,251	1,210	1,169	1,128	1,087	1,046	1,005	964
State Income Tax	348	328	309	292	281	274	266	259	251	244	236	229	221	214	206	199	191	184	177
State Investment Tax Credit																			
Total State Tax	348	328	309	292	281	274	266	259	251	244	236	229	221	214	206	199	191	184	177
Total Taxes	2,253	2,125	1,996	1,888	1,819	1,771	1,722	1,674	1,625	1,577	1,528	1,480	1,431	1,383	1,334	1,286	1,237	1,189	1,141
Revenue Requirement Factors																			
Revenue Requirement Factors	0.0762	0.0729	0.0695	0.0669	0.0651	0.0639	0.0627	0.0615	0.0602	0.0590	0.0578	0.0565	0.0553	0.0541	0.0528	0.0516	0.0504	0.0491	0.0479
Revenue Requirement	10,566	10,113	9,660	9,207	8,854	8,502	8,150	7,797	7,445	7,093	6,741	6,389	6,037	5,685	5,333	4,981	4,629	4,277	3,925
Revenue Taxes	939	899	858	824	803	788	773	757	742	727	712	697	681	666	651	636	621	605	590
Income Before Degr. Int. Inc Tax	6,627	6,215	5,802	5,454	5,224	5,076	4,922	4,766	4,611	4,455	4,300	4,144	3,988	3,832	3,676	3,520	3,364	3,208	3,052
Depreciation Expense	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392
O&M																			
Interest Expense	1,445	1,362	1,280	1,210	1,166	1,104	1,024	944	864	784	704	624	544	464	384	304	224	144	64

MCO Above the Cap Revenue Requirer																						
Revenue Requirements Model - Calculi																						
	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069		
Manual Input																						
O&M Escalation Rate																						
O&M	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	
Plant Asset Depreciation																						
Book Depreciation	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	
Book Depreciation Rates	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	
Depreciation Expense	83,704	86,096	88,487	90,879	93,270	95,662	98,054	100,445	102,837	105,228	107,620	110,011	112,403	114,794	117,186	119,578	121,969	124,361	126,753	129,144	131,536	
Accumulated Depreciation																						
Tax Depreciation																						
Tax Depreciation Rates (Straight Line)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
Revenue Bond Financed Tax Basis (SL)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
Non-Bond Financed Tax Basis (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	
Accumulated Tax Depreciation	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	
State Investment Tax Credit (ITC)																						
Book																						
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	
Amortization of State ITC																						
Accumulated Amortization																						
Deferred ITC																						
Tax																						
Deferred Tax Calculation																						
Book Accumulated Depreciation	83,704	86,096	88,487	90,879	93,270	95,662	98,054	100,445	102,837	105,228	107,620	110,011	112,403	114,794	117,186	119,578	121,969	124,361	126,753	129,144	131,536	
Tax Accumulated Depreciation	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Book/Tax Acc Depr. Difference	(55,006)	(52,614)	(50,223)	(47,831)	(45,439)	(43,048)	(40,656)	(38,265)	(35,873)	(33,482)	(31,090)	(28,699)	(26,307)	(23,916)	(21,524)	(19,132)	(16,741)	(14,349)	(11,957)	(9,565)	(7,173)	
Deferred ITC																						
Net Deferred Tax Asset (Liability)	(21,403)	(20,472)	(19,541)	(18,611)	(17,680)	(16,750)	(15,819)	(14,889)	(13,958)	(13,028)	(12,097)	(11,167)	(10,236)	(9,306)	(8,375)	(7,444)	(6,514)	(5,583)	(4,653)	(3,722)	(2,792)	
Deferred Tax Base	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	
Deferred Taxes - Federal	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	
Deferred Taxes - State excluding credit	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	
Change in Deferred Taxes	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	
Accumulated Deferred Taxes	21,403	20,472	19,541	18,611	17,680	16,750	15,819	14,889	13,958	13,028	12,097	11,167	10,236	9,306	8,375	7,444	6,514	5,583	4,653	3,722	2,792	
Change in Deferred ITC																						
Rate Base and Financing																						
Investment (Rate Base)	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	
Gross Plant	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	
Accumulated Depreciation	63,704	66,096	68,487	70,879	73,270	75,662	78,054	80,445	82,837	85,228	87,620	90,011	92,403	94,794	97,186	99,578	101,969	104,361	106,753	109,144	111,536	
Accumulated Deferred Taxes	21,403	20,472	19,541	18,611	17,680	16,750	15,819	14,889	13,958	13,028	12,097	11,167	10,236	9,306	8,375	7,444	6,514	5,583	4,653	3,722	2,792	
Accumulated Deferred ITC																						
Ending Net Investment	33,893	32,142	30,681	29,220	27,759	26,298	24,837	23,376	21,915	20,454	18,993	17,532	16,071	14,610	13,149	11,688	10,227	8,766	7,305	5,844	4,383	
Average Net Investment	34,334	32,673	31,412	29,951	28,490	27,029	25,568	24,107	22,646	21,185	19,724	18,263	16,802	15,341	13,880	12,419	10,958	9,497	8,036	6,575	5,114	
Average Financing																						
Short Term Debt	422	404	386	368	350	332	314	296	278	261	243	225	207	189	171	153	135	117	99	81	63	
Long Term Debt (Revenue Bonds)	13,197	12,638	12,074	11,513	10,951	10,390	9,828	9,266	8,705	8,143	7,582	7,020	6,459	5,897	5,335	4,774	4,212	3,650	3,088	2,527	1,965	
Taxable Debt	791	757	724	690	656	623	589	555	522	488	454	421	387	353	320	286	252	219	186	152	119	
Preferred Stock	400	383	366	349	332	315	298	281	264	247	230	213	196	179	162	145	128	111	94	77	60	
Common Equity	19,522	18,692	17,861	17,030	16,199	15,369	14,538	13,707	12,876	12,046	11,215	10,384	9,552	8,723	7,892	7,061	6,231	5,401	4,570	3,740	2,910	
Total Financing	34,334	32,673	31,412	29,951	28,490	27,029	25,568	24,107	22,646	21,185	19,724	18,263	16,802	15,341	13,880	12,419	10,958	9,497	8,036	6,575	5,114	
Return on Investment																						
Short Term Debt	5	5	5	5	5	4	4	4	4	4	3	3	3	3	3	2	2	2	2	2	2	
Long Term Debt (Taxable Debt)	688	633	583	531	483	437	392	347	302	257	212	167	122	77	32	24	21	21	21	21	21	
Hybrids	58	55	53	51	48	46	43	41	39	36	33	31	28	26	23	21	18	16	16	16	16	
Total Interest Expense	731	700	669	638	607	575	544	513	482	451	420	389	358	327	296	264	233	202	171	141	110	
Preferred Dividends	33	32	30	29	27	26	25	23	22	20	19	18	16	15	13	12	11	9	8	7	6	
Net Income on Common	1,757	1,682	1,607	1,533	1,458	1,383	1,308	1,234	1,159	1,084	1,009	935	860	785	710	635	561	486	411	336	261	
Income Taxes																						
Income Before Pref Dividends	1,790	1,714	1,638	1,562	1,485	1,409	1,333	1,257	1,181	1,104	1,028	952	876	800	724	647	571	495	419	343	267	
Income Before Taxes (Including ITC)	2,930	2,805	2,681	2,556	2,431	2,307	2,182	2,057	1,933	1,808	1,683	1,558	1,434	1,309	1,184	1,059	934	809	684	559	434	
Income Before Tax (excl. ITC)	2,930	2,805	2,681	2,556	2,431	2,307	2,182	2,057	1,933	1,808	1,683	1,558	1,434	1,309	1,184	1,059	934	809	684	559	434	
Federal Income Tax	984	923	862	801	740	679	618	557	496	435	374	313	252	191	130	69	8	5	5	5	5	
State Income Tax	176	169	161	154	146	139	131	124	116	109	101	94	86	79	71	64	56	49	42	35	28	
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total State Tax	1,140	1,092	1,043	995	946	898	849	801	752	703	655	606	558	509	461	412	364	315	266	217	168	
Revenue Requirement Calculation																						
Revenue Requirement Factors	0.0479	0.0467	0.0454	0.0442	0.0430	0.0417	0.0405	0.0393	0.0381	0.0368	0.0356	0.0343	0.0331	0.0319	0.0306	0.0294	0.0282	0.0270	0.0258	0.0246	0.0234	
Revenue Requirement	6,643	6,472	6,301	6,130	5,959	5,788	5,617	5,446	5,275	5,104	4,933	4,762	4,591	4,420	4,249	4,078	3,907	3,736	3,565	3,394	3,223	
Revenue Taxes	590	575	560	545	529	514	498	484	468	453	438	423	409	393	378	362	347	332	317	302	287	
Income Before Dep. Int. Inc Tax	6,053	5,897	5,741	5,585	5,430	5,274	5,118	4,962	4,806	4,651	4,495	4,339	4,183	4,027	3,871</							

MECO Above the Gap Revenue Requirement													
Revenue Requirements Model - Calculated													
	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	Total
Manual Input	54	55	56	57	58	59	60	61	62	63	64	65	
O&M Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation													
Book Depreciation	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	1,724%	100.00%
Book Depreciation Rates	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	2,392	138,710
Depreciation Expense	129,144	129,144	131,535	133,927	136,318	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Accumulated Depreciation	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Tax Depreciation	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Tax Depreciation Rates (Straight Line)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Revenue Bond Financed Tax Basis (SL)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
NonRB Financed Tax Basis (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Tax Depreciation	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Accumulated Tax Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-
State Investment Tax Credit (ITC)	-	-	-	-	-	-	-	-	-	-	-	-	-
Book	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
State ITC Amortization Rate	-	-	-	-	-	-	-	-	-	-	-	-	-
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation													
Book Accumulated Depreciation	126,752	129,144	131,535	133,927	136,318	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Tax Accumulated Depreciation	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Book/Tax Acc Depr Difference	(11,958)	(9,566)	(7,175)	(4,783)	(2,392)	-	-	-	-	-	-	-	-
Deferred ITC	(4,653)	(3,722)	(2,792)	(1,861)	(931)	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)	(2,392)
Deferred Tax Base	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)	(787)
Deferred Taxes - Federal	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)	(144)
Deferred Taxes - State excluding credit	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)	(931)
Change in Deferred Taxes	4,653	3,722	2,792	1,861	931	0	0	0	0	0	0	0	0
Accumulated Deferred Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing													
Investment (Rate Base)	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Gross Plant	126,752	129,144	131,535	133,927	136,318	138,710	138,710	138,710	138,710	138,710	138,710	138,710	138,710
Accumulated Depreciation	4,653	3,722	2,792	1,861	931	0	0	0	0	0	0	0	0
Accumulated Deferred Taxes	7,305	5,644	4,383	2,922	1,461	0	0	0	0	0	0	0	0
Accumulated Deferred ITC	8,036	6,575	5,114	3,653	2,192	731	0	0	0	0	0	0	0
Ending Net Investment	-	-	-	-	-	-	-	-	-	-	-	-	-
Average Net Investment	-	-	-	-	-	-	-	-	-	-	-	-	-
Average Financing	-	-	-	-	-	-	-	-	-	-	-	-	-
Short Term Debt	99	81	63	45	27	9	0	0	0	0	0	0	0
Long Term Debt (Revenue Bonds)	3,089	2,527	1,966	1,404	842	281	0	0	0	0	0	0	0
Taxable Debt	185	151	118	84	50	17	0	0	0	0	0	0	0
Preferred Stock	94	77	60	43	26	9	0	0	0	0	0	0	0
Common Equity	4,569	3,738	2,908	2,077	1,246	415	0	0	0	0	0	0	0
Total Financing	8,036	6,575	5,114	3,653	2,192	731	0	0	0	0	0	0	0
Return on Investment													
Short Term Debt (Taxable Debt)	1	1	1	1	1	1	1	1	1	1	1	1	1
Long Term Debt (Taxable Debt)	156	128	99	71	43	14	0	0	0	0	0	0	0
Hybrids	14	11	9	6	4	1	0	0	0	0	0	0	0
Total Interest Expense	171	140	109	78	47	16	0	0	0	0	0	0	0
Preferred Dividends	8	6	5	4	2	1	0	0	0	0	0	0	0
Net Income on Common	411	336	262	187	112	37	0	0	0	0	0	0	0
Income Taxes													
Income Before Pref Dividends	419	343	267	190	114	38	0	0	0	0	0	0	0
Income Before Taxes (including ITC)	686	561	436	312	187	62	0	0	0	0	0	0	0
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	686	561	436	312	187	62	0	0	0	0	0	0	0
Federal Income Tax	226	185	144	103	62	21	0	0	0	0	0	0	0
State Income Tax	41	34	26	19	11	4	0	0	0	0	0	0	0
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-
Total State Tax	41	34	26	19	11	4	0	0	0	0	0	0	0
Total Taxes	267	218	170	121	73	24	0	0	0	0	0	0	0
Revenue Requirement Calculation													
Revenue Requirement Factors	0.0257	0.0245	0.0232	0.0220	0.0208	0.0195	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Revenue Requirement	3,565	3,394	3,223	3,052	2,881	2,710	0	0	0	0	0	0	0
Revenue Taxes	317	302	286	271	256	241	0	0	0	0	0	0	0
Income Before Degr. Int. Inc Tax	3,248	3,093	2,937	2,781	2,625	2,469	0	0	0	0	0	0	0
Depreciation Expense	2,392	2,392	2,392	2,392	2,392	2,392	0	0	0	0	0	0	0
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest Expense	171	140	109	78	47	16	0	0	0	0	0	0	0

MECO Above the Cap Revenue Requirement - Bill Impact													
Revenue Requirements Model - Calculations													
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2027	
	1	2	3	4	5	6	7	8	9	10	11	12	13
Manual Input													
O&M													
Escalation Rate													
O&M													
Plant Asset Depreciation													
Book Depreciation													
Book Depreciation Rates	0.000%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%
Depreciation Expense	-	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526
Accumulated Depreciation	-	2,526	5,053	7,579	10,106	12,632	15,158	17,685	20,211	22,737	25,264	27,790	30,317
Tax Depreciation													
Tax Depreciation Rates (Straight Line)	30	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (SL)	0.0%	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	20	7.218%	6.677%	6.177%	5.713%	5.285%	4.888%	4.522%	4.192%	3.892%	3.618%	3.368%	3.140%
NonRB Financed Tax Basis (MACRS)	100.0%	6,063	11,672	10,796	9,987	9,237	8,545	7,903	7,312	6,763	6,256	5,789	5,359
Tax Depreciation	6,063	11,672	10,796	9,987	9,237	8,545	7,903	7,312	6,763	6,256	5,789	5,359	4,965
Accumulated Tax Depreciation	6,063	17,736	28,532	38,519	47,756	56,301	64,205	71,516	78,731	85,944	93,158	100,371	107,586
State Investment Tax Credit (ITC)													
Book													
State ITC Amortization Rate	4.00%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation													
Book Accumulated Depreciation	-	2,526	5,053	7,579	10,106	12,632	15,158	17,685	20,211	22,737	25,264	27,790	30,317
Tax Accumulated Depreciation	6,063	17,736	28,532	38,519	47,756	56,301	64,205	71,516	78,731	85,944	93,158	100,371	107,586
Book/Tax Acc Depr Difference	(6,063)	(15,209)	(23,479)	(30,940)	(37,651)	(43,670)	(49,047)	(53,832)	(58,520)	(63,206)	(67,895)	(72,581)	(77,269)
Deferred ITC													
Net Deferred Tax Asset (Liability)	(2,359)	(5,918)	(9,136)	(12,039)	(14,650)	(16,992)	(19,084)	(20,946)	(22,770)	(24,593)	(26,418)	(28,241)	(30,065)
Deferred Tax Base	6,063	9,146	8,270	7,461	6,711	6,019	5,377	4,785	4,246	3,753	3,306	2,903	2,543
Deferred Taxes - Federal	1,995	3,009	2,720	2,454	2,208	1,980	1,769	1,574	1,392	1,222	1,064	918	784
Deferred Taxes - State excluding credit	365	550	497	449	404	362	323	288	252	221	192	164	140
Change in Deferred Taxes	2,359	3,559	3,217	2,903	2,611	2,342	2,092	1,862	1,644	1,443	1,272	1,102	944
Accumulated Deferred Taxes	2,359	5,918	9,136	12,039	14,650	16,992	19,084	20,946	22,770	24,593	26,418	28,241	30,065
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing													
Investment: (Rate Base)													
Gross Plant	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Accumulated Depreciation	-	2,526	5,053	7,579	10,106	12,632	15,158	17,685	20,211	22,737	25,264	27,790	30,317
Accumulated Deferred Taxes	2,359	5,918	9,136	12,039	14,650	16,992	19,084	20,946	22,770	24,593	26,418	28,241	30,065
Ending Net Investment	159,329	153,244	147,500	142,070	136,933	132,065	127,446	123,058	118,707	114,357	110,007	105,657	101,306
Average Net Investment	79,665	156,287	150,372	144,785	139,502	134,489	129,755	125,252	120,883	116,532	112,182	107,832	103,482
Average Financing:													
Short Term Debt	980	1,922	1,849	1,781	1,716	1,654	1,596	1,540	1,487	1,433	1,380	1,326	1,273
Long Term Debt (Revenue Bonds)	38,44%	60,075	57,802	55,654	53,623	51,700	49,877	48,146	46,486	44,894	43,322	41,780	40,277
Taxable Debt	2,30%	1,836	3,601	3,485	3,336	3,154	2,990	2,886	2,785	2,685	2,585	2,485	2,384
Preferred Stock	1.17%	929	1,823	1,754	1,688	1,627	1,513	1,461	1,410	1,359	1,308	1,258	1,207
Common Equity	56.86%	88,866	85,503	82,326	79,322	76,477	73,780	71,219	68,735	66,261	63,788	61,314	58,841
Total Financing	79,665	156,287	150,372	144,785	139,502	134,489	129,755	125,252	120,883	116,532	112,182	107,832	103,482
Return on Investment													
Short Term Debt	1.25%	12	24	22	21	21	20	19	19	18	17	17	16
Long Term Debt (Taxable Debt)	5.06%	1,549	3,040	2,816	2,713	2,616	2,524	2,436	2,351	2,267	2,182	2,097	2,013
Hybrids	7.32%	134	264	254	244	235	227	219	211	204	197	189	182
Total Interest Expense	1.69%	3,327	3,201	3,083	2,970	2,864	2,763	2,667	2,574	2,481	2,388	2,296	2,203
Preferred Dividends	8.25%	77	150	145	139	134	129	125	121	116	112	104	100
Net Income on Common	9.00%	4,077	7,998	7,695	7,409	7,139	6,883	6,640	6,410	6,186	5,964	5,741	5,518
Income Taxes													
Income Before Pref Dividends		4,153	8,148	7,549	7,273	7,012	6,765	6,530	6,302	6,076	5,849	5,622	5,395

MECO Above the Cap Revenue Required Revenue Requirements Model - Calculati														
	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Manual input	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation														
Book Depreciation	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%
Book Depreciation Rates	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526
Depreciation Expense	32,843	35,369	37,896	40,422	42,948	45,475	48,001	50,528	53,054	55,580	58,107	60,633	63,159	65,686
Accumulated Depreciation														
Tax Depreciation	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%
Tax Depreciation Rates (Straight Line)														
Revenue Bond Financed Tax Basis (SL)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%
NonRB Financed Tax Basis (MACRS)	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215
Tax Depreciation	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215	7,213	7,215
Accumulated Tax Depreciation	114,799	122,013	129,226	136,441	143,654	150,868	158,081	161,688	161,688	161,688	161,688	161,688	161,688	161,688
State Investment Tax Credit (ITC)														
Book														
State ITC Amortization Rate	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax														
Deferred Tax Calculation														
Book Accumulated Depreciation	32,843	35,369	37,896	40,422	42,948	45,475	48,001	50,528	53,054	55,580	58,107	60,633	63,159	65,686
Tax Accumulated Depreciation	114,799	122,013	129,226	136,441	143,654	150,868	158,081	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Book/Tax Acc Depr Difference	(81,956)	(86,644)	(91,330)	(96,019)	(100,705)	(105,393)	(110,080)	(111,161)	(108,634)	(106,108)	(103,582)	(101,055)	(98,529)	(96,002)
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(31,889)	(33,713)	(35,536)	(37,361)	(39,184)	(41,008)	(42,832)	(43,252)	(42,269)	(41,286)	(40,303)	(39,320)	(38,337)	(37,354)
Deferred Tax Base	4,687	4,688	4,687	4,688	4,687	4,688	4,687	4,687	4,687	4,687	4,687	4,687	4,687	4,687
Deferred Taxes - Federal	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542	1,542
Deferred Taxes - State excluding credit	282	282	282	282	282	282	282	282	282	282	282	282	282	282
Change in Deferred Taxes	1,824	1,824	1,824	1,824	1,824	1,824	1,824	1,824	1,824	1,824	1,824	1,824	1,824	1,824
Accumulated Deferred Taxes	31,889	33,713	35,536	37,361	39,184	41,008	42,832	43,252	42,269	41,286	40,303	39,320	38,337	37,354
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing														
Investment: (Rate Base)														
Gross Plant	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Accumulated Depreciation	32,843	35,369	37,896	40,422	42,948	45,475	48,001	50,528	53,054	55,580	58,107	60,633	63,159	65,686
Accumulated Deferred Taxes	31,889	33,713	35,536	37,361	39,184	41,008	42,832	43,252	42,269	41,286	40,303	39,320	38,337	37,354
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	96,957	92,606	88,256	83,906	79,556	75,205	70,855	67,908	66,365	64,822	63,278	61,735	60,191	58,648
Average Net Investment	99,131	94,781	90,431	86,081	81,731	77,380	73,030	69,382	67,137	65,593	64,050	62,507	60,963	59,420
Average Financing:														
Short Term Debt	1,219	1,166	1,112	1,059	1,005	952	898	853	826	807	788	769	750	731
Long Term Debt (Revenue Bonds)	38,105	36,433	34,761	33,089	31,416	29,744	28,072	26,670	25,807	25,213	24,620	24,027	23,434	22,840
Preferred Stock	1,156	1,105	1,054	1,004	953	902	852	809	783	765	747	729	711	693
Common Equity	56,367	53,893	51,420	48,946	46,473	43,999	41,526	39,451	38,174	37,297	36,419	35,542	34,664	33,787
Total Financing	99,131	94,781	90,431	86,081	81,731	77,380	73,030	69,382	67,137	65,593	64,050	62,507	60,963	59,420
Return on Investment														
Short Term Debt	15	15	14	13	13	12	11	11	10	10	10	10	9	9
Long Term Debt (Taxable Debt)	1,928	1,844	1,759	1,674	1,590	1,506	1,420	1,349	1,306	1,276	1,246	1,216	1,186	1,156
Hybrids	167	160	153	145	138	131	123	117	113	111	108	105	103	100
Total Interest Expense	2,111	2,018	1,925	1,833	1,740	1,647	1,555	1,472	1,429	1,397	1,364	1,331	1,298	1,265
Preferred Dividends	95	91	87	83	79	74	70	67	66	65	64	63	62	61
Net Income on Common	5,073	4,850	4,628	4,405	4,183	3,960	3,737	3,551	3,436	3,357	3,278	3,199	3,120	3,041
Income Taxes														
Income Before Pref Dividends	5,168	4,942	4,715	4,488	4,261	4,034	3,808	3,617	3,500	3,420	3,339	3,259	3,178	3,098

MECO Above the Cap Revenue Requirer Revenue Requirements Model - Calculati														
	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2070
Manual input	28	29	30	31	32	33	34	35	36	37	38	39	40	56
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation														
Book Depreciation	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%	1,563%
Book Depreciation Rates	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526
Depreciation Expense	68,212	70,739	73,265	75,791	78,318	80,844	83,371	85,897	88,423	90,950	93,476	96,002	98,529	138,951
Accumulated Depreciation														
Tax Depreciation	3,333%	3,334%	3,333%	1,667%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%
Tax Depreciation Rates (Straight Line)	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%
Revenue Bond Financed Tax Basis (SL)	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Tax Depreciation Rates (MACRS)	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%
NonRB Financed Tax Basis (MACRS)	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Tax Depreciation														
Accumulated Tax Depreciation														
State Investment Tax Credit (ITC)														
Book														
State ITC Amortization Rate	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%
Amortization of State ITC														
Accumulated Amortization														
Deferred ITC														
Tax														
Deferred Tax Calculation														
Book Accumulated Depreciation	68,212	70,739	73,265	75,791	78,318	80,844	83,371	85,897	88,423	90,950	93,476	96,002	98,529	138,951
Tax Accumulated Depreciation	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Book/Tax Acc Depr Difference	(93,476)	(90,950)	(88,423)	(85,897)	(83,371)	(80,844)	(78,318)	(75,791)	(73,265)	(70,739)	(68,212)	(65,686)	(63,159)	(22,737)
Deferred ITC														
Net Deferred Tax Asset (Liability)	(36,371)	(35,388)	(34,405)	(33,422)	(32,439)	(31,456)	(30,473)	(29,490)	(28,507)	(27,524)	(26,541)	(25,558)	(24,575)	(8,847)
Deferred Tax Base	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)
Deferred Taxes - Federal	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)
Deferred Taxes - State excluding credit	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)
Change in Deferred Taxes	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)
Accumulated Deferred Taxes	36,371	35,388	34,405	33,422	32,439	31,456	30,473	29,490	28,507	27,524	26,541	25,558	24,575	8,847
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing														
Investment: (Rate Base)														
Gross Plant	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Accumulated Depreciation	68,212	70,739	73,265	75,791	78,318	80,844	83,371	85,897	88,423	90,950	93,476	96,002	98,529	138,951
Accumulated Deferred Taxes	36,371	35,388	34,405	33,422	32,439	31,456	30,473	29,490	28,507	27,524	26,541	25,558	24,575	8,847
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	57,105	56,561	54,018	52,475	50,931	49,388	47,844	46,301	44,758	43,214	41,671	40,128	38,584	13,890
Average Net Investment	57,876	56,333	54,790	53,246	51,703	50,160	48,616	47,073	45,529	43,986	42,443	40,899	39,356	14,662
Average Financing:														
Short Term Debt	712	693	674	655	636	617	598	579	560	541	522	503	484	180
Long Term Debt (Revenue Bonds)	22,247	21,654	21,061	20,467	19,874	19,281	18,688	18,094	17,501	16,908	16,315	15,721	15,128	5,636
Long Term Debt (Taxable Debt)	1,334	1,298	1,262	1,227	1,191	1,156	1,120	1,085	1,049	1,013	978	942	907	338
Preferred Stock	675	657	639	621	603	585	567	549	531	513	495	477	459	171
Common Equity	32,909	32,031	31,154	30,276	29,399	28,521	27,644	26,766	25,888	25,011	24,133	23,256	22,378	8,337
Total Financing	57,876	56,333	54,790	53,246	51,703	50,160	48,616	47,073	45,529	43,986	42,443	40,899	39,356	14,662
Return on Investment														
Short Term Debt	9	9	8	8	8	8	7	7	7	7	7	6	6	2
Long Term Debt (Taxable Debt)	1,126	1,096	1,066	1,036	1,006	976	946	916	886	856	826	795	765	285
Hybrids	98	95	92	90	87	84	82	79	77	74	72	69	66	25
Total Interest Expense	1,232	1,199	1,166	1,134	1,101	1,068	1,035	1,002	969	936	904	871	838	312
Preferred Dividends	56	54	53	51	49	48	47	44	44	42	42	39	38	14
Net Income on Common	2,962	2,883	2,804	2,725	2,646	2,567	2,488	2,409	2,330	2,251	2,172	2,093	2,014	750
Income Taxes														
Income Before Pref Dividends	3,017	2,937	2,857	2,776	2,696	2,615	2,535	2,454	2,374	2,293	2,213	2,132	2,052	764

MECO Above the Cap Revenue Requirement										
Revenue Requirements Model - Calculati										
	2071	2072	2073	2074	2075	2076	2077	2078	2079	Total
Manual Input	57	58	59	60	61	62	63	64	65	
Escalation Rate	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation										
Book Depreciation										
Book Depreciation Rates	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	1.563%	100.00%
Depreciation Expense	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	2,526	161,688
Accumulated Depreciation	141,477	144,004	146,530	149,056	151,583	154,109	156,636	159,162	161,688	
Tax Depreciation										
Tax Depreciation Rates (Straight Line)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Revenue Bond Financed Tax Basis (SL)	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
NonRB Financed Tax Basis (MACRS)	-	-	-	-	-	-	-	-	-	-
Tax Depreciation	-	-	-	-	-	-	-	-	-	-
Accumulated Tax Depreciation	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
State Investment Tax Credit (ITC)										
Book										
State ITC Amortization Rate	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-
Tax										
Deferred Tax Calculation										
Book Accumulated Depreciation	141,477	144,004	146,530	149,056	151,583	154,109	156,636	159,162	161,688	
Tax Accumulated Depreciation	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	
Book/Tax Acc Depr Difference	(20,211)	(17,685)	(15,156)	(12,632)	(10,106)	(7,579)	(5,053)	(2,526)	(0)	
Deferred ITC	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(7,864)	(6,881)	(5,898)	(4,915)	(3,932)	(2,949)	(1,966)	(983)	(0)	
Deferred Tax Base	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)	(2,526)
Deferred Taxes - Federal	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)	(831)
Deferred Taxes - State excluding credit	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)	(152)
Change in Deferred Taxes	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)	(983)
Accumulated Deferred Taxes	7,864	6,881	5,898	4,915	3,932	2,949	1,966	983	(0)	
check	0	-	-	-	-	-	-	-	-	-
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing										
Investment: (Rate Base)										
Gross Plant	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688	161,688
Accumulated Depreciation	141,477	144,004	146,530	149,056	151,583	154,109	156,636	159,162	161,688	
Accumulated Deferred Taxes	7,864	6,881	5,898	4,915	3,932	2,949	1,966	983	(0)	
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	12,347	10,804	9,260	7,717	6,173	4,630	3,087	1,543	0	
Average Net Investment	13,119	11,575	10,032	8,489	6,945	5,402	3,858	2,315	772	
Average Financing:										
Short Term Debt	161	142	123	104	85	66	47	28	9	
Long Term Debt (Revenue Bonds)	5,043	4,449	3,856	3,263	2,670	2,076	1,483	890	297	
Taxable Debt	302	267	231	196	160	124	89	53	18	
Preferred Stock	153	135	117	99	81	63	45	27	9	
Common Equity	7,459	6,582	5,704	4,827	3,949	3,072	2,194	1,316	439	
Total Financing	13,119	11,575	10,032	8,489	6,945	5,402	3,858	2,315	772	
Return on Investment										
Short Term Debt	2	2	2	1	1	1	1	0	0	
Long Term Debt (Taxable Debt)	255	225	195	165	135	105	75	45	15	
Hybrids	22	20	17	14	11	7	4	1	1	
Total Interest Expense	279	246	214	181	148	115	82	49	16	
Preferred Dividends	13	11	10	8	7	5	4	2	1	
Net Income on Common	671	592	513	434	355	276	197	118	39	
Income Taxes										
Income Before Pref Dividends	684	603	523	443	362	282	201	121	40	

MECO Above the Cap Revenue Requirement - Bill Impact											
Revenue Requirements Model - Calculations											
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Manual Input	1	2	3	4	5	6	7	8	9	10	11
O&M											
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation											
Book Depreciation											
Book Depreciation Rates	0.000%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%
Depreciation Expense	-	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
Accumulated Depreciation	-	18,816	37,632	56,447	75,263	94,079	112,895	131,710	150,526	169,342	188,158
Tax Depreciation											
Tax Depreciation Rates (Straight Line)	30	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (S/L)	0.0%	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	20	3.750%	7.219%	6.177%	5.713%	5.285%	4.888%	4.522%	4.462%	4.461%	4.462%
NonRB Financed Tax Basis (MACRS)	100.0%	40,219	77,424	71,611	66,248	61,272	56,682	52,424	48,498	47,844	47,855
Tax Depreciation	40.219	77,424	71,611	66,248	61,272	56,682	52,424	48,498	47,855	47,844	47,855
Accumulated Tax Depreciation	40.219	117,642	189,253	255,502	316,774	373,455	425,879	474,377	522,232	570,076	617,931
State Investment Tax Credit (ITC)											
Book											
State ITC Amortization Rate	0.000%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	4.00%	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation											
Book Accumulated Depreciation	-	18,816	37,632	56,447	75,263	94,079	112,895	131,710	150,526	169,342	188,158
Tax Accumulated Depreciation	40.219	117,642	189,253	255,502	316,774	373,455	425,879	474,377	522,232	570,076	617,931
Book/Tax Acc Depr Difference	(40.219)	(98,827)	(151,622)	(199,054)	(241,510)	(279,376)	(312,984)	(342,667)	(371,706)	(400,734)	(429,774)
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(15,649)	(38,453)	(58,996)	(77,452)	(93,971)	(108,705)	(121,781)	(133,331)	(144,630)	(155,925)	(167,224)
Deferred Tax Base	40.219	58,608	52,795	47,433	42,456	37,866	33,608	29,683	29,039	29,028	29,039
Deferred Taxes - Federal	13.230	19,279	17,367	15,603	13,966	12,456	11,055	9,764	9,552	9,549	9,552
Deferred Taxes - State excluding credit	2.419	3,525	3,176	2,853	2,554	2,278	2,022	1,785	1,747	1,746	1,747
Change in Deferred Taxes	15.649	22,804	20,542	18,456	16,520	14,734	13,077	11,549	11,299	11,295	11,299
Accumulated Deferred Taxes	15.649	38,453	58,996	77,452	93,971	108,705	121,781	133,331	144,630	155,925	167,224
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing											
Investment: (Rate Base)											
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500
Accumulated Depreciation	-	18,816	37,632	56,447	75,263	94,079	112,895	131,710	150,526	169,342	188,158
Accumulated Deferred Taxes	15.649	38,453	58,996	77,452	93,971	108,705	121,781	133,331	144,630	155,925	167,224
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	-	1,056,851	1,015,231	938,601	903,265	869,716	837,824	807,458	777,343	747,233	717,118
Average Net Investment	528,425	1,036,041	995,552	957,237	920,933	886,491	853,770	822,641	792,401	762,288	732,175
Average Financing:											
Short Term Debt	1.23%	6,499	12,742	11,773	11,326	10,902	10,500	10,117	9,745	9,375	9,005
Long Term Debt (Revenue Bonds)	38.44%	203,122	398,244	362,680	367,953	340,759	328,181	316,215	304,591	293,016	281,441
Taxable Debt	2.30%	12,175	23,871	22,938	22,056	21,219	20,425	19,564	18,258	17,564	16,870
Preferred Stock	1.17%	6,162	12,082	11,610	11,163	10,740	10,338	9,956	9,241	8,890	8,538
Common Equity	56.86%	300,467	589,102	566,079	544,293	523,651	485,461	467,761	450,566	433,444	416,321
Total Financing		528,425	1,036,041	995,552	920,933	886,491	853,770	822,641	792,401	762,288	732,175

Revenue Requirements Model - Calculations												
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Manual Input												
Short Term Debt	81	159	153	147	142	136	131	126	122	117	113	
Long Term Debt (Taxable Debt)	10,278	20,151	19,364	18,618	17,912	17,242	16,606	16,000	15,412	14,827	14,241	
Hybrids	891	1,747	1,679	1,614	1,553	1,495	1,440	1,387	1,336	1,286	1,235	
Total Interest Expense	11,250	22,058	21,196	20,380	19,607	18,874	18,177	17,514	16,871	16,229	15,588	
Preferred Dividends	508	997	958	921	886	853	821	791	762	733	704	
Net Income on Common	27,042	53,019	50,947	48,986	47,129	45,366	43,691	42,098	40,551	39,010	37,469	
Income Taxes												
Income Before Pref Dividends	27,550	54,016	51,905	49,907	48,015	46,219	44,513	42,890	41,313	39,743	38,173	
Income Before Taxes (including ITC)	45,098	88,420	84,964	81,694	78,596	75,657	72,864	70,208	67,627	65,057	62,487	
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	
Income Before Taxes (excluding ITC)	45,098	88,420	84,964	81,694	78,596	75,657	72,864	70,208	67,627	65,057	62,487	
Federal Income Tax	14,835	29,085	27,949	26,873	25,854	24,887	23,968	23,095	22,246	21,400	20,555	
State Income Tax	2,713	5,318	5,111	4,914	4,728	4,551	4,383	4,223	4,068	3,913	3,759	
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	
Total State Tax	2,713	5,318	5,111	4,914	4,728	4,551	4,383	4,223	4,068	3,913	3,759	
Total Taxes	17,548	34,404	33,059	31,787	30,582	29,438	28,351	27,318	26,313	25,313	24,313	
Revenue Requirement Calculation												
Revenue Requirement Factors	0.0577	0.1323	0.1279	0.1237	0.1197	0.1160	0.1124	0.1090	0.1057	0.1024	0.0992	
Revenue Requirement	61,843	141,901	137,163	132,679	128,430	124,399	120,570	116,927	113,388	109,863	106,339	
Revenue Taxes	5,495	12,608	12,187	11,789	11,411	11,053	10,713	10,389	10,074	9,761	9,448	
Income Before Depr, Int, Inc Tax	56,348	129,293	124,976	120,890	117,019	113,346	109,857	106,538	103,313	100,102	96,891	
Depreciation Expense	-	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	
O&M	-	-	-	-	-	-	-	-	-	-	-	
Interest Expense	11,250	22,058	21,196	20,380	19,607	18,874	18,177	17,514	16,871	16,229	15,588	
Income Before Income Taxes	45,098	88,420	84,964	81,694	78,596	75,657	72,864	70,208	67,627	65,057	62,487	
Income Taxes - Federal	14,835	29,085	27,949	26,873	25,854	24,887	23,968	23,095	22,246	21,400	20,555	
Income Taxes - State	2,713	5,318	5,111	4,914	4,728	4,551	4,383	4,223	4,068	3,913	3,759	
State ITC	-	-	-	-	-	-	-	-	-	-	-	
Total Income Taxes	17,548	34,404	33,059	31,787	30,582	29,438	28,351	27,318	26,313	25,313	24,313	
Preferred Dividends	508	997	958	921	886	853	821	791	762	733	704	
Net Income for Common	27,042	53,019	50,947	48,986	47,129	45,366	43,691	42,098	40,551	39,010	37,469	
Book Financial Statements												
check												
Balance Sheet												
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	
Accumulated Depreciation	-	18,816	37,632	56,447	75,263	94,079	112,895	131,710	150,526	169,342	188,158	
Accumulated Deferred Taxes	15,649	38,453	58,996	77,452	93,971	108,705	121,781	133,331	144,630	155,925	167,224	
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	
Ending Net Investment	1,056,851	1,015,231	975,872	938,601	903,265	869,716	837,824	807,458	777,343	747,233	717,118	
Short Term Debt	12,998	12,486	12,002	11,543	11,109	10,696	10,304	9,930	9,560	9,190	8,819	
Long Term Debt (Taxable Debt)	406,243	390,245	375,116	360,789	347,207	334,310	322,051	310,379	298,803	287,229	275,653	
Hybrids	24,351	23,392	22,485	21,626	20,812	20,039	19,304	18,604	17,911	17,217	16,523	
Preferred Stock	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179	
Common Equity	600,934	577,269	554,890	533,697	513,605	494,528	476,394	459,128	442,004	424,883	407,759	
Financing	1,056,851	1,015,231	975,872	938,601	903,265	869,716	837,824	807,458	777,343	747,233	717,118	
Income Statement												
Revenue	61,843	141,901	137,163	132,679	128,430	124,399	120,570	116,927	113,388	109,863	106,339	
Revenue Taxes	5,495	12,608	12,187	11,789	11,411	11,053	10,713	10,389	10,074	9,761	9,448	
Income Before Depr, Int, Inc Tax	56,348	129,293	124,976	120,890	117,019	113,346	109,857	106,538	103,313	100,102	96,891	
Depreciation Expense	-	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	
O&M	-	-	-	-	-	-	-	-	-	-	-	
Interest Expense	11,250	22,058	21,196	20,380	19,607	18,874	18,177	17,514	16,871	16,229	15,588	
Income Before Income Taxes	45,098	88,420	84,964	81,694	78,596	75,657	72,864	70,208	67,627	65,057	62,487	

MECO Above the Cap Revenue Requirement												
Revenue Requirements Model - Calculati												
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Manual Input	12	13	14	15	16	17	18	19	20	21	22	23
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation												
Book Depreciation												
Book Depreciation Rates	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
Accumulated Depreciation	206,974	225,789	244,605	263,421	282,237	301,053	319,868	338,684	357,500	376,316	395,131	413,947
Tax Depreciation												
Tax Depreciation Rates (Straight Line)	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (S/L)												
Tax Depreciation Rates (MACRS)	4.461%	4.462%	4.461%	4.462%	4.461%	4.462%	4.461%	4.462%	4.461%	4.462%	4.461%	4.462%
NonRB Financed Tax Basis (MACRS)	47,844	47,855	47,844	47,855	47,844	47,855	47,844	47,855	47,844	47,855	47,844	47,855
Tax Depreciation	47,844	47,855	47,844	47,855	47,844	47,855	47,844	47,855	47,844	47,855	47,844	47,855
Accumulated Tax Depreciation	665,776	713,631	761,475	809,330	857,174	905,029	952,873	1,000,728	1,048,572	1,096,416	1,144,261	1,192,105
State Investment Tax Credit (ITC)												
Book												
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Tax												
Deferred Tax Calculation												
Book Accumulated Depreciation	206,974	225,789	244,605	263,421	282,237	301,053	319,868	338,684	357,500	376,316	395,131	413,947
Tax Accumulated Depreciation	665,776	713,631	761,475	809,330	857,174	905,029	952,873	1,000,728	1,048,572	1,096,416	1,144,261	1,192,105
Book/Tax Acc Depr Difference	(458,802)	(487,841)	(516,870)	(545,909)	(574,937)	(603,976)	(633,005)	(662,044)	(691,072)	(720,100)	(749,129)	(778,158)
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(178,519)	(189,818)	(201,113)	(212,412)	(223,707)	(235,006)	(246,301)	(257,600)	(268,895)	(279,194)	(290,489)	(301,784)
Deferred Tax Base	29,028	29,039	29,028	29,039	29,028	29,039	29,028	29,039	29,028	29,039	29,028	29,039
Deferred Taxes - Federal	9,549	9,552	9,549	9,552	9,549	9,552	9,549	9,552	9,549	9,552	9,549	9,552
Deferred Taxes - State excluding credit	1,746	1,747	1,746	1,747	1,746	1,747	1,746	1,747	1,746	1,747	1,746	1,747
Change in Deferred Taxes	11,295	11,299	11,295	11,299	11,295	11,299	11,295	11,299	11,295	11,299	11,295	11,299
Accumulated Deferred Taxes	178,519	189,818	201,113	212,412	223,707	235,006	246,301	257,600	268,895	279,194	290,489	301,784
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing												
Investment: (Rate Base)												
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500
Accumulated Depreciation	206,974	225,789	244,605	263,421	282,237	301,053	319,868	338,684	357,500	376,316	395,131	413,947
Accumulated Deferred Taxes	178,519	189,818	201,113	212,412	223,707	235,006	246,301	257,600	268,895	279,194	290,489	301,784
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	687,007	656,892	626,782	596,667	566,556	536,441	506,331	476,216	446,105	425,990	413,806	402,311
Average Net Investment	702,063	671,950	641,837	611,724	581,612	551,499	521,386	491,273	461,160	435,703	419,553	408,058
Average Financing:												
Short Term Debt	8,634	8,264	7,894	7,523	7,153	6,783	6,412	6,042	5,672	5,358	5,160	5,018
Long Term Debt (Revenue Bonds)	269,866	258,291	246,716	235,141	223,566	211,991	200,416	188,841	177,266	167,480	161,272	156,854
Taxable Debt	16,176	15,482	14,788	14,095	13,401	12,707	12,013	11,319	10,626	10,039	9,667	9,402
Preferred Stock	8,187	7,836	7,485	7,134	6,783	6,431	6,080	5,729	5,378	5,081	4,893	4,759
Common Equity	399,199	382,076	364,954	347,832	330,709	313,587	296,465	279,342	262,220	247,744	238,562	232,026
Total Financing	702,063	671,950	641,837	611,724	581,612	551,499	521,386	491,273	461,160	435,703	419,553	408,058

Revenue Requirements Model - Calculati												
	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
Manual Input												
Return on Investment												
Short Term Debt	108	103	99	94	89	85	80	76	71	67	64	63
Long Term Debt (Taxable Debt)	13,655	13,070	12,484	11,898	11,312	10,727	10,141	9,555	8,970	8,474	8,160	7,937
Hybrids	1,184	1,333	1,083	981	930	879	829	778	728	735	708	688
Total Interest Expense	14,947	14,306	13,665	13,024	12,383	11,742	11,101	10,459	9,818	9,276	8,932	8,688
Preferred Dividends	675	646	618	589	560	531	502	473	444	419	404	393
Net Income on Common	35,928	34,387	32,846	31,305	29,764	28,223	26,682	25,141	23,600	22,297	21,471	20,882
Income Taxes												
Income Before Pref Dividends	36,603	35,033	33,463	31,893	30,323	28,753	27,183	25,613	24,043	22,716	21,874	21,275
Income Before Taxes (including ITC)	59,917	57,347	54,777	52,207	49,637	47,067	44,497	41,927	39,357	37,185	35,806	34,825
Investment Tax Credit												
Income Before Taxes (excluding ITC)	59,917	57,347	54,777	52,207	49,637	47,067	44,497	41,927	39,357	37,185	35,806	34,825
Federal Income Tax	19,709	18,864	18,019	17,173	16,328	15,483	14,637	13,792	12,946	12,232	11,778	11,456
State Income Tax	3,604	3,449	3,295	3,140	2,986	2,831	2,677	2,522	2,367	2,237	2,154	2,095
State Investment Tax Credit												
Total State Tax	3,604	3,449	3,295	3,140	2,986	2,831	2,677	2,522	2,367	2,237	2,154	2,095
Total Taxes	23,314	22,314	21,314	20,314	19,314	18,314	17,314	16,314	15,314	14,468	13,932	13,550
Revenue Requirement Calculation												
Revenue Requirement Factors	0.0959	0.0926	0.0893	0.0860	0.0827	0.0794	0.0761	0.0729	0.0696	0.0668	0.0650	0.0638
Revenue Requirement	102,815	99,291	95,767	92,242	88,718	85,194	81,670	78,146	74,622	71,642	69,752	68,407
Revenue Taxes	9,135	8,822	8,509	8,196	7,883	7,569	7,256	6,943	6,630	6,365	6,197	6,078
Income Before Depr. Int, Inc Tax	93,680	90,469	87,258	84,047	80,836	77,625	74,414	71,202	67,991	65,277	63,555	62,329
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
O&M												
Interest Expense	14,947	14,306	13,665	13,024	12,383	11,742	11,101	10,459	9,818	9,276	8,932	8,688
Income Before Income Taxes	59,917	57,347	54,777	52,207	49,637	47,067	44,497	41,927	39,357	37,185	35,806	34,825
Income Taxes - Federal	19,709	18,864	18,019	17,173	16,328	15,483	14,637	13,792	12,946	12,232	11,778	11,456
Income Taxes - State	3,604	3,449	3,295	3,140	2,986	2,831	2,677	2,522	2,367	2,237	2,154	2,095
State ITC												
Total Income Taxes	23,314	22,314	21,314	20,314	19,314	18,314	17,314	16,314	15,314	14,468	13,932	13,550
Preferred Dividends	675	646	618	589	560	531	502	473	444	419	404	393
Net Income for Common	35,928	34,387	32,846	31,305	29,764	28,223	26,682	25,141	23,600	22,297	21,471	20,882
Book Financial Statements												
Balance Sheet												
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500
Accumulated Depreciation	206,974	225,789	244,605	263,421	282,237	301,053	319,868	338,684	357,500	376,316	395,131	413,947
Accumulated Deferred Taxes	178,519	189,818	201,113	212,412	223,707	235,006	246,301	257,600	268,895	270,884	263,562	256,241
Accumulated Deferred ITC												
Ending Net Investment	687,007	656,892	626,782	596,667	566,556	536,441	506,331	476,216	446,105	425,300	413,806	402,311
Short Term Debt	8,449	8,079	7,708	7,338	6,968	6,597	6,227	5,857	5,486	5,231	5,089	4,948
Long Term Debt (Taxable Debt)	284,079	252,503	240,929	229,353	217,779	206,203	194,629	183,053	171,479	163,481	159,063	154,645
Hybrids	15,829	15,135	14,442	13,748	13,054	12,360	11,666	10,972	10,279	9,799	9,534	9,270
Preferred Stock	8,012	7,661	7,309	6,958	6,607	6,256	5,905	5,554	5,202	4,960	4,826	4,692
Common Equity	390,638	373,515	356,393	339,270	322,149	305,025	287,904	270,780	253,659	241,829	235,294	228,758
Financing	687,007	656,892	626,782	596,667	566,556	536,441	506,331	476,216	446,105	425,300	413,806	402,311
Income Statement												
Revenue	102,815	99,291	95,767	92,242	88,718	85,194	81,670	78,146	74,622	71,642	69,752	68,407
Revenue Taxes	9,135	8,822	8,509	8,196	7,883	7,569	7,256	6,943	6,630	6,365	6,197	6,078
Income Before Depr. Int, Inc Tax	93,680	90,469	87,258	84,047	80,836	77,625	74,414	71,202	67,991	65,277	63,555	62,329
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
O&M												
Interest Expense	14,947	14,306	13,665	13,024	12,383	11,742	11,101	10,459	9,818	9,276	8,932	8,688
Income Before Income Taxes	59,917	57,347	54,777	52,207	49,637	47,067	44,497	41,927	39,357	37,185	35,806	34,825
Income Taxes - Federal	19,709	18,864	18,019	17,173	16,328	15,483	14,637	13,792	12,946	12,232	11,778	11,456
Income Taxes - State	3,604	3,449	3,295	3,140	2,986	2,831	2,677	2,522	2,367	2,237	2,154	2,095
State ITC												
Total Income Taxes	23,314	22,314	21,314	20,314	19,314	18,314	17,314	16,314	15,314	14,468	13,932	13,550
Preferred Dividends	675	646	618	589	560	531	502	473	444	419	404	393
Net Income for Common	35,928	34,387	32,846	31,305	29,764	28,223	26,682	25,141	23,600	22,297	21,471	20,882

MECO Above the Cap Revenue Requirer												
Revenue Requirements Model - Calculati												
	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Manual Input	24	25	26	27	28	29	30	31	32	33	34	35
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation												
Book Depreciation												
Book Depreciation Rates	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
Accumulated Depreciation	432,763	451,579	470,395	489,210	508,026	526,842	545,658	564,474	583,289	602,105	620,921	639,737
Tax Depreciation												
Tax Depreciation Rates (Straight Line)	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (S/L)	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
NonRB Financed Tax Basis (MACRS)	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Tax Depreciation	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500
State Investment Tax Credit (ITC)												
Book												
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Tax												
Deferred Tax Calculation												
Book Accumulated Depreciation	432,763	451,579	470,395	489,210	508,026	526,842	545,658	564,474	583,289	602,105	620,921	639,737
Tax Accumulated Depreciation	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500
Book/Tax Acc Depr Difference	(639,737)	(620,921)	(602,105)	(583,289)	(564,474)	(545,658)	(526,842)	(508,026)	(489,210)	(470,395)	(451,579)	(432,763)
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(248,920)	(241,599)	(234,278)	(226,957)	(219,635)	(212,314)	(204,993)	(197,672)	(190,351)	(183,029)	(175,708)	(168,387)
Deferred Tax Base	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)
Deferred Taxes - Federal	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)
Deferred Taxes - State excluding credit	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)
Change in Deferred Taxes	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)
Accumulated Deferred Taxes	248,920	241,599	234,278	226,957	219,635	212,314	204,993	197,672	190,351	183,029	175,708	168,387
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
check	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing												
Investment: (Rate Base)												
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500
Accumulated Depreciation	432,763	451,579	470,395	489,210	508,026	526,842	545,658	564,474	583,289	602,105	620,921	639,737
Accumulated Deferred Taxes	248,920	241,599	234,278	226,957	219,635	212,314	204,993	197,672	190,351	183,029	175,708	168,387
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	390,817	379,322	367,827	356,333	344,838	333,344	321,849	310,354	298,860	287,365	275,871	264,376
Average Net Investment	396,564	385,069	373,575	362,080	350,585	339,091	327,596	316,102	304,607	293,112	281,618	270,123
Average Financing:												
Short Term Debt	4,877	4,736	4,594	4,453	4,312	4,170	4,029	3,888	3,746	3,605	3,463	3,322
Long Term Debt (Revenue Bonds)	152,435	148,017	143,598	139,180	134,762	130,343	125,925	121,506	117,088	112,670	108,251	103,833
Taxable Debt	9,137	8,872	8,607	8,343	8,078	7,813	7,548	7,283	7,018	6,754	6,489	6,224
Preferred Stock	4,625	4,491	4,357	4,222	4,088	3,954	3,820	3,686	3,552	3,418	3,284	3,150
Common Equity	225,490	218,954	212,418	205,882	199,346	192,810	186,274	179,738	173,202	166,666	160,130	153,594
Total Financing	396,564	385,069	373,575	362,080	350,585	339,091	327,596	316,102	304,607	293,112	281,618	270,123

Revenue Requirements Model - Calculati												
	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
	24	25	26	27	28	29	30	31	32	33	34	35
Manual Input												
Return on Investment												
Short Term Debt	61	59	57	56	54	52	50	49	47	45	43	42
Long Term Debt (Taxable Debt)	7,713	7,490	7,266	7,043	6,819	6,595	6,372	6,148	5,925	5,701	5,478	5,254
Hybrids	669	630	611	611	591	572	553	533	514	494	475	456
Total Interest Expense	8,443	8,198	7,954	7,709	7,464	7,219	6,975	6,730	6,485	6,241	5,996	5,751
Preferred Dividends	382	370	359	348	337	326	315	304	293	282	271	260
Net Income on Common	20,294	19,706	19,118	18,529	17,941	17,353	16,765	16,176	15,588	15,000	14,412	13,823
Income Taxes												
Income Before Pref Dividends	20,676	20,076	19,477	18,878	18,278	17,679	17,080	16,481	15,881	15,282	14,683	14,083
Income Before Taxes (including ITC)	33,844	32,863	31,882	30,901	29,920	28,939	27,958	26,977	25,996	25,015	24,034	23,053
Investment Tax Credit												
Income Before Taxes (excluding ITC)	33,844	32,863	31,882	30,901	29,920	28,939	27,958	26,977	25,996	25,015	24,034	23,053
Federal Income Tax	11,133	10,810	10,488	10,165	9,842	9,520	9,197	8,874	8,551	8,229	7,906	7,583
State Income Tax	2,036	1,977	1,918	1,859	1,800	1,741	1,682	1,623	1,564	1,505	1,446	1,387
State Investment Tax Credit												
Total State Tax	2,036	1,977	1,918	1,859	1,800	1,741	1,682	1,623	1,564	1,505	1,446	1,387
Total Taxes	13,169	12,787	12,405	12,024	11,642	11,260	10,879	10,497	10,115	9,733	9,352	8,970
Revenue Requirement Calculation												
Revenue Requirement Factors	0.0625	0.0613	0.0600	0.0588	0.0575	0.0563	0.0550	0.0537	0.0525	0.0512	0.0500	0.0487
Revenue Requirement	67,062	65,716	64,371	63,026	61,681	60,335	58,990	57,645	56,300	54,954	53,609	52,264
Revenue Taxes	5,958	5,839	5,719	5,600	5,480	5,361	5,241	5,122	5,002	4,883	4,763	4,644
Income Before Depr, Int, Inc Tax	61,103	59,877	58,652	57,426	56,200	54,975	53,749	52,523	51,297	50,072	48,846	47,620
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
O&M												
Interest Expense	8,443	8,198	7,954	7,709	7,464	7,219	6,975	6,730	6,485	6,241	5,996	5,751
Income Before Income Taxes	33,844	32,863	31,882	30,901	29,920	28,939	27,958	26,977	25,996	25,015	24,034	23,053
Income Taxes - Federal	11,133	10,810	10,488	10,165	9,842	9,520	9,197	8,874	8,551	8,229	7,906	7,583
Income Taxes - State	2,036	1,977	1,918	1,859	1,800	1,741	1,682	1,623	1,564	1,505	1,446	1,387
State ITC												
Total Income Taxes	13,169	12,787	12,405	12,024	11,642	11,260	10,879	10,497	10,115	9,733	9,352	8,970
Preferred Dividends	382	370	359	348	337	326	315	304	293	282	271	260
Net Income for Common	20,294	19,706	19,118	18,529	17,941	17,353	16,765	16,176	15,588	15,000	14,412	13,823
Book Financial Statements												
Balance Sheet												
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500
Accumulated Depreciation	432,763	451,579	470,395	489,210	508,026	526,842	545,658	564,474	583,289	602,105	620,921	639,737
Accumulated Deferred Taxes	248,920	241,599	234,278	226,957	219,635	212,314	204,993	197,672	190,351	183,029	175,708	168,387
Accumulated Deferred ITC												
Ending Net Investment	390,817	379,322	367,827	356,333	344,838	333,344	321,849	310,354	298,860	287,365	275,871	264,376
Short Term Debt	4,806	4,665	4,524	4,382	4,241	4,100	3,958	3,817	3,676	3,534	3,393	3,251
Long Term Debt (Taxable Debt)	150,226	145,808	141,389	136,971	132,552	128,134	123,716	119,297	114,879	110,460	106,042	101,624
Hybrids	9,005	8,740	8,475	8,210	7,945	7,681	7,416	7,151	6,886	6,621	6,356	6,091
Preferred Stock	4,558	4,424	4,290	4,155	4,021	3,887	3,753	3,619	3,485	3,351	3,217	3,083
Common Equity	222,222	215,686	209,150	202,614	196,078	189,542	183,006	176,470	169,934	163,398	156,862	150,326
Financing	390,817	379,322	367,827	356,333	344,838	333,344	321,849	310,354	298,860	287,365	275,871	264,376
Income Statement												
Revenue	67,062	65,716	64,371	63,026	61,681	60,335	58,990	57,645	56,300	54,954	53,609	52,264
Revenue Taxes	5,958	5,839	5,719	5,600	5,480	5,361	5,241	5,122	5,002	4,883	4,763	4,644
Income Before Depr, Int, Inc Tax	61,103	59,877	58,652	57,426	56,200	54,975	53,749	52,523	51,297	50,072	48,846	47,620
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816
O&M												
Interest Expense	8,443	8,198	7,954	7,709	7,464	7,219	6,975	6,730	6,485	6,241	5,996	5,751
Income Before Income Taxes	33,844	32,863	31,882	30,901	29,920	28,939	27,958	26,977	25,996	25,015	24,034	23,053

MECO Above the Cap Revenue Requirren									
Revenue Requirements Model - Calculati									
	2050	2051	2052	2053	2054	2070	2071	2072	Total
Manual input	36	37	38	39	40	56	57	58	
O&M									
Escalation Rate	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation									
Book Depreciation									
Book Depreciation Rates	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	1.754%	100.00%
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816	1,072,500
Accumulated Depreciation	658,552	677,368	696,184	715,000	733,816	1,034,868	1,053,684	1,072,500	
Tax Depreciation									
Tax Depreciation Rates (Straight Line)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Revenue Bond Financed Tax Basis (S/L)	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
NonRB Financed Tax Basis (MACRS)	-	-	-	-	-	-	-	-	-
Tax Depreciation	-	-	-	-	-	-	-	-	-
Accumulated Tax Depreciation	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	
State Investment Tax Credit (ITC)									
Book									
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	0.000%	0.000%	0.000%	100.00%
Amortization of State ITC	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-
Tax									
Deferred Tax Calculation									
Book Accumulated Depreciation	658,552	677,368	696,184	715,000	733,816	1,034,868	1,053,684	1,072,500	
Tax Accumulated Depreciation	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	
Book/Tax Acc Depr Difference	(413,947)	(395,131)	(376,316)	(357,500)	(338,684)	(37,632)	(18,816)	-	
Deferred ITC	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(161,066)	(153,745)	(146,424)	(139,102)	(131,781)	(14,642)	(7,321)	-	
Deferred Tax Base	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	(18,816)	
Deferred Taxes - Federal	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	(6,189)	
Deferred Taxes - State excluding credit	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	(1,132)	
Change in Deferred Taxes	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	(7,321)	
Accumulated Deferred Taxes	161,066	153,745	146,424	139,102	131,781	14,642	7,321	(0)	
Change in Deferred ITC	-	-	-	-	-	-	-	-	(0)
Rate Base and Financing									
Investment: (Rate Base)									
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	
Accumulated Depreciation	658,552	677,368	696,184	715,000	733,816	1,034,868	1,053,684	1,072,500	
Accumulated Deferred Taxes	161,066	153,745	146,424	139,102	131,781	14,642	7,321	(0)	
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-
Ending Net Investment	252,881	241,387	229,892	218,397	206,903	22,989	11,495	(0)	
Average Net Investment	258,629	247,134	235,639	224,145	212,650	28,737	17,242	5,747	
Average Financing:									
Short Term Debt	3,181	3,039	2,898	2,757	2,615	353	212	71	
Long Term Debt (Revenue Bonds)	99,414	94,996	90,578	86,159	81,741	11,046	6,628	2,209	
Taxable Debt	5,959	5,694	5,429	5,164	4,900	662	397	132	
Preferred Stock	3,016	2,748	2,482	2,216	1,951	335	201	67	
Common Equity	147,058	140,523	133,987	127,451	120,915	16,340	9,804	3,268	
Total Financing	258,629	247,134	235,639	224,145	212,650	28,737	17,242	5,747	

Revenue Requirements Model - Calculati										
	2050	2051	2052	2053	2054	2070	2071	2072	Total	
Return on Investment										
Manual Input	36	37	38	39	40	56	57	58	59	
Short Term Debt	40	38	36	34	33	4	3	1		
Long Term Debt (Taxable Debt)	5,030	4,807	4,583	4,360	4,136	559	335	112		
Hybrids	436	417	397	378	359	48	29	10		
Total Interest Expense	5,506	5,262	5,017	4,772	4,527	612	367	122		
Preferred Dividends	249	238	227	216	205	28	17	6		
Net Income on Common	13,235	12,647	12,059	11,471	10,882	1,471	882	294		
Income Taxes										
Income Before Pref Dividends	13,484	12,885	12,286	11,686	11,087	1,498	899	300		
Income Before Taxes (including ITC)	22,072	21,091	20,110	19,129	18,148	2,452	1,471	490		
Investment Tax Credit	-	-	-	-	-	-	-	-		
Income Before Taxes (excluding ITC)	22,072	21,091	20,110	19,129	18,148	2,452	1,471	490		
Federal Income Tax	7,261	6,938	6,615	6,293	5,970	807	484	161		
State Income Tax	1,328	1,269	1,210	1,151	1,092	148	89	30		
State Investment Tax Credit	-	-	-	-	-	-	-	-		
Total State Tax	1,328	1,269	1,210	1,151	1,092	148	89	30		
Total Taxes	8,588	8,207	7,825	7,443	7,062	954	573	191		
Revenue Requirement Calculation										
Revenue Requirement Factors	0.0475	0.0462	0.0450	0.0437	0.0425	0.0224	0.0211	0.0199		
Revenue Requirement	50,919	49,573	48,228	46,883	45,538	24,014	22,668	21,323		
Revenue Taxes	4,524	4,405	4,285	4,166	4,046	2,134	2,014	1,895		
Income Before Depr, Int, Inc Tax	46,395	45,169	43,943	42,717	41,492	21,880	20,654	19,429		
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816		
O&M	-	-	-	-	-	-	-	-		
Interest Expense	5,506	5,262	5,017	4,772	4,527	612	367	122		
Income Before Income Taxes	22,072	21,091	20,110	19,129	18,148	2,452	1,471	490		
Income Taxes - Federal	7,261	6,938	6,615	6,293	5,970	807	484	161		
Income Taxes - State	1,328	1,269	1,210	1,151	1,092	148	89	30		
State ITC	-	-	-	-	-	-	-	-		
Total Income Taxes	8,588	8,207	7,825	7,443	7,062	954	573	191		
Preferred Dividends	249	238	227	216	205	28	17	6		
Net Income for Common	13,235	12,647	12,059	11,471	10,882	1,471	882	294		
Book Financial Statements										
Balance Sheet										
Gross Plant	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500	1,072,500		
Accumulated Depreciation	658,552	677,368	696,184	715,000	733,816	1,034,868	1,053,684	1,072,500		
Accumulated Deferred Taxes	161,066	153,745	146,424	139,102	131,781	14,642	7,321	(0)		
Accumulated Deferred ITC	-	-	-	-	-	-	-	-		
Ending Net Investment	252,881	241,387	229,892	218,397	206,903	22,989	11,495	(0)		
Short Term Debt	3,110	2,969	2,827	2,686	2,545	283	141	(0)		
Long Term Debt (Taxable Debt)	97,205	92,787	88,368	83,950	79,531	8,837	4,418	(0)		
Hybrids	5,827	5,562	5,297	5,032	4,767	550	265	(0)		
Preferred Stock	2,949	2,815	2,681	2,547	2,413	268	134	(0)		
Common Equity	143,790	137,255	130,719	124,183	117,647	13,072	6,536	(0)		
Financing	252,881	241,387	229,892	218,397	206,903	22,989	11,495	(0)		
Income Statement										
Revenue	50,919	49,573	48,228	46,883	45,538	24,014	22,668	21,323		
Revenue Taxes	4,524	4,405	4,285	4,166	4,046	2,134	2,014	1,895		
Income Before Depr, Int, Inc Tax	46,395	45,169	43,943	42,717	41,492	21,880	20,654	19,429		
Depreciation Expense	18,816	18,816	18,816	18,816	18,816	18,816	18,816	18,816		
O&M	-	-	-	-	-	-	-	-		
Interest Expense	5,506	5,262	5,017	4,772	4,527	612	367	122		
Income Before Income Taxes	22,072	21,091	20,110	19,129	18,148	2,452	1,471	490		

MECO Above the Cap Revenue Requirement - Bill Impact													
Revenue Requirements Model - Calculations													
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2027	
	1	2	3	4	5	6	7	8	9	10	11	12	13
Manual Input													
O&M													
Escalation Rate													
O&M													
Plant Asset Depreciation													
Book Depreciation													
Depreciation Expense	0.000%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%
Accumulated Depreciation	-	5,771	5,771	11,542	17,313	23,084	28,855	34,627	40,398	46,169	51,940	57,711	63,482
Tax Depreciation													
Tax Depreciation Rates (Straight Line)	30	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (SL)	0.0%	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	20	7.218%	6.677%	6.171%	5.713%	5.285%	4.888%	4.522%	4.182%	3.861%	3.559%	3.273%	3.002%
NonRB Financed Tax Basis (MACRS)	100.0%	10,604	20,414	18,881	17,468	16,155	14,945	13,822	12,787	11,741	10,684	9,615	8,536
Tax Depreciation													
Accumulated Tax Depreciation	10,604	31,019	49,900	67,368	83,523	98,468	112,291	125,078	137,696	150,311	162,929	175,544	188,161
State Investment Tax Credit (ITC)													
Book													
State ITC Amortization Rate	4.00%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation													
Book Accumulated Depreciation													
Tax Accumulated Depreciation													
Book/Tax Acc Depr Difference	10,604	31,019	49,900	67,368	83,523	98,468	112,291	125,078	137,696	150,311	162,929	175,544	188,161
Deferred ITC	(10,604)	(25,247)	(38,358)	(50,054)	(60,439)	(69,613)	(77,664)	(84,680)	(91,527)	(98,371)	(105,218)	(112,062)	(118,908)
Net Deferred Tax Asset (Liability)	(4,126)	(9,824)	(14,925)	(19,476)	(23,517)	(27,086)	(30,219)	(32,949)	(35,613)	(38,276)	(40,940)	(43,603)	(46,267)
Deferred Tax Base	10,604	14,643	13,110	11,696	10,384	9,174	8,051	7,016	6,047	5,140	4,287	3,484	2,721
Deferred Taxes - Federal	3,488	4,817	4,313	3,848	3,416	3,018	2,648	2,308	1,996	1,711	1,451	1,209	987
Deferred Taxes - State excluding credit	638	881	789	704	625	552	484	422	366	314	266	222	181
Change in Deferred Taxes	4,126	5,698	5,101	4,551	4,041	3,570	3,133	2,730	2,362	2,025	1,717	1,431	1,168
Accumulated Deferred Taxes	4,126	9,824	14,925	19,476	23,517	27,086	30,219	32,949	35,613	38,276	40,940	43,603	46,267
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing													
Investment: (Rate Base)													
Gross Plant	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
Accumulated Depreciation	-	5,771	11,542	17,313	23,084	28,855	34,627	40,398	46,169	51,940	57,711	63,482	69,253
Accumulated Deferred Taxes	4,126	9,824	14,925	19,476	23,517	27,086	30,219	32,949	35,613	38,276	40,940	43,603	46,267
Ending Net Investment	278,657	267,189	256,316	245,994	236,183	226,842	217,938	209,437	201,002	192,968	184,133	175,699	167,264
Average Net Investment	139,329	272,923	261,753	251,155	241,089	231,512	222,390	213,688	205,219	196,785	188,350	179,916	171,481
Average Financing:													
Short Term Debt	1,714	3,357	3,219	3,089	2,965	2,847	2,735	2,628	2,524	2,420	2,316	2,213	2,109
Long Term Debt (Revenue Bonds)	38,44%	53,557	104,909	100,615	96,542	92,672	88,991	85,485	82,139	78,884	75,642	72,400	69,156
Taxable Debt	2,30%	3,210	6,288	6,031	5,787	5,555	5,334	5,124	4,924	4,728	4,534	4,340	4,145
Preferred Stock	1,17%	1,625	3,052	2,929	2,812	2,700	2,593	2,492	2,393	2,296	2,200	2,098	1,995
Common Equity	56.86%	79,224	155,186	148,835	142,809	137,085	131,640	126,453	121,505	116,690	111,894	107,098	102,302
Total Financing	139,329	272,923	261,753	251,155	241,089	231,512	222,390	213,688	205,219	196,785	188,350	179,916	171,481
Return on Investment													
Short Term Debt	1.25%	21	42	39	37	36	34	33	32	30	29	28	26
Long Term Debt (Taxable Debt)	5.06%	2,710	5,308	5,091	4,885	4,689	4,503	4,326	4,156	3,992	3,827	3,663	3,500
Hybrids	7.32%	235	460	441	424	407	375	360	346	332	318	303	289
Total Interest Expense	2,966	5,811	5,573	5,347	5,133	4,929	4,735	4,550	4,369	4,190	4,010	3,830	3,651
Preferred Dividends	8.25%	134	263	252	242	232	214	206	197	189	181	173	165
Net Income on Common	9.00%	7,130	13,967	13,395	12,853	12,338	11,848	11,381	10,935	10,502	10,070	9,639	9,207
Income Taxes													
Income Before Pref Dividends		7,264	14,229	13,647	13,094	12,570	12,070	11,595	11,141	10,699	10,260	9,820	9,380

MECO Above the Cap Revenue Requirer Revenue Requirements Model - Calculati														
	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
Manual input	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation														
Book Depreciation	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%
Book Depreciation Rates	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771
Depreciation Expense	75,024	80,795	86,566	92,337	98,109	103,880	109,651	115,422	121,193	126,964	132,735	138,506	144,277	150,048
Accumulated Depreciation														
Tax Depreciation	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%
Tax Depreciation Rates (Straight Line)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Revenue Bond Financed Tax Basis (SL)	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%
Tax Depreciation Rates (MACRS)	12,618	12,618	12,618	12,618	12,618	12,618	12,618	12,618	12,618	12,618	12,618	12,618	12,618	12,618
NonRB Financed Tax Basis (MACRS)	12,615	12,618	12,615	12,618	12,615	12,618	12,615	12,618	12,615	12,618	12,615	12,618	12,615	12,618
Tax Depreciation	200,776	213,394	226,009	238,627	251,242	263,860	276,475	289,090	299,705	309,320	318,935	328,550	338,165	347,780
Accumulated Tax Depreciation														
State Investment Tax Credit (ITC)														
Book														
State ITC Amortization Rate	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax														
Deferred Tax Calculation														
Book Accumulated Depreciation	75,024	80,795	86,566	92,337	98,109	103,880	109,651	115,422	121,193	126,964	132,735	138,506	144,277	150,048
Tax Accumulated Depreciation	200,776	213,394	226,009	238,627	251,242	263,860	276,475	289,090	299,705	309,320	318,935	328,550	338,165	347,780
Book/Tax Acc Depr Difference	(125,752)	(132,599)	(139,443)	(146,289)	(153,133)	(159,980)	(166,824)	(173,668)	(180,512)	(187,356)	(194,200)	(201,044)	(207,888)	(214,732)
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(48,930)	(51,594)	(54,257)	(56,921)	(59,584)	(62,248)	(64,911)	(67,575)	(70,239)	(72,902)	(75,566)	(78,229)	(80,893)	(83,557)
Deferred Tax Base	6,844	6,847	6,844	6,847	6,844	6,847	6,844	6,847	6,844	6,847	6,844	6,847	6,844	6,847
Deferred Taxes - Federal	2,251	2,252	2,251	2,252	2,251	2,252	2,251	2,252	2,251	2,252	2,251	2,252	2,251	2,252
Deferred Taxes - State excluding credit	412	412	412	412	412	412	412	412	412	412	412	412	412	412
Change in Deferred Taxes	2,663	2,664	2,663	2,664	2,663	2,664	2,663	2,664	2,663	2,664	2,663	2,664	2,663	2,664
Accumulated Deferred Taxes	48,930	51,594	54,257	56,921	59,584	62,248	64,911	67,575	70,239	72,902	75,566	78,229	80,893	83,557
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing														
Investment: (Rate Base)														
Gross Plant	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
Accumulated Depreciation	75,024	80,795	86,566	92,337	98,109	103,880	109,651	115,422	121,193	126,964	132,735	138,506	144,277	150,048
Accumulated Deferred Taxes	48,930	51,594	54,257	56,921	59,584	62,248	64,911	67,575	70,239	72,902	75,566	78,229	80,893	83,557
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	158,830	150,394	141,960	133,525	125,091	116,656	108,222	102,242	98,716	95,191	91,665	88,139	84,614	81,088
Average Net Investment	163,047	154,612	146,177	137,743	129,308	120,874	112,439	105,232	100,479	96,953	93,428	89,902	86,377	82,851
Average Financing:														
Short Term Debt	2,005	1,901	1,798	1,694	1,590	1,487	1,383	1,294	1,236	1,192	1,149	1,106	1,062	1,019
Long Term Debt (Revenue Bonds)	62,674	59,431	56,189	52,947	49,705	46,463	43,220	40,450	38,623	37,268	35,913	34,558	33,202	31,847
Long Term Debt (Taxable Debt)	3,757	3,562	3,368	3,174	2,979	2,785	2,591	2,425	2,315	2,234	2,153	2,071	1,990	1,909
Preferred Stock	1,901	1,803	1,705	1,606	1,508	1,410	1,311	1,227	1,172	1,131	1,090	1,048	1,007	966
Common Equity	92,710	87,914	83,118	78,322	73,526	68,730	63,934	59,138	57,133	55,128	53,124	51,119	49,114	47,110
Total Financing	163,047	154,612	146,177	137,743	129,308	120,874	112,439	105,232	100,479	96,953	93,428	89,902	86,377	82,851
Return on Investment														
Short Term Debt	25	24	22	21	20	19	17	16	15	15	14	14	13	13
Long Term Debt (Taxable Debt)	3,007	2,843	2,679	2,679	2,515	2,351	2,187	2,047	1,954	1,886	1,817	1,749	1,680	1,611
Hybrids	275	261	247	232	218	204	190	177	169	164	158	152	146	140
Total Interest Expense	3,471	3,292	3,112	2,933	2,753	2,573	2,394	2,240	2,139	2,064	1,989	1,914	1,839	1,764
Preferred Dividends	157	149	141	133	124	116	108	101	97	93	86	86	83	80
Net Income on Common	8,344	7,912	7,481	7,049	6,617	6,186	5,754	5,385	5,142	4,982	4,761	4,601	4,420	4,240
Income Taxes														
Income Before Pref Dividends	8,501	8,061	7,621	7,181	6,742	6,302	5,862	5,486	5,239	5,055	4,871	4,687	4,503	4,320

MECO Above the Cap Revenue Requir Revenue Requirements Model - Calculati														
	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
Manual input	28	29	30	31	32	33	34	35	36	37	38	39	40	41
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation														
Book Depreciation	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%	2,041%
Book Depreciation Rates	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771
Depreciation Expense	155,820	161,591	167,362	173,133	178,904	184,675	190,446	196,217	201,988	207,759	213,530	219,302	225,073	230,844
Accumulated Depreciation														
Tax Depreciation	3,333%	3,333%	3,333%	1,667%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%
Tax Depreciation Rates (Straight Line)	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%
Revenue Bond Financed Tax Basis (SL)	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%
Tax Depreciation Rates (MACRS)	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%	0,000%
NonRB Financed Tax Basis (MACRS)														
Tax Depreciation	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
Accumulated Tax Depreciation														
State Investment Tax Credit (ITC)														
Book														
State ITC Amortization Rate	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%
Amortization of State ITC														
Accumulated Amortization														
Deferred ITC														
Tax														
Deferred Tax Calculation														
Book Accumulated Depreciation	155,820	161,591	167,362	173,133	178,904	184,675	190,446	196,217	201,988	207,759	213,530	219,302	225,073	230,844
Tax Accumulated Depreciation	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
Book/Tax Acc Depr Difference	(126,964)	(121,193)	(115,422)	(109,651)	(103,880)	(98,109)	(92,337)	(86,566)	(80,795)	(75,024)	(69,253)	(63,482)	(57,711)	(51,940)
Deferred ITC														
Net Deferred Tax Asset (Liability)	(49,401)	(47,156)	(44,910)	(42,665)	(40,419)	(38,174)	(35,928)	(33,683)	(31,437)	(29,192)	(26,946)	(24,701)	(22,455)	(20,210)
Deferred Tax Base	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)
Deferred Taxes - Federal	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)
Deferred Taxes - State excluding credit	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)
Change in Deferred Taxes	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)
Accumulated Deferred Taxes	49,401	47,156	44,910	42,665	40,419	38,174	35,928	33,683	31,437	29,192	26,946	24,701	22,455	20,210
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing														
Investment: (Rate Base)														
Gross Plant	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
Accumulated Depreciation	155,820	161,591	167,362	173,133	178,904	184,675	190,446	196,217	201,988	207,759	213,530	219,302	225,073	230,844
Accumulated Deferred Taxes	49,401	47,156	44,910	42,665	40,419	38,174	35,928	33,683	31,437	29,192	26,946	24,701	22,455	20,210
Accumulated Deferred ITC														
Ending Net Investment	77,563	74,037	70,511	66,986	63,460	59,935	56,409	52,884	49,358	45,832	42,307	38,781	35,256	31,730
Average Net Investment	79,925	75,800	72,274	68,749	65,223	61,698	58,172	54,646	51,121	47,595	44,070	40,544	37,019	33,493
Average Financing:														
Short Term Debt	976	932	889	846	802	759	715	672	629	585	542	499	455	412
Long Term Debt (Revenue Bonds)	30,492	29,137	27,782	26,426	25,071	23,716	22,361	21,006	19,650	18,295	16,940	15,585	14,230	12,874
Long Term Debt (Taxable Debt)	1,828	1,746	1,665	1,584	1,503	1,422	1,340	1,259	1,178	1,097	1,015	934	853	772
Preferred Stock	925	884	843	802	761	720	678	637	596	555	514	473	432	391
Common Equity	45,105	43,100	41,096	39,091	37,086	35,082	33,077	31,072	29,068	27,063	25,058	23,054	21,049	19,044
Total Financing	79,925	75,800	72,274	68,749	65,223	61,698	58,172	54,646	51,121	47,595	44,070	40,544	37,019	33,493
Return on Investment														
Short Term Debt	12	12	11	11	10	9	9	8	8	7	7	6	6	5
Long Term Debt (Taxable Debt)	1,543	1,474	1,406	1,337	1,269	1,200	1,131	1,063	994	926	857	789	720	651
Hybrids	134	128	122	116	110	104	98	92	86	80	74	68	62	56
Total Interest Expense	1,689	1,614	1,539	1,464	1,389	1,314	1,239	1,163	1,088	1,013	938	863	788	713
Preferred Dividends	76	73	70	66	63	59	56	53	49	46	42	39	36	32
Net Income on Common	4,059	3,879	3,699	3,518	3,338	3,157	2,977	2,797	2,616	2,436	2,255	2,075	1,894	1,714
Income Taxes														
Income Before Pref Dividends	4,136	3,952	3,768	3,584	3,401	3,217	3,033	2,849	2,665	2,481	2,298	2,114	1,930	1,746

MECO Above the Cap Revenue Requirement												
Revenue Requirements Model - Calclat												
	2056	2057	2058	2059	2060	2061	2062	2063	2064			
	42	43	44	45	46	47	48	49	50	Total		
Manual Input												
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation												
Book Depreciation												
Book Depreciation Rates	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	2.041%	100.00%
Depreciation Expense	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	5,771	282,784
Accumulated Depreciation	236,615	242,386	248,157	253,928	259,699	265,470	271,241	277,012	282,784	282,784	282,784	282,784
Tax Depreciation												
Tax Depreciation Rates (Straight Line)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
Revenue Bond Financed Tax Basis (SL)	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%
NonRB Financed Tax Basis (MACRS)	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Tax Depreciation	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
State Investment Tax Credit (ITC)												
Book												
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	100.00%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Tax												
Deferred Tax Calculation												
Book Accumulated Depreciation	236,615	242,386	248,157	253,928	259,699	265,470	271,241	277,012	282,784	282,784	282,784	282,784
Tax Accumulated Depreciation	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
Book/Tax Acc Depr Difference	(46,169)	(40,398)	(34,627)	(28,855)	(23,084)	(17,313)	(11,542)	(5,771)	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(17,964)	(15,719)	(13,473)	(11,228)	(8,982)	(6,737)	(4,491)	(2,246)	-	-	-	-
Deferred Tax Base	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)	(5,771)
Deferred Taxes - Federal	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)	(1,898)
Deferred Taxes - State excluding credit	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)	(347)
Change in Deferred Taxes	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)
Accumulated Deferred Taxes	17,964	15,719	13,473	11,228	8,982	6,737	4,491	2,246	0	0	0	0
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing												
Investment: (Rate Base)												
Gross Plant	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784	282,784
Accumulated Depreciation	236,615	242,386	248,157	253,928	259,699	265,470	271,241	277,012	282,784	282,784	282,784	282,784
Accumulated Deferred Taxes	17,964	15,719	13,473	11,228	8,982	6,737	4,491	2,246	0	0	0	0
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	28,205	24,679	21,153	17,628	14,102	10,577	7,051	3,526	0	0	0	0
Average Net Investment	29,967	26,442	22,916	19,391	15,865	12,340	8,814	5,288	1,763	1,763	1,763	1,763
Average Financing:												
Short Term Debt	369	325	282	238	195	152	108	65	22	22	22	22
Long Term Debt (Revenue Bonds)	11,519	10,164	8,809	7,454	6,098	4,743	3,388	2,033	678	678	678	678
Taxable Debt	690	609	528	447	366	284	203	122	41	41	41	41
Preferred Stock	349	308	267	226	185	144	103	62	21	21	21	21
Common Equity	17,040	15,035	13,030	11,026	9,021	7,016	5,012	3,007	1,002	1,002	1,002	1,002
Total Financing	29,967	26,442	22,916	19,391	15,865	12,340	8,814	5,288	1,763	1,763	1,763	1,763
Return on Investment												
Short Term Debt	5	4	4	3	2	2	1	1	0	0	0	0
Long Term Debt (Taxable Debt)	583	514	446	377	309	240	171	103	34	34	34	34
Hybrids	51	45	39	33	27	21	15	9	3	3	3	3
Total Interest Expense	638	563	488	413	338	263	188	113	38	38	38	38
Preferred Dividends	29	25	22	19	15	12	8	5	2	2	2	2
Net Income on Common	1,534	1,353	1,173	992	812	631	451	271	90	90	90	90
Income Taxes												
Income Before Pref Dividends	1,562	1,379	1,195	1,011	827	643	460	276	92	92	92	92

MECO Above the Cap Revenue Requirement - Bill Impact											
Revenue Requirements Model - Calculations											
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Manual input	1	2	3	4	5	6	7	8	9	10	
O&M											
Escalation Rate	-	-	-	-	-	-	-	-	-	-	
O&M	-	-	-	-	-	-	-	-	-	-	
Plant Asset Depreciation											
Book Depreciation											
Book Depreciation Rates	0.000%	7.143%	7.143%	7.143%	7.143%	7.143%	7.143%	7.143%	7.143%	7.143%	7.143%
Depreciation Expense	-	20,954	20,954	20,954	20,954	20,954	20,954	20,954	20,954	20,954	20,954
Accumulated Depreciation	-	20,954	41,907	62,861	83,814	104,768	125,722	146,675	167,629	188,582	188,582
Tax Depreciation											
Tax Depreciation Rates (Straight Line)	30	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (S/L)	0.0%										
Tax Depreciation Rates (MACRS)	20	7.219%	6.677%	6.177%	5.713%	5.285%	4.888%	4.522%	4.462%	4.461%	4.461%
NonRB Financed Tax Basis (MACRS)	11,001	21,177	19,587	18,120	16,759	15,504	14,339	13,265	13,089	13,086	13,086
Tax Depreciation	11,001	21,177	19,587	18,120	16,759	15,504	14,339	13,265	13,089	13,086	13,086
Accumulated Tax Depreciation	11,001	32,178	51,765	69,885	86,644	102,148	116,487	129,752	142,841	155,927	155,927
State Investment Tax Credit (ITC)											
Book											
State ITC Amortization Rate	0.000%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	4.00%	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation											
Book Accumulated Depreciation	-	20,954	41,907	62,861	83,814	104,768	125,722	146,675	167,629	188,582	188,582
Tax Accumulated Depreciation	11,001	32,178	51,765	69,885	86,644	102,148	116,487	129,752	142,841	155,927	155,927
Book/Tax Acc Depr Difference	(11,001)	(11,224)	(9,857)	(7,024)	(2,830)	2,620	9,235	16,923	24,788	32,655	32,655
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(4,280)	(4,367)	(3,835)	(2,733)	(1,101)	1,020	3,593	6,585	9,645	12,706	12,706
Deferred Tax Base	11,001	223	(1,367)	(2,833)	(4,194)	(5,450)	(6,615)	(7,888)	(7,864)	(7,867)	(7,867)
Deferred Taxes - Federal	3,619	73	(450)	(932)	(1,380)	(1,793)	(2,176)	(2,529)	(2,587)	(2,588)	(2,588)
Deferred Taxes - State excluding credit	662	13	(82)	(170)	(252)	(328)	(398)	(462)	(473)	(473)	(473)
Change in Deferred Taxes	4,280	87	(532)	(1,102)	(1,632)	(2,121)	(2,574)	(2,991)	(3,060)	(3,061)	(3,061)
Accumulated Deferred Taxes	4,280	4,367	3,835	2,733	1,101	(1,020)	(3,593)	(6,585)	(9,645)	(12,706)	(12,706)
Change in Deferred ITC	-	-	-	-	-	0	0	-	-	-	-
Rate Base and Financing											
Investment: (Rate Base)											
Gross Plant	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350
Accumulated Depreciation	-	20,954	41,907	62,861	83,814	104,768	125,722	146,675	167,629	188,582	188,582
Accumulated Deferred Taxes	4,280	4,367	3,835	2,733	1,101	(1,020)	(3,593)	(6,585)	(9,645)	(12,706)	(12,706)
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	289,070	268,030	247,608	227,757	208,435	189,602	171,222	153,260	135,366	117,474	117,474
Average Net Investment	144,535	278,550	257,819	237,682	218,096	199,019	180,412	162,241	144,313	126,420	126,420
Average Financing:											
Short Term Debt	1.23%	1,778	3,426	2,923	2,682	2,448	2,219	1,995	1,775	1,555	1,555
Long Term Debt (Revenue Bonds)	38.44%	55,558	107,072	91,363	83,834	76,501	69,349	62,364	55,473	48,595	48,595
Taxable Debt	2.30%	3,330	6,418	5,476	4,586	4,502	4,157	3,738	3,325	2,913	2,913
Preferred Stock	1.17%	1,686	3,248	3,007	2,772	2,543	2,104	1,892	1,683	1,474	1,474
Common Equity	56.86%	82,184	158,386	146,598	135,148	124,011	102,584	92,252	82,058	71,884	71,884

Revenue Requirements Model - Calculations												
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024		
Manual Input												
Total Financing	144,535 1	278,550 2	257,819 3	237,682 4	218,096 5	199,019 6	180,412 7	162,241 8	144,313 9	126,420 10		
Return on Investment												
Short Term Debt	22	43	40	37	34	31	28	25	22	19		
Long Term Debt (Taxable Debt)	2,811	5,418	5,015	4,623	4,242	3,871	3,509	3,156	2,807	2,459		
Hybrids	244	470	435	401	368	336	304	274	243	213		
Total Interest Expense	3,077	5,930	5,489	5,060	4,643	4,237	3,841	3,454	3,072	2,692		
Preferred Dividends	139	268	248	229	210	191	174	156	139	122		
Net Income on Common	7,397	14,255	13,194	12,163	11,161	10,185	9,233	8,303	7,385	6,470		
Income Taxes												
Income Before Pref Dividends	7,536	14,523	13,442	12,392	11,371	10,376	9,406	8,459	7,524	6,591		
Income Before Taxes (including ITC)	12,335	23,773	22,003	20,285	18,613	16,985	15,397	13,846	12,316	10,789		
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-		
Income Before Taxes (excluding ITC)	12,335	23,773	22,003	20,285	18,613	16,985	15,397	13,846	12,316	10,789		
Federal Income Tax	4,058	7,820	7,238	6,673	6,123	5,587	5,065	4,555	4,051	3,549		
State Income Tax	742	1,430	1,324	1,220	1,120	1,022	926	833	741	649		
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-		
Total State Tax	742	1,430	1,324	1,220	1,120	1,022	926	833	741	649		
Total Taxes	4,800	9,250	8,561	7,893	7,242	6,609	5,991	5,388	4,792	4,198		
Revenue Requirement Calculation												
Revenue Requirement Factors	0.0577	0.1895	0.1813	0.1732	0.1654	0.1578	0.1504	0.1431	0.1360	0.1288		
Revenue Requirement	16,915	55,596	53,170	50,814	48,521	46,289	44,111	41,984	39,886	37,792		
Revenue Taxes	1,503	4,940	4,724	4,515	4,311	4,113	3,919	3,730	3,544	3,358		
Income Before Depr, Int, Inc Tax	15,412	50,657	48,446	46,299	44,210	42,176	40,192	38,254	36,342	34,434		
Depreciation Expense	-	20,954	20,954	20,954	20,954	20,954	20,954	20,954	20,954	20,954		
O&M	-	-	-	-	-	-	-	-	-	-		
Interest Expense	3,077	5,930	5,489	5,060	4,643	4,237	3,841	3,454	3,072	2,692		
Income Before Income Taxes	12,335	23,773	22,003	20,285	18,613	16,985	15,397	13,846	12,316	10,789		
Income Taxes - Federal	4,058	7,820	7,238	6,673	6,123	5,587	5,065	4,555	4,051	3,549		
Income Taxes - State	742	1,430	1,324	1,220	1,120	1,022	926	833	741	649		
State ITC	-	-	-	-	-	-	-	-	-	-		
Total Income Taxes	4,800	9,250	8,561	7,893	7,242	6,609	5,991	5,388	4,792	4,198		
Preferred Dividends	139	268	248	229	210	191	174	156	139	122		
Net Income for Common	7,397	14,255	13,194	12,163	11,161	10,185	9,233	8,303	7,385	6,470		
Book Financial Statements												
Balance Sheet												
Gross Plant	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350		
Accumulated Depreciation	-	20,954	41,907	62,861	83,814	104,768	125,722	146,675	167,629	188,582		
Accumulated Deferred Taxes	4,280	4,367	3,835	2,733	1,101	(1,020)	(3,593)	(6,585)	(9,645)	(12,706)		
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-		
Ending Net Investment	289,070	268,030	247,608	227,757	208,435	189,602	171,222	153,260	135,366	117,474		
Short Term Debt	3,555	3,296	3,045	2,801	2,563	2,332	2,106	1,885	1,665	1,445		
Long Term Debt (Taxable Debt)	111,116	103,028	95,178	87,547	80,120	72,881	65,816	58,912	52,034	45,156		
Hybrids	6,660	6,176	5,705	5,248	4,803	4,369	3,945	3,531	3,119	2,707		
Preferred Stock	3,371	3,126	2,888	2,656	2,431	2,211	1,997	1,787	1,579	1,370		
Common Equity	164,368	152,404	140,792	129,504	118,518	107,809	97,358	87,145	76,971	66,797		
Financing	289,070	268,030	247,608	227,757	208,435	189,602	171,222	153,260	135,366	117,474		
Income Statement												
Revenue	16,915	55,596	53,170	50,814	48,521	46,289	44,111	41,984	39,886	37,792		
Revenue Taxes	1,503	4,940	4,724	4,515	4,311	4,113	3,919	3,730	3,544	3,358		

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MECO Above the Cap Revenue Requirement												
Revenue Requirements Model - Calculatic												
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Manual input	11	12	13	14	15	16	17	18	19	20	21	
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation												
Book Depreciation												
Book Depreciation Rates	7.143%	7.143%	7.143%	7.143%	7.143%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Depreciation Expense	20,954	20,954	20,954	20,954	20,954	-	-	-	-	-	-	-
Accumulated Depreciation	209,536	230,490	251,443	272,397	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350
Tax Depreciation												
Tax Depreciation Rates (Straight Line)	3.333%	3.333%	3.334%	3.333%	55.003%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Revenue Bond Financed Tax Basis (S/L)	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	4.462%	4.461%	4.462%	4.461%	29.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
NonRB Financed Tax Basis (MACRS)	13,089	13,086	13,089	13,086	85,072	-	-	-	-	-	-	-
Tax Depreciation	13,089	13,086	13,089	13,086	85,072	-	-	-	-	-	-	-
Accumulated Tax Depreciation	169,017	182,103	195,192	208,279	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350
State Investment Tax Credit (ITC)												
Book												
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Tax												
Deferred Tax Calculation												
Book Accumulated Depreciation	209,536	230,490	251,443	272,397	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350
Tax Accumulated Depreciation	169,017	182,103	195,192	208,279	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350
Book/Tax Acc Depr Difference	40,519	48,386	56,251	64,118	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	15,766	18,827	21,887	24,948	-	-	-	-	-	-	-	-
Deferred Tax Base	(7,864)	(7,867)	(7,864)	(7,867)	64,118	-	-	-	-	-	-	-
Deferred Taxes - Federal	(2,587)	(2,588)	(2,587)	(2,588)	21,091	-	-	-	-	-	-	-
Deferred Taxes - State excluding credit	(473)	(473)	(473)	(473)	3,857	-	-	-	-	-	-	-
Change in Deferred Taxes	(3,060)	(3,061)	(3,060)	(3,061)	24,948	-	-	-	-	-	-	-
Accumulated Deferred Taxes	(15,766)	(18,827)	(21,887)	(24,948)	-	-	-	-	-	-	-	-
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing												
Investment (Rate Base)												
Gross Plant	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350
Accumulated Depreciation	209,536	230,490	251,443	272,397	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350
Accumulated Deferred Taxes	(15,766)	(18,827)	(21,887)	(24,948)	-	-	-	-	-	-	-	-
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	99,580	81,688	63,794	45,902	-	-	-	-	-	-	-	-
Average Net Investment	108,527	90,634	72,741	54,848	22,951	-	-	-	-	-	-	-
Average Financing:												
Short Term Debt	1,335	1,115	895	675	282	-	-	-	-	-	-	-
Long Term Debt (Revenue Bonds)	41,717	34,839	27,961	21,083	8,822	-	-	-	-	-	-	-
Taxable Debt	2,501	2,088	1,676	1,264	529	-	-	-	-	-	-	-
Preferred Stock	1,266	1,057	848	640	268	-	-	-	-	-	-	-
Common Equity	61,709	51,535	41,361	31,187	13,050	-	-	-	-	-	-	-

Revenue Requirements Model - Calculatic												
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
	11	12	13	14	15	16	17	18	19	20	21	
Manual Input	108,527	90,634	72,741	54,848	22,951	-	-	-	-	-	-	
Total Financing												
Return on Investment												
Short Term Debt	17	14	11	8	4	-	-	-	-	-	-	
Long Term Debt (Taxable Debt)	2,111	1,763	1,415	1,067	446	-	-	-	-	-	-	
Hybrids	183	153	123	93	39	-	-	-	-	-	-	
Total Interest Expense	2,311	1,930	1,549	1,168	489	-	-	-	-	-	-	
Preferred Dividends	104	87	70	53	22	-	-	-	-	-	-	
Net Income on Common	5,554	4,638	3,723	2,807	1,175	-	-	-	-	-	-	
Income Taxes												
Income Before Pref Dividends	5,658	4,725	3,792	2,860	1,197	-	-	-	-	-	-	
Income Before Taxes (including ITC)	9,262	7,735	6,208	4,681	1,959	-	-	-	-	-	-	
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	
Income Before Taxes (excluding ITC)	9,262	7,735	6,208	4,681	1,959	-	-	-	-	-	-	
Federal Income Tax	3,047	2,544	2,042	1,540	644	-	-	-	-	-	-	
State Income Tax	557	465	373	282	118	-	-	-	-	-	-	
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	
Total State Tax	557	465	373	282	118	-	-	-	-	-	-	
Total Taxes	3,604	3,010	2,416	1,821	762	-	-	-	-	-	-	
Revenue Requirement Calculation												
Revenue Requirement Factors	0.1217	0.1146	0.1074	0.1003	0.0876	-	-	-	-	-	-	
Revenue Requirement	35,698	33,604	31,510	29,416	25,683	-	-	-	-	-	-	
Revenue Taxes	3,172	2,986	2,800	2,614	2,282	-	-	-	-	-	-	
Income Before Depr. Int, Inc Tax	32,526	30,618	28,710	26,802	23,401	-	-	-	-	-	-	
Depreciation Expense	20,954	20,954	20,954	20,954	20,954	-	-	-	-	-	-	
O&M	-	-	-	-	-	-	-	-	-	-	-	
Interest Expense	2,311	1,930	1,549	1,168	489	-	-	-	-	-	-	
Income Before Income Taxes	9,262	7,735	6,208	4,681	1,959	-	-	-	-	-	-	
Income Taxes - Federal	3,047	2,544	2,042	1,540	644	-	-	-	-	-	-	
Income Taxes - State	557	465	373	282	118	-	-	-	-	-	-	
State ITC	-	-	-	-	-	-	-	-	-	-	-	
Total Income Taxes	3,604	3,010	2,416	1,821	762	-	-	-	-	-	-	
Preferred Dividends	104	87	70	53	22	-	-	-	-	-	-	
Net Income for Common	5,554	4,638	3,723	2,807	1,175	-	-	-	-	-	-	
Book Financial Statements												
Balance Sheet												
Gross Plant	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	293,350	
Accumulated Depreciation	209,536	230,490	251,443	272,397	293,350	293,350	293,350	293,350	293,350	293,350	293,350	
Accumulated Deferred Taxes	(15,766)	(18,827)	(21,887)	(24,948)	-	-	-	-	-	-	-	
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	
Ending Net Investment	99,560	81,688	63,794	45,902	-	-	-	-	-	-	-	
Short Term Debt	1,225	1,005	785	565	-	-	-	-	-	-	-	
Long Term Debt (Taxable Debt)	38,278	31,400	24,522	17,644	-	-	-	-	-	-	-	
Hybrids	2,294	1,892	1,470	1,058	-	-	-	-	-	-	-	
Preferred Stock	1,161	953	744	535	-	-	-	-	-	-	-	
Common Equity	56,622	46,448	36,274	26,100	-	-	-	-	-	-	-	
Financing	99,560	81,688	63,794	45,902	-	-	-	-	-	-	-	
Income Statement												
Revenue	35,698	33,604	31,510	29,416	25,683	-	-	-	-	-	-	
Revenue Taxes	3,172	2,986	2,800	2,614	2,282	-	-	-	-	-	-	

MECO Above the Cap Revenue Requirement - Bill Impact											
Revenue Requirements Model - Calculations											
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	
Manual input	1	2	3	4	5	6	7	8	9	10	
O&M											
Escalation Rate	-	-	-	-	-	-	-	-	-	-	
O&M	-	-	-	-	-	-	-	-	-	-	
Plant Asset Depreciation											
Book Depreciation											
Book Depreciation Rates	0.000%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%
Depreciation Expense	-	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513
Accumulated Depreciation	-	4,513	9,026	13,539	18,052	22,565	27,077	31,590	36,103	40,616	40,616
Tax Depreciation											
Tax Depreciation Rates (Straight Line)	30	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (S/L)	0.0%										
Tax Depreciation Rates (MACRS)	20	7.219%	6.677%	6.177%	5.713%	5.285%	4.888%	4.522%	4.462%	4.461%	4.461%
NonRB Financed Tax Basis (MACRS)	3,215	6,190	5,725	5,296	4,899	4,532	4,191	3,877	3,826	3,825	3,825
Tax Depreciation	3,215	6,190	5,725	5,296	4,899	4,532	4,191	3,877	3,826	3,825	3,825
Accumulated Tax Depreciation	3,215	9,405	15,131	20,427	25,326	29,857	34,049	37,926	41,752	45,577	45,577
State Investment Tax Credit (ITC)											
Book											
State ITC Amortization Rate	0.000%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	4.00%	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation											
Book Accumulated Depreciation	-	4,513	9,026	13,539	18,052	22,565	27,077	31,590	36,103	40,616	40,616
Tax Accumulated Depreciation	3,215	9,405	15,131	20,427	25,326	29,857	34,049	37,926	41,752	45,577	45,577
Book/Tax Acc Depr Difference	(3,215)	(4,892)	(6,105)	(6,888)	(7,274)	(7,293)	(6,971)	(6,336)	(5,649)	(4,961)	(4,961)
Deferred ITC											
Net Deferred Tax Asset (Liability)	(1,251)	(1,904)	(2,375)	(2,680)	(2,830)	(2,838)	(2,712)	(2,465)	(2,198)	(1,930)	(1,930)
Deferred Tax Base	3,215	1,677	1,212	784	386	19	(322)	(636)	(687)	(688)	(688)
Deferred Taxes - Federal	1,058	552	399	258	127	6	(106)	(209)	(226)	(226)	(226)
Deferred Taxes - State excluding credit	193	101	73	47	23	1	(19)	(38)	(41)	(41)	(41)
Change in Deferred Taxes	1,251	653	472	305	150	7	(125)	(247)	(267)	(268)	(268)
Accumulated Deferred Taxes	1,251	1,904	2,375	2,680	2,830	2,838	2,712	2,465	2,198	1,930	1,930
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	0	0
Rate Base and Financing											
Investment: (Rate Base)											
Gross Plant	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745
Accumulated Depreciation	-	4,513	9,026	13,539	18,052	22,565	27,077	31,590	36,103	40,616	40,616
Accumulated Deferred Taxes	1,251	1,904	2,375	2,680	2,830	2,838	2,712	2,465	2,198	1,930	1,930
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	84,494	79,329	74,344	69,526	64,863	60,343	55,955	51,690	47,444	43,199	43,199
Average Net Investment	42,247	81,911	76,836	71,935	67,195	62,603	58,149	53,822	49,567	45,321	45,321
Average Financing:											
Short Term Debt	520	1,007	945	885	826	770	715	662	610	557	557
Long Term Debt (Revenue Bonds)	16,239	31,486	29,535	27,651	25,829	24,064	22,352	20,689	19,053	17,421	17,421
Taxable Debt	973	1,887	1,770	1,657	1,548	1,442	1,340	1,240	1,142	1,044	1,044
Preferred Stock	493	955	896	839	784	730	678	628	578	529	529
Common Equity	24,022	46,575	43,690	40,903	38,208	35,597	33,064	30,604	28,184	25,770	25,770

Revenue Requirements Model - Calculations												
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024		
<u>Manual Input</u>												
Total Financing	42,247	81,911	76,836	71,935	67,195	62,603	58,149	53,822	49,567	45,321		
<u>Return on Investment</u>												
Short Term Debt	6	13	12	11	10	10	9	8	8	7		
Long Term Debt (Taxable Debt)	822	1,593	1,494	1,399	1,307	1,218	1,131	1,047	964	882		
Hybrids	71	138	130	121	113	106	98	91	84	76		
Total Interest Expense	899	1,744	1,636	1,532	1,431	1,333	1,238	1,146	1,055	965		
Preferred Dividends	41	79	74	69	65	60	56	52	48	44		
Net Income on Common	2,162	4,192	3,932	3,681	3,439	3,204	2,976	2,754	2,537	2,319		
<u>Income Taxes</u>												
Income Before Pref Dividends	2,203	4,271	4,006	3,750	3,503	3,264	3,032	2,806	2,584	2,363		
Income Before Taxes (including ITC)	3,606	6,991	6,558	6,139	5,735	5,343	4,963	4,593	4,230	3,868		
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-		
Income Before Taxes (excluding ITC)	3,606	6,991	6,558	6,139	5,735	5,343	4,963	4,593	4,230	3,868		
Federal Income Tax	1,186	2,300	2,157	2,019	1,886	1,758	1,632	1,511	1,392	1,272		
State Income Tax	217	420	394	369	345	321	299	276	254	233		
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-		
Total State Tax	217	420	394	369	345	321	299	276	254	233		
Total Taxes	1,403	2,720	2,552	2,389	2,231	2,079	1,931	1,787	1,646	1,505		
<u>Revenue Requirement Calculation</u>												
Revenue Requirement Factors	0.0577	0.1696	0.1626	0.1559	0.1495	0.1432	0.1371	0.1312	0.1254	0.1196		
Revenue Requirement	4,944	14,539	13,945	13,372	12,817	12,280	11,758	11,252	10,754	10,257		
Revenue Taxes	439	1,292	1,239	1,188	1,139	1,091	1,045	1,000	955	911		
Income Before Depr, Int, Inc Tax	4,505	13,247	12,706	12,184	11,678	11,189	10,714	10,252	9,798	9,346		
Depreciation Expense	-	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513		
O&M	-	-	-	-	-	-	-	-	-	-		
Interest Expense	899	1,744	1,636	1,532	1,431	1,333	1,238	1,146	1,055	965		
Income Before Income Taxes	3,606	6,991	6,558	6,139	5,735	5,343	4,963	4,593	4,230	3,868		
Income Taxes - Federal	1,186	2,300	2,157	2,019	1,886	1,758	1,632	1,511	1,392	1,272		
Income Taxes - State	217	420	394	369	345	321	299	276	254	233		
State ITC	-	-	-	-	-	-	-	-	-	-		
Total Income Taxes	1,403	2,720	2,552	2,389	2,231	2,079	1,931	1,787	1,646	1,505		
Preferred Dividends	41	79	74	69	65	60	56	52	48	44		
Net Income for Common	2,162	4,192	3,932	3,681	3,439	3,204	2,976	2,754	2,537	2,319		
<u>Book Financial Statements</u>												
Balance Sheet												
Gross Plant	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745		
Accumulated Depreciation	-	4,513	9,026	13,539	18,052	22,565	27,077	31,590	36,103	40,616		
Accumulated Deferred Taxes	1,251	1,904	2,375	2,680	2,930	2,838	2,712	2,465	2,198	1,930		
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-		
Ending Net Investment	84,494	79,329	74,344	69,526	64,863	60,343	55,955	51,690	47,444	43,199		
Short Term Debt	1,039	976	914	855	798	742	688	636	583	531		
Long Term Debt (Taxable Debt)	32,479	30,493	28,577	26,725	24,933	23,195	21,509	19,869	18,237	16,605		
Hybrids	1,947	1,828	1,713	1,602	1,495	1,390	1,289	1,191	1,093	995		
Preferred Stock	985	985	867	811	756	704	653	603	553	504		
Common Equity	48,044	45,107	42,273	39,533	36,882	34,312	31,817	29,391	26,977	24,563		
Financing	84,494	79,329	74,344	69,526	64,863	60,343	55,955	51,690	47,444	43,199		
Income Statement												
Revenue	4,944	14,539	13,945	13,372	12,817	12,280	11,758	11,252	10,754	10,257		
Revenue Taxes	439	1,292	1,239	1,188	1,139	1,091	1,045	1,000	955	911		

MECO Above the Cap Revenue Requirement Revenue Requirements Model - Calculatic												
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>	
Manual input												
O&M												
Escalation Rate												
O&M												
Plant Asset Depreciation												
Book Depreciation												
Book Depreciation Rates	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	5.263%	0.000%
Depreciation Expense	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	-
Accumulated Depreciation	45,129	49,642	54,155	58,668	63,181	67,694	72,206	76,719	81,232	85,745	85,745	
Tax Depreciation												
Tax Depreciation Rates (Straight Line)	3.333%	3.333%	3.334%	3.333%	3.334%	3.333%	3.334%	3.333%	3.334%	3.333%	3.334%	3.334%
Revenue Bond Financed Tax Basis (S/L)												
Tax Depreciation Rates (MACRS)	4.462%	4.461%	4.462%	4.461%	4.462%	4.461%	4.462%	4.461%	4.462%	4.461%	4.461%	2.231%
NonRB Financed Tax Basis (MACRS)	3,826	3,825	3,826	3,826	3,825	3,826	3,826	3,825	3,826	3,826	3,825	1,913
Tax Depreciation	3,826	3,825	3,826	3,826	3,825	3,826	3,826	3,825	3,826	3,826	3,825	1,913
Accumulated Tax Depreciation	49,403	53,228	57,054	60,879	64,705	68,530	72,356	76,181	80,007	83,832	85,745	
State Investment Tax Credit (ITC)												
Book												
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC												
Accumulated Amortization												
Deferred ITC												
Tax												
Deferred Tax Calculation												
Book Accumulated Depreciation	45,129	49,642	54,155	58,668	63,181	67,694	72,206	76,719	81,232	85,745	85,745	
Tax Accumulated Depreciation	49,403	53,228	57,054	60,879	64,705	68,530	72,356	76,181	80,007	83,832	85,745	
Book/Tax Acc Depr Difference	(4,274)	(3,586)	(2,899)	(2,211)	(1,524)	(837)	(150)	538	1,225	1,913	-	
Deferred ITC												
Net Deferred Tax Asset (Liability)	(1,663)	(1,395)	(1,128)	(860)	(593)	(326)	(58)	209	477	744	-	
Deferred Tax Base	(687)	(688)	(687)	(688)	(687)	(688)	(687)	(688)	(687)	(688)	(688)	1,913
Deferred Taxes - Federal	(226)	(226)	(226)	(226)	(226)	(226)	(226)	(226)	(226)	(226)	(226)	629
Deferred Taxes - State excluding credit	(41)	(41)	(41)	(41)	(41)	(41)	(41)	(41)	(41)	(41)	(41)	115
Change in Deferred Taxes	(267)	(268)	(267)	(268)	(267)	(268)	(267)	(268)	(267)	(268)	(268)	744
Accumulated Deferred Taxes	1,663	1,395	1,128	860	593	326	58	(209)	(477)	(744)	-	
Change in Deferred ITC	0	0	0	0	0	0	0	0	0	0	0	
Rate Base and Financing												
Investment (Rate Base)												
Gross Plant	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	
Accumulated Depreciation	45,129	49,642	54,155	58,668	63,181	67,694	72,206	76,719	81,232	85,745	85,745	
Accumulated Deferred Taxes	1,663	1,395	1,128	860	593	326	58	(209)	(477)	(744)	-	
Accumulated Deferred ITC												
Ending Net Investment	38,953	34,708	30,462	26,217	21,971	17,726	13,481	9,235	4,990	744	(0)	
Average Net Investment	41,076	36,831	32,585	28,340	24,094	19,849	15,603	11,358	7,112	2,867	372	
Average Financing:												
Short Term Debt	505	453	401	349	296	244	192	140	87	35	5	
Long Term Debt (Revenue Bonds)	15,789	14,157	12,525	10,893	9,262	7,630	5,998	4,366	2,734	1,102	143	
Taxable Debt	946	849	751	653	555	457	360	262	164	66	9	
Preferred Stock	479	479	479	479	479	479	479	479	479	479	479	
Common Equity	23,356	20,942	18,528	16,114	13,700	11,286	8,872	6,458	4,044	1,630	212	

Revenue Requirements Model - Calculatic												
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	
Manual Input												
Total Financing	11 41,076	12 36,831	13 32,585	14 28,340	15 24,094	16 19,849	17 15,603	18 11,358	19 7,112	20 2,867	21 372	
Return on Investment												
Short Term Debt	6	6	5	4	4	3	2	2	1	0	0	
Long Term Debt (Taxable Debt)	799	716	634	551	469	386	303	221	138	56	7	
Hybrids	69	62	55	48	41	33	26	19	12	5	1	
Total Interest Expense	875	784	694	603	513	423	332	242	151	61	8	
Preferred Dividends	40	35	31	27	23	19	15	11	7	3	0	
Net Income on Common	2,102	1,885	1,668	1,450	1,233	1,016	798	581	364	147	19	
Income Taxes												
Income Before Pref Dividends	2,142	1,920	1,699	1,478	1,256	1,035	814	592	371	149	19	
Income Before Taxes (including ITC)	3,506	3,143	2,781	2,419	2,056	1,694	1,332	969	607	245	32	
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	
Income Before Taxes (excluding ITC)	3,506	3,143	2,781	2,419	2,056	1,694	1,332	969	607	245	32	
Federal Income Tax	1,153	1,034	915	796	676	557	438	319	200	80	10	
State Income Tax	211	189	167	145	124	102	80	58	37	15	2	
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	
Total State Tax	211	189	167	145	124	102	80	58	37	15	2	
Total Taxes	1,364	1,223	1,082	941	800	659	518	377	236	95	12	
Revenue Requirement Calculation												
Revenue Requirement Factors	0.1138	0.1080	0.1022	0.0964	0.0906	0.0849	0.0791	0.0733	0.0675	0.0617	0.0005	
Revenue Requirement	9,760	9,263	8,767	8,270	7,773	7,276	6,779	6,282	5,785	5,289	44	
Revenue Taxes	867	823	779	735	691	646	602	558	514	470	4	
Income Before Depr. Int, Inc Tax	8,893	8,440	7,988	7,535	7,082	6,629	6,177	5,724	5,271	4,819	40	
Depreciation Expense	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	4,513	-	
O&M	-	-	-	-	-	-	-	-	-	-	-	
Interest Expense	875	784	694	603	513	423	332	242	151	61	8	
Income Before Income Taxes	3,506	3,143	2,781	2,419	2,056	1,694	1,332	969	607	245	32	
Income Taxes - Federal	1,153	1,034	915	796	676	557	438	319	200	80	10	
Income Taxes - State	211	189	167	145	124	102	80	58	37	15	2	
State ITC	-	-	-	-	-	-	-	-	-	-	-	
Total Income Taxes	1,364	1,223	1,082	941	800	659	518	377	236	95	12	
Preferred Dividends	40	35	31	27	23	19	15	11	7	3	0	
Net Income for Common	2,102	1,885	1,668	1,450	1,233	1,016	798	581	364	147	19	
Book Financial Statements												
Balance Sheet												
Gross Plant	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	85,745	
Accumulated Depreciation	45,129	49,642	54,155	58,668	63,181	67,694	72,206	76,719	81,232	85,745	85,745	
Accumulated Deferred Taxes	1,663	1,395	1,128	860	593	326	58	(209)	(477)	(744)	-	
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	
Ending Net Investment	38,953	34,708	30,462	26,217	21,971	17,726	13,481	9,235	4,990	744	(0)	
Short Term Debt	479	427	375	322	270	218	166	114	61	9	(0)	
Long Term Debt (Taxable Debt)	14,973	13,341	11,709	10,078	8,446	6,814	5,182	3,550	1,918	286	(0)	
Hybrids	898	800	702	604	506	408	311	213	115	17	(0)	
Preferred Stock	454	405	355	306	256	207	157	108	58	9	(0)	
Common Equity	22,149	19,735	17,321	14,907	12,493	10,079	7,665	5,251	2,837	423	(0)	
Financing	38,953	34,708	30,462	26,217	21,971	17,726	13,481	9,235	4,990	744	(0)	
Income Statement												
Revenue	9,760	9,263	8,767	8,270	7,773	7,276	6,779	6,282	5,785	5,289	44	
Revenue Taxes	867	823	779	735	691	646	602	558	514	470	4	

MECO Above the Cap Revenue Requirement - Bill Impact															
Revenue Requirements Model - Calculations															
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>
	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M	O&M
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation															
Book Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Book Depreciation Rates	0.000%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%
Depreciation Expense	-	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741
Accumulated Depreciation	-	20,741	41,482	62,223	82,963	103,704	124,445	145,185	165,926	186,667	207,408	228,149	248,889	269,630	290,371
Tax Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (Straight-Line)	30	1.667%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (S/L)	0.0%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation Rates (MACRS)	20	3.750%	7.219%	6.177%	5.713%	5.248%	4.886%	4.522%	4.462%	4.461%	4.462%	4.461%	4.462%	4.461%	4.462%
NonRB Financed Tax Basis (MACRS)	100.0%	65,880	60,934	56,371	52,137	48,231	44,608	41,268	38,120	35,141	32,305	29,580	26,963	24,445	22,028
Tax Depreciation	-	34,222	65,880	60,934	56,371	52,137	48,231	44,608	41,268	38,120	35,141	32,305	29,580	26,963	24,445
Accumulated Tax Depreciation	-	34,222	100,102	161,036	217,407	269,544	317,774	362,382	403,650	444,370	485,080	525,800	566,511	607,231	647,942
State Investment Tax Credit (ITC)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Book	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
State ITC Amortization Rate	0.000%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation															
Book Accumulated Depreciation	-	20,741	41,482	62,223	82,963	103,704	124,445	145,185	165,926	186,667	207,408	228,149	248,889	269,630	290,371
Tax Accumulated Depreciation	-	34,222	100,102	161,036	217,407	269,544	317,774	362,382	403,650	444,370	485,080	525,800	566,511	607,231	647,942
Book/Tax Acc Depr Difference	(34,222)	(79,362)	(119,555)	(155,185)	(186,581)	(214,071)	(237,971)	(258,464)	(278,443)	(298,413)	(318,363)	(338,342)	(358,342)	(378,342)	(398,291)
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(13,316)	(30,879)	(46,519)	(60,382)	(72,588)	(83,294)	(92,581)	(100,568)	(108,342)	(116,112)	(123,886)	(131,656)	(139,430)	(147,200)	(154,974)
Deferred Tax Base	34,222	45,139	40,193	35,630	31,396	27,490	23,867	20,527	19,979	19,979	19,979	19,979	19,979	19,979	19,979
Deferred Taxes - Federal	11,257	14,848	13,221	11,720	10,328	9,043	7,851	6,752	6,572	6,569	6,572	6,569	6,572	6,569	6,572
Deferred Taxes - State excluding credit	2,068	2,418	2,418	2,418	2,418	2,418	2,418	2,418	2,418	2,418	2,418	2,418	2,418	2,418	2,418
Change in Deferred Taxes	13,316	17,564	15,339	13,864	12,216	10,666	9,287	7,987	7,774	7,774	7,774	7,774	7,774	7,774	7,774
Accumulated Deferred Taxes	13,316	30,879	46,519	60,382	72,588	83,294	92,581	100,568	108,342	116,112	123,886	131,656	139,430	147,200	154,974
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing															
Investment - (Rate Base)	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594	912,594
Gross Plant	-	20,741	41,482	62,223	82,963	103,704	124,445	145,185	165,926	186,667	207,408	228,149	248,889	269,630	290,371
Accumulated Depreciation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Deferred Taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ending Net Investment	899,279	860,974	824,594	789,990	757,033	725,586	695,589	666,841	638,326	609,815	581,301	552,780	524,275	495,764	467,249
Average Net Investment	449,639	850,126	842,784	807,292	773,511	741,315	710,582	681,205	652,854	624,071	595,558	567,045	538,532	510,019	481,507
Average Financing:															
Short Term Debt	5,530	10,924	10,965	9,928	9,513	9,117	8,739	8,378	8,028	7,675	7,324	6,974	6,623	6,272	5,922
Long Term Debt (Revenue Bonds)	172,837	338,312	323,958	310,315	297,330	284,554	273,141	261,849	250,647	239,867	228,927	217,967	207,007	196,047	185,087
Taxable Debt	2,30%	10,360	19,418	18,601	17,822	17,080	16,372	15,686	15,036	14,379	13,722	13,065	12,408	11,751	11,094
Preferred Stock	1.17%	9,244	10,264	9,923	9,414	8,845	8,287	7,744	7,210	6,686	6,145	5,613	5,080	4,548	4,015
Common Equity	56.86%	253,669	500,447	479,214	459,033	439,825	421,518	404,043	387,339	371,063	354,852	338,639	322,427	306,214	290,001
Total Financing	449,639	860,126	842,784	807,292	773,511	741,315	710,582	681,205	652,854	624,071	595,558	567,045	538,532	510,019	481,507
Return on Investment															
Short Term Debt	69	135	130	124	119	114	109	105	100	96	92	87	83	78	74
Long Term Debt (Taxable Debt)	8,746	17,119	16,392	15,702	15,045	14,419	13,821	13,250	12,693	12,138	11,584	11,029	10,475	9,920	9,365
Hybrids	758	1,484	1,421	1,362	1,305	1,250	1,198	1,149	1,101	1,053	1,004	956	908	860	812
Total Interest Expense	9,573	18,738	17,943	17,188	16,468	15,783	15,129	14,503	13,894	13,287	12,680	12,073	11,466	10,859	10,252
Preferred Dividends	433	847	811	777	744	713	684	655	628	600	573	546	518	491	463
Net Income on Common	23,010	45,040	43,129	41,313	39,584	37,937	36,364	34,861	33,396	31,937	30,478	29,018	27,559	26,100	24,641
Income Taxes															
Income Before Pref Dividends	23,443	45,887	43,940	42,090	40,328	38,650	37,048	35,516	34,024	32,537	31,051	29,564	28,077	26,591	25,104
Income Before Taxes (including ITC)	38,374	75,114	71,927	68,898	66,015	63,267	60,644	58,137	55,694	53,261	50,827	48,394	45,961	43,527	41,094
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	38,374	75,114	71,927	68,898	66,015	63,267	60,644	58,137	55,694	53,261	50,827	48,394	45,961	43,527	41,094
Federal Income Tax	12,623	24,708	23,660	22,624	20,811	19,949	19,124	18,320	17,520	16,720	15,920	15,119	14,318	13,518	12,717
State Income Tax	2,308	4,518	4,326	4,144	3,971	3,806	3,648	3,497	3,350	3,204	3,057	2,911	2,765	2,618	2,472
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total State Tax	2,308	4,518	4,326	4,144	3,971	3,806	3,648	3,497	3,350	3,204	3,057	2,911	2,765	2,618	2,472
Total Taxes	14,931	29,227	27,986	26,808	25,666	24,617	23,596	22,621	21,670	20,724	19,777	18,830	17,883	16,936	15,989
Revenue Requirement Calculation															

MECO Above the Cap Revenue Requirer Revenue Requirements Model - Calculati																
	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Manual Input	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
O&M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation																
Book Depreciation	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%
Book Depreciation Rates	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741	20,741
Depreciation Expense	311,112	331,852	352,593	373,334	394,075	414,816	435,556	456,297	477,038	497,779	518,520	539,260	560,001	580,742	601,483	622,223
Accumulated Depreciation	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%
Tax Depreciation	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%
Revenue Bond Financed Tax Basis (SL)	40,711	40,720	40,711	40,720	40,711	40,720	40,711	40,720	40,711	40,720	40,711	40,720	40,711	40,720	40,711	40,720
NonRE Financed Tax Basis (MACRS)	729,373	770,083	810,804	851,524	892,234	932,944	973,654	1,014,364	1,055,074	1,095,784	1,136,494	1,177,204	1,217,914	1,258,624	1,299,334	1,340,044
Accumulated Tax Depreciation	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%
State Investment Tax Credit (ITC)																
Book																
State ITC Amortization Rate	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%	2,083%
Amortization of State ITC																
Accumulated Amortization																
Deferred ITC																
Tax																
Deferred Tax Calculation																
Book Accumulated Depreciation	311,112	331,852	352,593	373,334	394,075	414,816	435,556	456,297	477,038	497,779	518,520	539,260	560,001	580,742	601,483	622,223
Tax Accumulated Depreciation	729,373	770,083	810,804	851,524	892,234	932,944	973,654	1,014,364	1,055,074	1,095,784	1,136,494	1,177,204	1,217,914	1,258,624	1,299,334	1,340,044
Book/Tax Acc Depr Difference	(418,261)	(438,240)	(458,219)	(478,198)	(498,160)	(518,122)	(538,084)	(558,046)	(578,008)	(597,970)	(617,932)	(637,894)	(657,856)	(677,818)	(697,780)	(717,742)
Deferred ITC	(162,744)	(170,518)	(178,292)	(186,066)	(193,840)	(201,614)	(209,388)	(217,162)	(224,936)	(232,710)	(240,484)	(248,258)	(256,032)	(263,806)	(271,580)	(279,354)
Net Deferred Tax Asset (Liability)	19,970	19,979	19,970	19,979	19,970	19,979	19,970	19,979	19,970	19,979	19,970	19,979	19,970	19,979	19,970	19,979
Deferred Tax Base	6,569	6,572	6,569	6,572	6,569	6,572	6,569	6,572	6,569	6,572	6,569	6,572	6,569	6,572	6,569	6,572
Deferred Taxes - Federal	1,201	1,202	1,201	1,202	1,201	1,202	1,201	1,202	1,201	1,202	1,201	1,202	1,201	1,202	1,201	1,202
Deferred Taxes - State excluding credit	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774	7,774
Change in Deferred Taxes	162,744	170,518	178,292	186,066	193,840	201,614	209,388	217,162	224,936	232,710	240,484	248,258	256,032	263,806	271,580	279,354
Accumulated Deferred Taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing																
Investment: (Rate Base)																
Gross Plant	311,112	331,852	352,593	373,334	394,075	414,816	435,556	456,297	477,038	497,779	518,520	539,260	560,001	580,742	601,483	622,223
Accumulated Depreciation	162,744	170,518	178,292	186,066	193,840	201,614	209,388	217,162	224,936	232,710	240,484	248,258	256,032	263,806	271,580	279,354
Accumulated Deferred Taxes	436,738	410,224	381,712	353,198	324,687	304,084	291,424	278,753	266,082	253,412	240,741	228,071	215,400	202,729	190,059	177,388
Ending Net Investment	452,994	424,481	395,968	367,455	338,942	314,390	297,759	285,088	272,418	259,747	247,077	234,406	221,735	209,065	196,394	183,724
Average Financing:																
Short Term Debt	5,571	5,220	4,870	4,519	4,168	3,867	3,566	3,265	2,964	2,663	2,362	2,061	1,760	1,459	1,158	857
Long Term Debt (Revenue Bonds)	174,126	163,166	152,206	141,246	130,286	119,326	108,366	97,406	86,446	75,486	64,526	53,566	42,606	31,646	20,686	9,726
Long Term Debt (Revenue Bonds)	10,437	9,780	9,123	8,466	7,810	7,244	6,688	6,132	5,576	5,020	4,464	3,908	3,352	2,796	2,240	1,684
Long Term Debt (Revenue Bonds)	5,283	4,950	4,617	4,284	3,951	3,618	3,285	2,952	2,619	2,286	1,953	1,620	1,287	954	621	288
Common Equity	257,576	241,364	225,151	208,938	192,726	176,514	160,302	144,090	127,878	111,666	95,454	79,242	63,030	46,818	30,606	14,394
Total Financing	452,994	424,481	395,968	367,455	338,942	314,390	297,759	285,088	272,418	259,747	247,077	234,406	221,735	209,065	196,394	183,724
Return on Investment																
Short Term Debt	70	65	61	56	52	48	44	40	36	32	28	24	20	16	12	8
Long Term Debt (Taxable Debt)	8,811	8,256	7,702	7,147	6,592	6,115	5,639	5,162	4,685	4,208	3,731	3,254	2,777	2,300	1,823	1,346
Hybrids	764	716	668	620	572	524	476	428	380	332	284	236	188	140	92	44
Total Interest Expense	9,644	9,037	8,430	7,823	7,216	6,609	6,002	5,395	4,788	4,181	3,574	2,967	2,360	1,753	1,146	539
Preferred Dividends	436	408	381	354	326	302	286	274	262	250	238	226	213	201	189	177
Net Income on Common	23,182	21,723	20,264	18,804	17,345	16,089	15,238	14,589	13,941	13,293	12,644	11,996	11,347	10,699	10,050	9,402
Income Taxes																
Income Before Pref Dividends	23,618	22,131	20,645	19,158	17,671	16,391	15,542	14,884	14,203	13,542	12,887	12,221	11,561	10,900	10,239	9,579
Income Before Taxes (including ITC)	38,660	36,227	33,794	31,360	28,927	26,831	25,412	24,331	23,249	22,168	21,087	20,005	18,924	17,842	16,761	15,680
Investment Tax Credit	36,227	33,794	31,360	28,927	26,831	25,412	24,331	23,249	22,168	21,087	20,005	18,924	17,842	16,761	15,680	14,600
Income Before Taxes (excluding ITC)	12,717	11,917	11,117	10,317	9,517	8,717	8,229	7,843	7,457	7,071	6,685	6,299	5,913	5,527	5,141	4,755
Federal Income Tax	2,325	2,179	2,033	1,886	1,740	1,614	1,529	1,463	1,398	1,333	1,268	1,203	1,138	1,073	1,008	943
State Investment Tax Credit	2,325	2,179	2,033	1,886	1,740	1,614	1,529	1,463	1,398	1,333	1,268	1,203	1,138	1,073	1,008	943
Total State Tax	15,043	14,096	13,149	12,202	11,255	10,440	9,888	9,467	9,046	8,625	8,205	7,784	7,363	6,942	6,522	6,101
Total Taxes																
Revenue Requirement Calculation																

MECO Above the Cap Revenue Requirement Revenue Requirements Model - Calculati													
	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074
Manual Input	48	49	50	51	52	53	54	55	56	57	58	59	60
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-
ORM	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation													
Book Depreciation	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Depreciation Expense	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594
Accumulated Depreciation	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Tax Depreciation													
Tax Depreciation Rates (Straight Line)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Revenue Bond Financed Tax Basis (S/L)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
NonRB Financed Tax Basis (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Tax Depreciation	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594
Accumulated Tax Depreciation	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
State Investment Tax Credit (ITC)	2.083%	2.083%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Book	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
State ITC Amortization Rate	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Calculation													
Book Accumulated Depreciation	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594
Tax Accumulated Depreciation	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594
Book/Tax Acc. Depr. Difference	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Tax Base	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Taxes - Federal	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred Taxes - State excluding credit	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Deferred Taxes	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Deferred Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing													
Investment: (Rate Base)	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594
Gross Plant	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594
Accumulated Depreciation	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594	912.594
Accumulated Deferred Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0
Accumulated Deferred ITC	0	0	0	0	0	0	0	0	0	0	0	0	0
Ending Net Investment	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Average Net Investment	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Average Financing:													
Short Term Debt	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Long Term Debt (Revenue Bonds)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Long Term Debt (Revenue Bonds)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Taxable Debt	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Preferred Stock	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Common Equity	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Total Financing	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Return on Investment													
Short Term Debt	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Long Term Debt (Taxable Debt)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Hybrids	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Total Interest Expense	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Preferred Dividends	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Net Income on Common	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Income Taxes													
Income Before Pref Dividends	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Income Before Taxes (including ITC)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Federal Income Tax	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
State Income Tax	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
State Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-
Total State Tax	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Total Taxes	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Revenue Requirement Calculation													

MECO Above the Cap Revenue Requirement - Bill Impact														
Revenue Requirements Model - Calculations														
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Manual Input														
Escalation Rate														
O&M														
O&M														
Plant Asset Depreciation														
Book Depreciation														
Book Depreciation Rates	0.000%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%	1.961%
Depreciation Expense	-	6,481	6,481	6,481	6,481	32,406	38,887	45,368	51,849	58,330	64,812	71,293	77,774	84,255
Accumulated Depreciation	-	6,481	12,962	19,443	25,925	32,406	38,887	45,368	51,849	58,330	64,812	71,293	77,774	84,255
Tax Depreciation														
Tax Depreciation Rates (Straight Line)	30	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%	3.333%
Revenue Bond Financed Tax Basis (SL)	0.0%													
Tax Depreciation Rates (MACRS)	20	3.750%	6.170%	6.170%	6.170%	5.285%	4.898%	4.522%	4.162%	3.826%	3.509%	3.209%	2.924%	2.652%
Non-BB Financed Tax Basis (MACRS)	100.0%	23,882	22,070	20,417	18,884	17,469	16,157	14,947	13,843	12,836	11,924	11,101	10,365	9,717
Tax Depreciation		23,882	22,070	20,417	18,884	17,469	16,157	14,947	13,843	12,836	11,924	11,101	10,365	9,717
Accumulated Tax Depreciation		36,257	58,327	78,744	97,628	115,097	131,254	146,201	160,950	175,695	190,444	205,189	219,938	234,683
State Investment Tax Credit (ITC)														
Book														
State ITC Amortization Rate	0.000%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC														
Accumulated Amortization														
Deferred ITC														
Tax														
Deferred Tax Calculated														
Book Accumulated Depreciation		6,481	12,962	19,443	25,925	32,406	38,887	45,368	51,849	58,330	64,812	71,293	77,774	84,255
Tax Accumulated Depreciation	12,395	36,257	58,327	76,744	97,628	115,097	131,254	146,201	160,950	175,695	190,444	205,189	219,938	234,683
Book/Tax Acc Depr Difference	(12,395)	(29,776)	(45,365)	(59,301)	(71,703)	(82,691)	(92,367)	(100,833)	(109,100)	(117,364)	(125,632)	(133,896)	(142,164)	(150,428)
Deferred ITC														
Net Deferred Tax Asset (Liability)	(4,823)	(11,566)	(17,651)	(23,074)	(27,900)	(32,175)	(35,940)	(39,234)	(42,451)	(45,666)	(48,883)	(52,099)	(55,316)	(58,531)
Deferred Tax Base	12,395	17,380	15,589	13,936	12,403	10,988	9,676	8,466	7,268	6,268	5,268	4,268	3,268	2,268
Deferred Taxes - Federal	4,077	5,717	5,128	4,584	4,080	3,614	3,183	2,785	2,420	2,083	1,762	1,465	1,191	927
Deferred Taxes - State excluding credit	746	1,045	938	838	746	661	582	509	447	391	340	293	250	210
Change in Deferred Taxes	4,823	6,762	6,066	5,423	4,826	4,275	3,765	3,276	2,817	2,374	1,942	1,522	1,111	817
Accumulated Deferred Taxes		11,586	17,651	23,074	27,900	32,175	35,940	39,234	42,451	45,666	48,883	52,099	55,316	58,531
Change in Deferred ITC														
Rate Base and Financing														
Investment: (Rate Base)														
Gross Plant	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539
Accumulated Depreciation	6,481	12,962	19,443	25,925	32,406	38,887	45,368	51,849	58,330	64,812	71,293	77,774	84,255	84,255
Accumulated Deferred Taxes	4,823	11,586	17,651	23,074	27,900	32,175	35,940	39,234	42,451	45,666	48,883	52,099	55,316	58,531
Accumulated Deferred ITC														
Ending Net Investment	325,716	312,473	299,926	285,022	276,715	265,959	255,713	245,937	236,239	226,543	216,845	207,148	197,450	187,753
Average Net Investment	162,858	313,094	306,199	293,974	282,359	271,337	260,836	250,825	241,088	231,391	221,694	211,996	202,299	192,601
Average Financing:														
Short Term Debt	2,003	3,924	3,766	3,615	3,473	3,337	3,208	3,085	2,965	2,846	2,726	2,607	2,488	2,369
Long Term Debt (Revenue Bonds)	62,601	122,657	117,700	113,001	108,540	104,289	100,263	96,415	92,672	89,044	85,217	81,488	77,762	74,034
Taxable Debt	3,752	7,382	7,055	6,773	6,506	6,252	6,010	5,779	5,555	5,331	5,108	4,885	4,661	4,438
Preferred Stock	1,899	3,721	3,571	3,428	3,293	3,164	3,042	2,925	2,812	2,702	2,595	2,492	2,391	2,291
Common Equity	92,603	181,440	174,107	167,156	160,557	154,283	148,313	142,613	137,083	131,571	126,059	120,547	115,029	109,515
Total Financing	162,858	313,094	306,199	293,974	282,359	271,337	260,836	250,825	241,088	231,391	221,694	211,996	202,299	192,601
Return on Investment														
Short Term Debt	25	49	47	45	43	42	40	39	37	36	34	33	31	30
Long Term Debt (Taxable Debt)	5,066	6,206	5,956	5,718	5,492	5,278	5,073	4,879	4,689	4,501	4,312	4,123	3,935	3,746
Hybrids	275	538	516	496	476	458	440	423	407	390	374	358	341	325
Total Interest Expense	3,467	6,794	6,519	6,259	6,012	5,777	5,553	5,340	5,133	4,926	4,720	4,513	4,307	4,101
Preferred Dividends	157	307	295	283	272	261	251	241	232	223	213	204	195	185
Net Income on Common	8,334	16,330	15,670	15,044	14,450	13,886	13,348	12,836	12,338	11,841	11,345	10,849	10,353	9,856
Income Taxes														
Income Before Pref Dividends	8,491	16,637	15,964	15,327	14,722	14,147	13,599	13,077	12,570	12,064	11,558	11,053	10,547	10,042
Income Before Taxes (including ITC)	13,899	27,233	26,132	25,089	24,098	23,157	22,261	21,406	20,575	19,748	18,920	18,093	17,265	16,437
Investment Tax Credit														
Income Before Taxes (excluding ITC)	13,899	27,233	26,132	25,089	24,098	23,157	22,261	21,406	20,575	19,748	18,920	18,093	17,265	16,437
Federal Income Tax	4,572	9,168	8,596	8,263	7,927	7,617	7,323	7,042	6,768	6,496	6,224	5,952	5,679	5,407
State Income Tax	838	1,638	1,572	1,509	1,450	1,393	1,339	1,286	1,238	1,186	1,138	1,086	1,038	989

MECO Above the Cap Revenue Requirement														
Revenue Requirements Model - Calculati														
	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Manual Input														
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation														
Book Depreciation	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%
Depreciation Expense	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481
Accumulated Depreciation	90,736	97,217	103,699	110,180	116,661	123,142	129,623	136,104	142,586	149,067	155,548	162,029	168,510	174,991
Tax Depreciation Rates (Straight Line)	3.334%	3.333%	3.334%	3.333%	3.334%	3.333%	3.334%	3.333%	3.334%	3.333%	3.334%	3.333%	3.334%	3.333%
Revenue Bond Financed Tax Basis (S/L)	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%
NonRB Financed Tax Basis (MACRS)	14,749	14,745	14,749	14,745	14,749	14,745	14,749	14,745	14,749	14,745	14,749	14,745	14,749	14,745
Accumulated Tax Depreciation	249,432	264,177	278,926	293,671	308,420	323,165	337,910	352,655	367,400	382,145	396,890	411,635	426,380	441,125
State Investment Tax Credit (ITC)														
Book														
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax														
Deferred Tax Calculation														
Book Accumulated Depreciation	90,736	97,217	103,699	110,180	116,661	123,142	129,623	136,104	142,586	149,067	155,548	162,029	168,510	174,991
Tax Accumulated Depreciation	249,432	264,177	278,926	293,671	308,420	323,165	337,910	352,655	367,400	382,145	396,890	411,635	426,380	441,125
Book/Tax Acc Depr Difference	(158,695)	(166,960)	(175,227)	(183,491)	(191,759)	(200,023)	(208,287)	(216,551)	(224,815)	(233,079)	(241,343)	(249,607)	(257,871)	(266,135)
Deferred ITC														
Net Deferred Tax Asset (Liability)	(61,748)	(64,964)	(68,180)	(71,396)	(74,613)	(77,828)	(81,044)	(84,260)	(87,476)	(90,692)	(93,908)	(97,124)	(100,340)	(103,556)
Deferred Tax Base	8,268	8,264	8,268	8,264	8,268	8,264	8,268	8,264	8,268	8,264	8,268	8,264	8,268	8,264
Deferred Taxes - Federal	2,720	2,718	2,720	2,718	2,720	2,718	2,720	2,718	2,720	2,718	2,720	2,718	2,720	2,718
Deferred Taxes - State excluding credit	497	497	497	497	497	497	497	497	497	497	497	497	497	497
Change in Deferred Taxes	3,217	3,216	3,217	3,216	3,217	3,216	3,217	3,216	3,217	3,216	3,217	3,216	3,217	3,216
Accumulated Deferred Taxes	61,748	64,964	68,180	71,396	74,613	77,828	81,044	84,260	87,476	90,692	93,908	97,124	100,340	103,556
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing														
Investment: (Rate Base)														
Gross Plant	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539
Accumulated Depreciation	90,736	97,217	103,699	110,180	116,661	123,142	129,623	136,104	142,586	149,067	155,548	162,029	168,510	174,991
Accumulated Deferred Taxes	61,748	64,964	68,180	71,396	74,613	77,828	81,044	84,260	87,476	90,692	93,908	97,124	100,340	103,556
Accumulated Deferred ITC														
Ending Net Investment	178,055	168,358	158,660	148,964	139,266	129,569	122,740	118,781	114,821	110,862	106,903	102,943	98,984	95,025
Average Net Investment	182,904	173,207	163,509	153,812	144,115	134,417	126,154	120,760	116,801	112,842	108,882	104,923	100,964	97,004
Average Financing:														
Short Term Debt	2,249	2,130	2,011	1,892	1,772	1,653	1,552	1,485	1,436	1,388	1,339	1,290	1,242	1,193
Long Term Debt (Revenue Bonds)	70,307	66,579	62,851	59,124	55,396	51,669	48,493	46,419	44,897	43,375	41,853	40,331	38,809	37,288
Taxable Debt	4,214	3,991	3,767	3,544	3,321	3,097	2,907	2,708	2,509	2,600	2,418	2,418	2,326	2,235
Preferred Stock	2,133	2,020	1,907	1,794	1,681	1,568	1,471	1,408	1,362	1,316	1,270	1,224	1,177	1,131
Common Equity	104,001	98,487	92,973	87,459	81,945	76,431	71,732	68,665	66,114	64,163	61,911	59,660	57,409	55,157
Total Financing	182,904	173,207	163,509	153,812	144,115	134,417	126,154	120,760	116,801	112,842	108,882	104,923	100,964	97,004
Return on Investment														
Short Term Debt	28	27	25	24	22	21	19	19	18	17	17	16	16	15
Long Term Debt (Taxable Debt)	3,558	3,369	3,180	2,992	2,803	2,614	2,454	2,349	2,272	2,195	2,118	2,041	1,964	1,887
Hybrids	308	292	276	259	243	227	213	204	197	190	184	177	170	164
Total Interest Expense	3,894	3,688	3,481	3,275	3,068	2,862	2,686	2,571	2,487	2,402	2,318	2,234	2,150	2,065
Preferred Dividends	176	167	157	148	139	129	121	116	112	109	105	101	97	93
Net Income on Common	9,360	8,864	8,368	7,871	7,375	6,879	6,456	6,180	5,977	5,775	5,572	5,369	5,167	4,964
Income Taxes														
Income Before Pref Dividends	9,536	9,030	8,525	8,019	7,514	7,008	6,577	6,296	6,090	5,883	5,677	5,470	5,264	5,057
Income Before Taxes (including ITC)	15,610	14,782	13,955	13,127	12,299	11,472	10,767	10,306	9,968	9,630	9,292	8,955	8,617	8,279
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	15,610	14,782	13,955	13,127	12,299	11,472	10,767	10,306	9,968	9,630	9,292	8,955	8,617	8,279
Federal Income Tax	5,135	4,863	4,590	4,318	4,046	3,774	3,542	3,390	3,279	3,168	3,057	2,946	2,834	2,723
State Income Tax	939	889	839	790	740	690	648	620	600	579	559	539	518	498

MECO Above the Cap Revenue Requirement Revenue Requirements Model - Calculati														
	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056
Manual Input	29	30	31	32	33	34	35	36	37	38	39	40	41	42
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OSM	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation														
Book Depreciation	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%
Book Depreciation Rates	6.481	6.481	6.481	6.481	6.481	6.481	6.481	6.481	6.481	6.481	6.481	6.481	6.481	6.481
Depreciation Expense	181,473	187,954	194,435	200,916	207,397	213,878	220,360	226,841	233,322	239,803	246,284	252,765	259,247	265,728
Accumulated Depreciation														
Tax Depreciation Rates (Straight Line)	3.334%	3.333%	1.667%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Revenue Bond Financed Tax Basis (SL)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Tax Depreciation Rates (MACRS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NonRB Financed Tax Basis (MACRS)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539
Accumulated Tax Depreciation														
State Investment Tax Credit (ITC)														
Book														
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax														
Deferred Tax Calculation														
Book Accumulated Depreciation	181,473	187,954	194,435	200,916	207,397	213,878	220,360	226,841	233,322	239,803	246,284	252,765	259,247	265,728
Tax Accumulated Depreciation	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539
Book/Tax Acc Depr Difference	(149,067)	(142,586)	(136,104)	(129,623)	(123,142)	(116,661)	(110,180)	(103,699)	(97,217)	(90,736)	(84,255)	(77,774)	(71,293)	(64,812)
Deferred ITC														
Net Deferred Tax Asset (Liability)	(58,002)	(55,480)	(52,958)	(50,436)	(47,914)	(45,393)	(42,871)	(40,349)	(37,827)	(35,305)	(32,783)	(30,262)	(27,740)	(25,218)
Deferred Tax Base	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)
Deferred Taxes - Federal	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)
Deferred Taxes - State excluding credit	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)
Change in Deferred Taxes	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)
Accumulated Deferred Taxes	58,002	55,480	52,958	50,436	47,914	45,393	42,871	40,349	37,827	35,305	32,783	30,262	27,740	25,218
check	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing														
Investment: (Rate Base)														
Gross Plant	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539
Accumulated Depreciation	181,473	187,954	194,435	200,916	207,397	213,878	220,360	226,841	233,322	239,803	246,284	252,765	259,247	265,728
Accumulated Deferred Taxes	58,002	55,480	52,958	50,436	47,914	45,393	42,871	40,349	37,827	35,305	32,783	30,262	27,740	25,218
Accumulated Deferred ITC														
Ending Net Investment	91,065	87,106	83,147	79,187	75,228	71,268	67,309	63,350	59,390	55,431	51,472	47,512	43,553	39,594
Average Net Investment	93,045	89,066	85,126	81,167	77,207	73,248	69,289	65,329	61,370	57,411	53,451	49,492	45,533	41,573
Average Financing:														
Short Term Debt	1,144	1,096	1,047	998	950	901	852	803	755	706	657	609	560	511
Long Term Debt (Revenue Bonds)	35,766	34,244	32,722	31,200	29,678	28,156	26,634	25,112	23,590	22,068	20,546	19,024	17,502	15,980
Taxable Debt	2,144	2,063	1,981	1,870	1,779	1,688	1,596	1,505	1,414	1,323	1,232	1,140	1,049	958
Preferred Stock	1,085	1,039	993	947	900	854	808	762	716	670	623	577	531	485
Common Equity	52,906	50,665	48,403	46,152	43,901	41,650	39,398	37,147	34,896	32,644	30,393	28,142	25,890	23,639
Total Financing	93,045	89,066	85,126	81,167	77,207	73,248	69,289	65,329	61,370	57,411	53,451	49,492	45,533	41,573
Return on Investment														
Short Term Debt	14	14	13	12	12	11	11	10	9	9	8	8	7	6
Long Term Debt (Taxable Debt)	1,810	1,733	1,656	1,579	1,502	1,425	1,348	1,271	1,194	1,117	1,040	963	886	809
Hybrids	157	144	137	130	124	117	110	104	97	90	83	77	70	63
Total Interest Expense	1,981	1,897	1,812	1,728	1,644	1,559	1,475	1,391	1,307	1,222	1,138	1,054	969	885
Preferred Dividends	90	86	82	78	74	70	67	63	59	55	51	48	44	40
Net Income on Common	4,762	4,559	4,356	4,154	3,951	3,748	3,546	3,343	3,141	2,938	2,735	2,533	2,330	2,128
Income Taxes														
Income Before Pref Dividends	4,851	4,645	4,438	4,232	4,025	3,819	3,612	3,406	3,200	2,993	2,787	2,580	2,374	2,167
Income Before Taxes (Including ITC)	7,941	7,603	7,265	6,927	6,589	6,251	5,913	5,575	5,238	4,900	4,562	4,224	3,886	3,548
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	7,941	7,603	7,265	6,927	6,589	6,251	5,913	5,575	5,238	4,900	4,562	4,224	3,886	3,548
Federal Income Tax	2,612	2,501	2,390	2,279	2,167	2,056	1,945	1,834	1,723	1,612	1,501	1,389	1,278	1,167
State Income Tax	478	457	437	417	396	376	356	335	315	295	274	254	234	213

MECO Above the Cap Revenue Requirement												
Revenue Requirements Model - Calculati												
	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066		
Manual Input	43	44	45	46	47	48	49	50	51	52	Total	
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-
O&M	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation												
Book Depreciation	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	1,961%	100.00%	
Book Depreciation Rates	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	6,481	330,539	
Depreciation Expense	272,209	278,690	285,171	291,652	298,134	304,615	311,096	317,577	324,058	330,539		
Accumulated Depreciation	-	-	-	-	-	-	-	-	-	-	-	-
Tax Depreciation	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%	
Tax Depreciation Rates (Straight Line)	-	-	-	-	-	-	-	-	-	-	-	-
Revenue Bond Financed Tax Basis (S/L)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%	
Tax Depreciation Rates (MACRS)	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	100.00%	
NonRB Financed Tax Basis (MACRS)	-	-	-	-	-	-	-	-	-	-	330,539	
Tax Depreciation	-	-	-	-	-	-	-	-	-	-	330,539	
Accumulated Tax Depreciation	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539		
Slate Investment Tax Credit (ITC)												
Book												
Slate ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	100.00%	
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Tax												
Deferred Tax Calculation												
Book Accumulated Depreciation	272,209	278,690	285,171	291,652	298,134	304,615	311,096	317,577	324,058	330,539		
Tax Accumulated Depreciation	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539		
Book/Tax Acc. Depr Difference	(58,330)	(51,849)	(45,368)	(38,887)	(32,406)	(25,925)	(19,443)	(12,962)	(6,481)	-		
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-
Net Deferred Tax Asset (Liability)	(22,696)	(20,174)	(17,653)	(15,131)	(12,609)	(10,087)	(7,565)	(5,044)	(2,522)	-		
Deferred Tax Base	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)	(6,481)		
Deferred Taxes - Federal	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)	(2,132)		
Deferred Taxes - State excluding credit	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)	(390)		
Change in Deferred Taxes	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)	(2,522)		
Accumulated Deferred Taxes	22,696	20,174	17,653	15,131	12,609	10,087	7,565	5,044	2,522	(0)		
Change in Deferred ITC	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)		
Rate Base and Financing												
Investment: (Rate Base)												
Gross Plant	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539	330,539		
Accumulated Depreciation	272,209	278,690	285,171	291,652	298,134	304,615	311,096	317,577	324,058	330,539		
Accumulated Deferred Taxes	22,696	20,174	17,653	15,131	12,609	10,087	7,565	5,044	2,522	(0)		
Accumulated Deferred ITC	-	-	-	-	-	-	-	-	-	-		
Ending Net Investment	35,634	31,675	27,716	23,756	19,797	15,837	11,878	7,919	3,959	(0)		
Average Net Investment	37,614	33,655	29,695	25,736	21,776	17,817	13,858	9,898	5,939	1,980		
Average Financing:												
Short Term Debt	463	414	365	317	268	219	170	122	73	24		
Long Term Debt (Revenue Bonds)	14,458	12,936	11,415	9,893	8,371	6,849	5,327	3,805	2,283	761		
Taxable Debt	867	775	684	593	502	411	319	228	137	46		
Preferred Stock	439	392	348	300	254	208	162	115	69	23		
Common Equity	21,388	19,136	16,885	14,634	12,382	10,131	7,880	5,628	3,377	1,126		
Total Financing	37,614	33,655	29,695	25,736	21,776	17,817	13,858	9,898	5,939	1,980		
Return on Investment												
Short Term Debt	6	5	5	4	3	3	2	2	1	0		
Long Term Debt (Taxable Debt)	732	655	578	501	424	347	270	193	116	39		
Hybrids	63	57	50	43	37	30	23	17	10	3		
Total Interest Expense	801	717	632	548	464	379	295	211	128	42		
Preferred Dividends	36	32	29	25	21	17	13	10	6	2		
Net Income on Common	1,925	1,722	1,520	1,317	1,114	912	709	507	304	101		
Income Taxes												
Income Before Pref Dividends	1,961	1,755	1,548	1,342	1,135	929	722	516	310	103		
Income Before Taxes (including ITC)	3,210	2,872	2,534	2,196	1,858	1,521	1,183	845	507	169		
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-		
Income Before Taxes (excluding ITC)	3,210	2,872	2,534	2,196	1,858	1,521	1,183	845	507	169		
Federal Income Tax	1,056	945	834	722	611	500	389	278	167	56		
State Income Tax	193	173	152	132	112	91	71	51	30	10		

MECO Above the Cap Revenue Requirement - Bill Impact															
Revenue Requirements Model - Calculations															
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation															
Book Depreciation															
Revenue Bond Financed Tax Basis (S/L)	30	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%	3,353%
Tax Depreciation Rates (Straight Line)	0.0%														
Tax Depreciation Rates (MACRS)	20	3,750%	6,677%	6,177%	5,713%	5,285%	4,888%	4,522%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%
NonRB Financed Tax Basis (MACRS)	100.0%	3,786	7,288	6,740	6,236	5,767	5,335	4,965	4,504	4,504	4,504	4,504	4,504	4,504	4,504
Tax Depreciation	3,786	11,073	17,813	24,049	29,816	35,152	40,086	44,651	49,155	53,659	58,163	62,666	67,171	71,674	76,178
Accumulated Tax Depreciation															
State Investment Tax Credit (ITC)															
Book															
State ITC Amortization Rate	0.000%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	4.00%														
Accumulated Amortization															
Deferred ITC															
Tax															
Deferred Tax Calculation															
Book Accumulated Depreciation		2,294	4,589	6,883	9,177	11,471	13,766	16,060	18,354	20,649	22,943	25,237	27,532	29,826	32,120
Tax Accumulated Depreciation		11,073	17,813	24,049	29,816	35,152	40,086	44,651	49,155	53,659	58,163	62,666	67,171	71,674	76,178
Book/Tax Acc Depr Difference	(3,786)	(8,719)	(13,225)	(17,166)	(20,639)	(23,680)	(26,320)	(28,591)	(30,801)	(33,010)	(35,220)	(37,429)	(39,639)	(41,848)	(44,058)
Deferred ITC															
Net Deferred Tax Asset (Liability)	(1,473)	(3,416)	(5,146)	(6,679)	(8,031)	(9,214)	(10,241)	(11,125)	(11,985)	(12,844)	(13,704)	(14,564)	(15,423)	(16,283)	(17,143)
Deferred Tax Base	3,786	4,993	4,446	3,941	3,473	3,041	2,640	2,271	2,210	2,210	2,210	2,210	2,210	2,210	2,210
Deferred Taxes - Federal	1,245	1,643	1,463	1,296	1,142	1,000	868	747	727	727	727	727	727	727	727
Deferred Taxes - State excluding credit	228	300	267	239	209	183	159	137	133	133	133	133	133	133	133
Change in Deferred Taxes	1,473	1,943	1,730	1,534	1,351	1,183	1,027	863	860	860	860	860	860	860	860
Accumulated Deferred Taxes	1,473	3,416	5,146	6,679	8,031	9,214	10,241	11,125	11,985	12,844	13,704	14,564	15,423	16,283	17,143
Change in Deferred ITC															
Rate Base and Financing															
Investment (Rate Base)															
Gross Plant	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
Accumulated Depreciation	2,294	4,589	6,883	9,177	11,471	13,766	16,060	18,354	20,649	22,943	25,237	27,532	29,826	32,120	
Accumulated Deferred Taxes	1,473	3,416	5,146	6,679	8,031	9,214	10,241	11,125	11,985	12,844	13,704	14,564	15,423	16,283	
Ending Net Investment	98,476	95,239	91,215	87,387	83,741	80,264	76,942	73,764	70,810	68,102	65,630	63,396	61,400	59,634	58,000
Average Net Investment	49,738	97,358	93,227	89,301	85,564	82,003	78,603	75,353	72,187	69,033	65,879	62,725	59,571	56,417	53,263
Average Financing:															
Short Term Debt	612	1,197	1,147	1,098	1,052	1,009	967	927	888	849	810	771	733	694	655
Long Term Debt (Revenue Bonds)	19,119	37,423	35,836	34,326	32,890	31,521	30,214	28,965	27,748	26,536	25,323	24,111	22,899	21,686	20,474
Taxable Debt	1,146	2,443	2,148	2,058	1,971	1,889	1,811	1,736	1,663	1,591	1,518	1,445	1,373	1,300	1,227
Preferred Stock	580	1,135	1,087	1,041	998	956	917	879	842	805	768	731	695	658	621
Common Equity	28,282	55,558	53,010	50,777	48,652	46,627	44,694	42,847	41,046	39,253	37,460	35,666	33,873	32,079	30,286
Total Financing	49,738	97,358	93,227	89,301	85,564	82,003	78,603	75,353	72,187	69,033	65,879	62,725	59,571	56,417	53,263
Return on Investment															
Short Term Debt	8	15	14	14	13	13	12	12	11	11	10	10	9	9	8
Long Term Debt (Taxable Debt)	967	1,894	1,813	1,737	1,664	1,585	1,509	1,436	1,404	1,343	1,281	1,220	1,159	1,097	1,036
Hybrids	64	164	157	151	144	138	133	127	122	116	111	106	100	95	90
Total Interest Expense	1,059	2,073	1,985	1,901	1,822	1,746	1,673	1,604	1,537	1,470	1,403	1,335	1,268	1,201	1,134
Preferred Dividends	48	94	90	86	82	79	76	73	69	66	63	60	57	54	51
Net Income on Common	2,545	4,982	4,771	4,570	4,379	4,196	4,022	3,856	3,694	3,531	3,371	3,210	3,049	2,887	2,726
Income Taxes															
Income Before Pref Dividends	2,593	5,076	4,861	4,656	4,461	4,275	4,098	3,929	3,764	3,599	3,435	3,270	3,106	2,941	2,777
Income Before Taxes (including ITC)	4,245	8,309	7,956	7,621	7,302	6,998	6,708	6,431	6,161	5,892	5,622	5,353	5,084	4,815	4,546
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	4,245	8,309	7,956	7,621	7,302	6,998	6,708	6,431	6,161	5,892	5,622	5,353	5,084	4,815	4,546
Federal Income Tax	1,396	2,733	2,617	2,507	2,402	2,302	2,207	2,115	2,027	1,938	1,849	1,761	1,672	1,584	1,495
State Income Tax	255	500	479	458	439	421	404	387	371	354	338	322	306	290	273

MECO Above the Cap Revenue Requirer Revenue Requirements Model - Calculat															
	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Manual Input															
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation															
Book Depreciation	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%	2,273%
Depreciation Expense	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294	2,294
Accumulated Depreciation	34,414	36,709	39,003	41,297	43,592	45,886	48,180	50,475	52,769	55,063	57,357	59,652	61,946	64,240	66,535
Tax Depreciation	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%	3,334%	3,333%
Tax Depreciation Rates (Straight Line)															
Revenue Bond Financed Tax Basis (S/L)	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%	4,462%	4,461%
Tax Depreciation Rates (MACRS)	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503
NonRB Financed Tax Basis (MACRS)	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503	4,504	4,503
Accumulated Tax Depreciation	80,682	85,186	89,689	94,194	98,697	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
State Investment Tax Credit (ITC)															
Book															
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax															
Deferred Tax Calculation															
Book Accumulated Depreciation	34,414	36,709	39,003	41,297	43,592	45,886	48,180	50,475	52,769	55,063	57,357	59,652	61,946	64,240	66,535
Tax Accumulated Depreciation	80,682	85,186	89,689	94,194	98,697	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
Book/Tax Acc. Depr. Difference	(46,267)	(48,477)	(50,686)	(52,896)	(55,106)	(57,315)	(59,525)	(61,735)	(63,945)	(66,155)	(68,365)	(70,575)	(72,785)	(75,000)	(77,210)
Deferred ITC	(18,002)	(18,862)	(19,722)	(20,582)	(21,442)	(21,425)	(20,532)	(19,640)	(18,747)	(17,854)	(16,961)	(16,069)	(15,176)	(14,283)	(13,391)
Net Deferred Tax Asset (Liability)	2,209	2,210	2,209	2,210	2,209	(42)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)
Deferred Tax Base	727	727	727	727	727	(14)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)
Deferred Taxes - Federal	133	133	133	133	133	(3)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)
Deferred Taxes - State excluding credit	860	860	860	860	860	(11)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)
Change in Deferred Taxes	18,002	18,862	19,722	20,582	21,442	21,425	20,532	19,640	18,747	17,854	16,961	16,069	15,176	14,283	13,391
Accumulated Deferred Taxes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing															
Investment: (Rate Base)															
Gross Plant	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
Accumulated Depreciation	34,414	36,709	39,003	41,297	43,592	45,886	48,180	50,475	52,769	55,063	57,357	59,652	61,946	64,240	66,535
Accumulated Deferred Taxes	18,002	18,862	19,722	20,582	21,442	21,425	20,532	19,640	18,747	17,854	16,961	16,069	15,176	14,283	13,391
Accumulated Deferred ITC	48,532	45,378	42,224	39,070	35,916	33,638	32,237	30,835	29,433	28,032	26,630	25,229	23,827	22,425	21,024
Ending Net Investment	50,109	46,955	43,801	40,647	37,493	34,777	32,597	31,536	30,134	28,733	27,331	25,929	24,528	23,126	21,725
Average Net Investment	616	577	539	500	461	428	405	388	371	353	336	319	302	284	267
Average Financing:															
Long Term Debt (Revenue Bonds)	19,261	18,049	16,837	15,624	14,412	13,368	12,661	12,122	11,583	11,045	10,506	9,967	9,428	8,890	8,351
Taxable Debt	1,155	1,082	1,009	937	864	801	759	727	694	662	630	597	565	533	501
Preferred Stock	584	548	511	474	437	406	384	368	352	335	319	302	286	270	253
Common Equity	28,493	26,689	24,906	23,112	21,319	19,775	18,729	17,932	17,135	16,338	15,541	14,744	13,947	13,150	12,353
Total Financing	50,109	46,955	43,801	40,647	37,493	34,777	32,597	31,536	30,134	28,733	27,331	25,929	24,528	23,126	21,725
Return on Investment															
Short Term Debt (Taxable Debt)	975	913	852	791	729	676	641	613	586	559	532	504	477	450	423
Hybrids	85	79	74	69	63	59	56	53	51	48	46	44	41	39	37
Total Interest Expense	1,067	1,000	953	895	838	790	761	736	711	682	658	629	602	575	548
Preferred Dividends	48	45	42	39	36	33	32	30	29	28	26	25	24	22	21
Net Income on Common	2,564	2,403	2,242	2,080	1,919	1,780	1,686	1,614	1,542	1,470	1,399	1,327	1,255	1,183	1,112
Income Taxes															
Income Before Pref Dividends	2,613	2,448	2,284	2,119	1,955	1,813	1,717	1,644	1,571	1,498	1,425	1,352	1,279	1,206	1,133
Income Before Taxes (including ITC)	4,277	4,007	3,738	3,469	3,200	2,968	2,811	2,691	2,572	2,452	2,333	2,213	2,093	1,974	1,854
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	4,277	4,007	3,738	3,469	3,200	2,968	2,811	2,691	2,572	2,452	2,333	2,213	2,093	1,974	1,854
Federal Income Tax	1,407	1,318	1,230	1,141	1,053	976	925	885	846	807	767	728	689	649	610
State Income Tax	257	241	225	209	192	179	169	162	155	147	140	133	126	119	112

MECO Above the Cap Revenue Requirment Requirements Model - Calculat															
	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
Manual Input	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Escalation Rate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant Asset Depreciation															
Book Depreciation	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%	2.273%
Depreciation Expense	68,829	71,123	73,418	75,712	78,006	80,300	82,595	84,889	87,183	89,478	91,772	94,066	96,361	98,655	100,949
Accumulated Depreciation	1,667%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Tax Depreciation	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Revenue Bond Financed Tax Basis (S/L)	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
NonRB Financed Tax Basis (MACRS)	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Tax Depreciation	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
Accumulated Tax Depreciation															
State Investment Tax Credit (ITC)															
Book															
State ITC Amortization Rate	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%	2.083%
Amortization of State ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Accumulated Amortization	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tax															
Deferred Tax Calculation															
Book Accumulated Depreciation	68,829	71,123	73,418	75,712	78,006	80,300	82,595	84,889	87,183	89,478	91,772	94,066	96,361	98,655	100,949
Tax Accumulated Depreciation	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
Book/Tax Acc. Depr. Difference	(32,120)	(29,826)	(27,532)	(25,237)	(22,943)	(20,649)	(18,354)	(16,060)	(13,766)	(11,471)	(9,177)	(6,883)	(4,589)	(2,294)	
Deferred ITC	(12,498)	(11,605)	(10,712)	(9,820)	(8,927)	(8,034)	(7,142)	(6,249)	(5,356)	(4,464)	(3,571)	(2,678)	(1,785)	(893)	
Net Deferred Tax Asset (Liability)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)	(2,294)
Deferred Tax Base	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)	(755)
Deferred Taxes - Federal	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)	(138)
Deferred Taxes - State excluding credit	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)	(893)
Change in Deferred Taxes	12,498	11,605	10,712	9,820	8,927	8,034	7,142	6,249	5,356	4,464	3,571	2,678	1,785	893	(0)
check	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Change in Deferred ITC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate Base and Financing															
Investment: (Rate Base)	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949	100,949
Gross Plant	68,829	71,123	73,418	75,712	78,006	80,300	82,595	84,889	87,183	89,478	91,772	94,066	96,361	98,655	100,949
Accumulated Depreciation	12,498	11,605	10,712	9,820	8,927	8,034	7,142	6,249	5,356	4,464	3,571	2,678	1,785	893	(0)
Accumulated Deferred Taxes	19,822	18,221	16,819	15,418	14,016	12,614	11,213	9,811	8,410	7,008	5,606	4,205	2,803	1,402	0
Ending Net Investment	20,323	18,921	17,520	16,118	14,717	13,315	11,914	10,512	9,110	7,709	6,307	4,906	3,504	2,102	701
Average Net Investment															
Average Financing:															
Short Term Debt	250	233	215	198	181	164	147	129	112	95	78	60	43	26	9
Long Term Debt (Revenue Bonds)	7,812	7,273	6,734	6,196	5,657	5,118	4,579	4,041	3,502	2,963	2,424	1,886	1,347	808	269
Taxable Debt	468	436	404	371	339	307	274	242	210	178	145	113	81	48	16
Preferred Stock	237	221	204	188	172	155	139	123	106	90	74	57	41	25	8
Common Equity	11,556	10,759	9,962	9,165	8,368	7,571	6,774	5,977	5,180	4,383	3,586	2,789	1,992	1,195	398
Total Financing	20,323	18,921	17,520	16,118	14,717	13,315	11,914	10,512	9,110	7,709	6,307	4,906	3,504	2,102	701
Return on Investment															
Short Term Debt	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2
Long Term Debt (Taxable Debt)	395	368	341	314	286	259	232	204	177	150	123	95	68	41	0
Hybrids	34	32	30	27	25	22	20	18	15	13	11	8	6	4	1
Total Interest Expense	433	403	373	343	313	283	254	224	194	164	134	104	75	45	15
Preferred Dividends	20	18	17	16	14	13	11	10	9	7	6	5	3	2	1
Net Income on Common	1,040	968	897	825	753	681	610	538	466	394	323	251	179	108	36
Income Taxes															
Income Before Pref Dividends	1,060	987	913	840	767	694	621	548	475	402	329	256	183	110	37
Income Before Taxes (including ITC)	1,734	1,615	1,495	1,376	1,256	1,136	1,017	897	778	658	538	419	299	179	60
Investment Tax Credit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Income Before Taxes (excluding ITC)	1,734	1,615	1,495	1,376	1,256	1,136	1,017	897	778	658	538	419	299	179	60
Federal Income Tax	571	531	492	453	413	374	334	295	256	216	177	138	98	59	20
State Income Tax	104	97	90	83	76	68	61	54	47	40	32	25	18	11	4

Maui Electric

2015 Plant Additions RAM Target (Depreciation and Amortization) --->

2015 Plant Additions RAM Target (Company Budget) --->

2015 Estimated Net Plant Additions --->

22,200,000
27,000,000
27,495,611

Project Code	Project Description	Select Type (Program/Project)	Select PSIP Category	Plant In Service Date	2015 Plant Addition Amount	2015 CIAC	2015 Net Plant Additions	Completed
2015 Estimated Completed Baseline Projects and Programs								
M0001178	M0001178: MPP UIC Well Modifications	Project	Reliability	Dec-15	1,442,405	-	1,442,405	
M0001932	M0001932: T&D Emergency Gen Replace	Project	Reliability	Dec-15	511,380	-	511,380	
M0001230	M0001230: Kaanapali P-3	Project	Customer Projects	Oct-15	66,079	(58,108)	7,971	
M0001987	M0001987: Old Haleakala Hwy. Sidewalk Improvement	Project	Customer Projects	Oct-15	194,521	(132,000)	62,521	
M0001354	M0001354: Mahana Estates	Project	Customer Projects	Sep-15	2,220,677	(1,528,243)	692,434	
M0001526	M0001526: Maui Business Pk Ph 2, South	Project	Customer Projects	Sep-15	152,154	(119,551)	32,603	
M0001962	M0001962: Maui Lam Phase 6, Incr. 2	Project	Customer Projects	Sep-15	756,791	(554,546)	202,245	
M0001541	M0001541: Molokai Waste Storage Struct	Project	Safety, Security and Environmental	Sep-15	267,981	-	267,981	
M0002059	M0002059: J F AIR LLC HANGAR	Project	Customer Projects	Aug-15	69,249	(70,310)	(1,061)	Yes
M0001999	M0001999: BioReal 250 FIT - Customer	Project	Facilitation of New or Renewable Energy	Aug-15	54,084	(92,722)	(38,638)	Yes
M0001985	M0001985: Central Maui Reg. Sports Park	Project	Customer Projects	Aug-15	431,848	(212,537)	219,311	
M0001752	M0001752: GT Day Tank	Project	Facilities	Aug-15	80,233		80,233	Yes
M0001926	M0001926: BioReal 250 FIT System	Project	Facilitation of New or Renewable Energy	Aug-15	74,751	(105,677)	(30,926)	Yes
M0001971	M0001971: MPP CT Fire Alarm Sys Upgrade	Project	Safety, Security and Environmental	Aug-15	525,080		525,080	Yes
M0001892	M0001892: MPP X1-X2 XFMR Replacement	Project	Reliability	Jul-15	689,757		689,757	Yes
M0001983	M0001983: M10-13 Control Room AC Replacement	Project	Reliability	Jul-15	80,288		80,288	Yes
M0001984	M0001984: M10-13 Control Room Roof Replace	Project	Reliability	Jul-15	87,886		87,886	Yes
M0001885	M0001885: M16 Boiler Feed Pump Replace	Project	Reliability	Jun-15	254,358		254,358	Yes
M0001929	M0001929: M8-M9 Gen Voltage Reg & Gov	Project	Reliability	Jun-15	87,815		87,815	Yes
M0001889	M0001889: Punene Shopping Center	Project	Customer Projects	May-15	49,172	13,700	62,872	Yes
M0001525	M0001525: M16 2015 Hot Section	Project	Reliability	May-15	755,429		755,429	Yes
M0001886	M0001886: M19 Boiler Feed Pump Replace	Project	Reliability	May-15	132,076		132,076	Yes
M0001863	M0001863: Japan-US Smart Grid - AMI	Project	Smart Grid and Demand Response	May-15	10,021		10,021	Yes
M0001899	M0001899: Sub34 CB#6811 Replacement	Project	Asset Management	Apr-15	332,676		332,676	Yes
M0001950	M0001950: VIP - Cash 'N Carry Lahaina	Project	Customer Connections	Apr-15	99,932	(44,078)	55,854	Yes
M0001982	M0001982: FAA Reloc/Conversion Kahului Airport	Project	Customer Projects	Apr-15	137,182	(59,977)	77,205	Yes
M0001264	M0001264: Maalaea REL Repl	Project	Reliability	Apr-15	240,656		240,656	Yes
M0001406	M0001406: Punene-Maalaea Rly Upgr	Project	Reliability	Apr-15	246,754		246,754	Yes
M0001735	M0001735: M17 PD Couplers	Project	Reliability	Apr-15	52,326		52,326	Yes
M0001956	M0001956: MOL CT Fire System Upgrade	Project	Safety, Security and Environmental	Apr-15	249,897		249,897	Yes
M0001898	M0001898: Sub34 CB#6808 Replacement	Project	Asset Management	Mar-15	126,991		126,991	Yes
M0001970	M0001970: PTC - Baldwin Bldg	Project	Customer Projects	Mar-15	102,944		102,944	Yes
M0001891	M0001891: Lanai Recloser Replacement	Project	Reliability	Mar-15	39,861		39,861	Yes
M0001928	M0001928: Waikapu Gardens Ph2	Project	Reliability	Mar-15	662,031	(456,231)	205,800	Yes
M0001531	M0001531: Kula Ag Tsf Replacement	Project	Safety, Security and Environmental	Mar-15	1,058,984		1,058,984	Yes
M0001714	M0001714: M14-16 Switchgr Breaker Upgd	Project	#N/A	Mar-15	213,721		213,721	Yes
M0001897	M0001897: Sub34 CB#6805 Replacement	Project	Asset Management	Feb-15	245,154		245,154	Yes
M0001909	M0001909: Owens FIT Customer	Project	Customer Projects	Feb-15	20,081		20,081	Yes
M0001925	M0001925: Owens FIT System	Project	Customer Projects	Feb-15	58,941		58,941	Yes
M0000019	M0000019: Damages Caused by External Party	Program	Safety, Security and Environmental		100,300		100,300	
M0000229	M0000229: Lifecycle Maintenance 02-03	Program	Enterprise IT Framework		81,797		81,797	
M0000316	M0000316: LCM-Batteries&Chargers	Program	Asset Management		25,036		25,036	
M0000317	M0000317: LCM-Distr ACB	Program	Asset Management		-		-	
M0000461	M0000461: T&D/Main Office Bldg Upgrade	Program	Facilities		44,997		44,997	
M0000690	M0000690: T&D Seada Equipment	Program	Enterprise IT Framework		64,614		64,614	

Maui Electric

2015 Plant Additions RAM Target (Depreciation and Amortization) --->

2015 Plant Additions RAM Target (Company Budget) --->

2015 Estimated Net Plant Additions --->

22,200,000
27,000,000
27,495,611

Project Code	Project Description	Select Type (Program/Project)	Select PSIP Category	Plant In Service Date	2015 Plant Addition Amount	2015 CIAC	2015 Net Plant Additions	Completed
M0000747	M0000747: Trans Syst Eq, Purch-Radiator	Program	Reliability		22,144		22,144	
M0000819	M0000819: LCM - Substation Equipment	Program	Asset Management		10,589		10,589	
M0001031	M0001031: Security Capital Equipment	Program	Safety, Security and Environmental		83,075		83,075	
M2600000	M2600000: MPP MINOR PS ADDITIONS	Program	Facilities		121,954		121,954	
M2601000	M2601000: KPP MINOR PS ADDITIONS	Program	Facilities		16,629		16,629	
M2602000	M2602000: LPP MINOR PS ADDITION	Program	Facilities		44,683		44,683	
M2603000	M2603000: MOE MINOR PS ADDITION	Program	Facilities		9,986		9,986	
M3030000	M3030000: MINOR R/W PURCH & APPRAI-MAI	Program	Customer Projects		661		661	
M3032000	M3032000: MINOR R/W PURCH & APPRAI-LAN	Program	Customer Projects		662		662	
M3033000	M3033000: MINOR R/W PURCH & APPRAI-MOI	Program	Customer Projects		677		677	
M3200000	M3200000: MPP MINOR PP ADDITIONS	Program	Facilities		190,989		190,989	
M3201000	M3201000: KPP MINOR PP ADDITIONS	Program	Facilities		101,075		101,075	
M3202000	M3202000: LPP MINOR PP ADDITIONS	Program	Facilities		25,405		25,405	
M3203000	M3203000: MOE MINOR PP ADDITIONS	Program	Facilities		83,792		83,792	
M3300000	M3300000: TRANSMISSION SUB ADDITIONS	Program	Reliability		93,886		93,886	
M3500000	M3500000: MINOR TRANSN PLANT LINES	Program	Asset Management		502,638		502,638	
M3600000	M3600000: MINOR DISTRIBUTION SS ADD	Program	Reliability		104,757		104,757	
M7000000	M7000000: OH SVC & EXTENSIONS	Program	Customer Projects		1,112,419	(79,570)	1,032,850	
M7010000	M7010000: OVERHEAD SERVICES & EXTENSIO	Program	Customer Projects		(84,742)		(84,742)	
M7300000	M7300000: MINOR POLE LINE RELOCA	Program	Customer Projects		240,178	127,210	367,388	
M7750000	M7750000: Other Overhead additions	Program	Asset Management		6,280,321	(28,339)	6,251,981	
M7900000	M7900000: METERS & METERING EQUIP (RB)	Program	Customer Connections		1,312,253	(5,000)	1,307,253	
M7910000	M7910000: TRANSFORMERS & REL, EQ, (RB)	Program	Customer Projects		2,340,285		2,340,285	
M7990000	M7990000: STREET LIGHTS	Program	Customer Projects		269,355	(71,849)	197,506	
M8000000	M8000000: UNDERGROUND SERVICES & EXT	Program	Customer Projects		2,451,614	(583,249)	1,868,365	
M8010000	M8010000: UG SERVICES & EXTENSIONS	Program	Customer Projects		103,756	118,150	221,906	
M8500000	M8500000: MINOR OH-UG CONVERSIONS	Program	Customer Projects		2,015	3,879	5,894	
M8700000	M8700000: MINOR CABLE FAILURE REPLACE	Program	Asset Management		317,323		317,323	
M8900000	M8900000: Other Underground Additions	Program	Asset Management		1,376,821	(3,110)	1,373,711	
M9000000	M9000000: Minor Communication Facilities	Program	Facilities		36,631		36,631	
M9080000	M9080000: T&D RADIO EQUIPMENT	Program	Facilities		957		957	
M9083000	M9083000: Mobile Radio Repl	Program	Facilities		5,536		5,536	
M9410000	M9410000: TOOLS & EQUIP-T&D	Program	Reliability		324,043		324,043	
M9420000	M9420000: TOOLS & EQUIP-PRODUCTION	Program	Reliability		215,955		215,955	
M9660000	M9660000: OFFICE FURN AND EQUIP ACC	Program	Facilities		4,305		4,305	
M9661000	M9661000: OFFICE FURN AND EQUIP ADMIN	Program	Facilities		9,129		9,129	
M9662000	M9662000: OFFICE FURN AND EQUIP T&D	Program	Facilities		11,029		11,029	
M9663000	M9663000: OFFICE FURN AND EQUIP PRO	Program	Facilities		27,010		27,010	
M9664000	M9664000: OFFICE FURN AND EQUIP ENG	Program	Facilities		13,667		13,667	
M9665000	M9665000: OFFICE FURN AND EQUIP CUS	Program	Facilities		7,678		7,678	
M9666000	M9666000: OFFICE FURN AND EQUIP CORP	Program	Facilities		1,632		1,632	
M9800000	M9800000: Vehicle Purchases	Program	Facilities		1,065,623		1,065,623	
T0001961	T0001961: Cash CIAC	Project	Customer Projects			(886,418)	(886,418)	
	Subtotal				32,057,302	(4,828,575)	27,228,726	

Maui Electric

2015 Plant Additions RAM Target (Depreciation and Amortization) --->

2015 Plant Additions RAM Target (Company Budget) --->

2015 Estimated Net Plant Additions --->

22,200,000
27,000,000
27,495,611

Project Code	Project Description	Select Type (Program/Project)	Select PSIP Category	Plant In Service Date	2015 Plant Addition Amount	2015 CIAC	2015 Net Plant Additions	Completed
Stragglng Costs								
M0001722	M0001722: Wailuku Hts Transformer	Project	Asset Management	Dec-14	11,346		11,346	Yes
M0001972	M0001972: MEO Transportation Fac.	Project	Customer Projects	Dec-14	14		14	Yes
M0001517	M0001517: Kuaa Modular Sub	Project	Reliability	Dec-14	121,963		121,963	Yes
M0001775	M0001775: Wailuku Hts Sub 18: PQM	Project	Reliability	Dec-14	10,510		10,510	Yes
M0001911	M0001911: Kooole Res Regulator Repl	Project	Reliability	Dec-14	47,479		47,479	Yes
M0001927	M0001927: Mobile DC Power System	Project	Reliability	Dec-14	173		173	Yes
M0001298	M0001298: Iao Valley Homesteads	Project	#N/A	Dec-14	(8,790)		(8,790)	Yes
M0001301	M0001301: Hana Plantation	Project	#N/A	Dec-14	(10,805)		(10,805)	Yes
M0001699	M0001699: MLP 14 - FIT System	Project	#N/A	Dec-14	5,724		5,724	Yes
M0001762	M0001762: MPP Inter Lighting 2014	Project	#N/A	Dec-14	307		307	Yes
M0001767	M0001767: LL1-L16 480v Power Supply	Project	#N/A	Dec-14	(6,489)		(6,489)	Yes
M0001774	M0001774: Clausung Milling Machine	Project	#N/A	Dec-14	36		36	Yes
M0001868	M0001868: Japan-US SG Auto Switching	Project	#N/A	Dec-14	206	(16,528)	(16,322)	Yes
M0001887	M0001887: MLP 6 - FIT	Project	#N/A	Dec-14	7,523		7,523	Yes
M0001902	M0001902: CEMS/RICE Upgrades	Project	#N/A	Dec-14	7,552		7,552	Yes
M0001912	M0001912: MLP 10 - FIT	Project	#N/A	Dec-14	11,688		11,688	Yes
M0001951	M0001951: Fiber & Electrical Test Eqpt	Project	#N/A	Dec-14	(269)		(269)	Yes
M0001961	M0001961: DCS Controller Modules Upgr	Project	#N/A	Dec-14	(15,744)		(15,744)	Yes
M0001969	M0001969: Eng. Clerk and Lib Renov.	Project	#N/A	Dec-14	(26,711)		(26,711)	Yes
M0001914	M0001914: Disrib. Circuit Monitoring	Project	Facilitation of New or Renewable Energy	Nov-14	45,459		45,459	Yes
M0001334	M0001334: Sub 17 CB6783 Replacement	Project	Reliability	Nov-14	16,510		16,510	Yes
M0001420	M0001420: M14 2014 Hot Section	Project	#N/A	Nov-14	2,403		2,403	Yes
M0001706	M0001706: Mobile Substation	Project	#N/A	Aug-14	181		181	Yes
M0001874	M0001874: Mahana Est Water Pumps	Project	#N/A	Aug-14	853		853	Yes
M0001358	M0001358: Kanaha-Pukalani REL Repl	Project	#N/A	Jul-14	5,751		5,751	Yes
M0001407	M0001407: Pukalani-Kanaha Rly Upgr	Project	#N/A	Jul-14	5,573		5,573	Yes
M0001359	M0001359: Lahaina-Lahainaluna SEL Repl	Project	#N/A	Jun-14	1,043		1,043	Yes
M0001360	M0001360: Lahainaluna-Lahaina SEL Repl	Project	#N/A	Jun-14	1,043		1,043	Yes
M0001879	M0001879: Sub 4 CB6842 Replacement	Project	#N/A	May-14	87		87	Yes
M0001745	M0001745: Puunana Microwave Tower	Project	#N/A	Apr-14	5,932		5,932	Yes
M0001513	M0001513: Mahinahina Switchgear	Project	#N/A	Dec-13	610		610	Yes
M0001685	M0001685: Mitsubishi Control Upgrades	Project	#N/A	Dec-13	(954)		(954)	Yes
M0001687	M0001687: CB 6727 Replace	Project	#N/A	Dec-13	2,690		2,690	Yes
M0001688	M0001688: CB 6832 Replace	Project	#N/A	Dec-13	9,720		9,720	Yes
M0001783	M0001783: DC Fast Charger #1	Project	#N/A	Dec-13	8,220		8,220	Yes
M0001409	M0001409: Kula-Pukalani Rly Upgr	Project	#N/A	Aug-13	(305)		(305)	Yes
M0001652	M0001652: M14-M17 COMS Relocation	Project	#N/A	May-13	13,134		13,134	Yes
M0001243	M0001243: LL1 Oxidation Catalyst	Project	#N/A	Dec-11	(60)		(60)	Yes
M0000266	M0000266: 6th Increment Distr Rebuild	Project	#N/A	Jul-11	4,435		4,435	Yes
M3544000	M3544000: Kaahumahu T.&D Ln Reconstruction	Project	#N/A	Apr-01	5,380		5,380	Yes
Subtotal					283,413	(16,528)	266,885	
Grand Total					32,340,715	(4,845,103)	27,495,611	

Maui Electric

2015 Plant Additions RAM Target (Depreciation and Amortization) --->

2015 Plant Additions RAM Target (Company Budget) --->

Grand Total Above RAM Cap

22,200,000
27,000,000
4,298,849

Project Code	Project Description	Select Type (Program/Project)	Select PSIP Category	Plant In Service Date	2015 Plant Addition Amount	2015 CIAC	2015 Net Plant Additions	Completed
M0001265	M0001265: Puunene Substation Relay Replacement	Project	Reliability	Oct-15	266,141	-	266,141	Yes
M0001266	M0001266: Kanaha Substation Relay Replacement	Project	Reliability	Oct-15	260,429	-	260,429	Yes
M0001335	M0001335: Kula Substation Circuit Break Replacement	Project	Reliability	Dec-15	271,675	-	271,675	Yes
M0001445	M0001445: Haiku 23KV Transmission Line Switch	Project	Reliability	Sep-15	138,710	-	138,710	Yes
M0001708	M0001708: Customer Owned Switch Vault	Project	Safety, Security and Environmental	Nov-15	121,745	-	121,745	Yes
M0001736	M0001736: M14-16 Inverter/Battery Charger System	Project	Reliability	Dec-15	445,549	-	445,549	Yes
M0001757	M0001757: Lanai Caterpillar Controls Upgrade	Project	Reliability	Oct-15	467,045	-	467,045	Yes
M0001894	M0001894: Keanae Substation Reconstruction	Project	Reliability	Sep-15	282,784	-	282,784	Yes
M0001918	M0001918: MPP-PUK-PUU Commun. Addition	Project	System Security Investments	Dec-15	293,350	-	293,350	Yes
M0001919	M0001919: Upcountry Recloser Replacement	Project	Reliability	Dec-15	208,231	-	208,231	Yes
M0001920	M0001920: West Maui Recloser Replacement	Project	Reliability	Dec-15	167,406	-	167,406	Yes
M0001921	M0001921: North Shore Recloser Replacement	Project	Reliability	Nov-15	161,688	-	161,688	Yes
M0001922	M0001922: Central Maui Recloser Replacement	Project	Reliability	Nov-15	555,610	-	555,610	Yes
M0001954	M0001954: M11 Replacement L/O Filter Housing	Project	Reliability	Sep-15	171,343	-	171,343	Yes
M0001955	M0001955: M10 Replacement L/O Filter Housing	Project	Reliability	Aug-15	159,196	-	159,196	Yes
M0001981	M0001981: Hana I Generator Replacement	Project	Reliability	Jun-15	100,949	-	100,949	Yes
M0002062	M0002062: E-Cell EDI Module Stacks Replacement	Project	Reliability	Sep-15	85,745	-	85,745	Yes
M0002063	M0002063: Molokai East End Regulators (E60)	Project	Reliability	Dec-15	141,252	-	141,252	Yes
Total					4,298,849	-	4,298,849	

**EXHIBIT IV.
TRANSMISSION AND DISTRIBUTION SYSTEM RELIABILITY PROJECT
DESCRIPTIONS**

M0001265 Pu‘unene Substation Relay Replacement
M0001266 Kanaha Substation Relay Replacement

Estimated cost: \$266,141
Estimated cost: \$260,429

Project Description

Upgrade the existing Kanaha–Pu‘unene 69kV transmission line protection relays at the Pu‘unene and Kanaha Substations. Both projects were placed in service in October 2015.

Customer Benefit/Customer Value

Protective relays trip circuit breakers when a fault is detected. The need to act quickly to protect circuits and equipment as well as the general public often requires protective relays to respond and trip a breaker very quickly. It is critical that well-functioning protective relays are installed. The existing relays are at the end of their useful lives and the manufacturer, ABB, no longer supports these relays. Currently the only source of replacement units or parts is from the Company’s decommissioned relays that have already been upgraded. These “spare” units are themselves very old and have been used extensively. The relays are an older design utilizing electromechanical properties of the flow of electricity to detect when faults occur on the system. This type of protection scheme doesn’t detect faults as quickly as a newer protection schemes the upgraded microprocessor-based relays are capable of.

The new relays will provide primary and backup protection schemes as is standard in the utility industry at this voltage level. They will utilize differential and POTT (permissive overreaching transfer trip) types of operation to detect and isolate faults. A differential protection scheme looks at the current flow in from one side of the transmission line and compares it to the current flow out of the other side of the line. If the two values cancel out (equal zero), then all of the current going into the relay is coming out the other side, meaning that there is no fault on the system. If the value doesn’t equal zero, then there is current going somewhere else which normally indicates a fault on the system. A POTT scheme is used to communicate and coordinate protection with the relays on the other end of the line. These types of schemes are very reliable and common throughout the utility industry. Communication between the substations is required for these schemes to function and is addressed in project M0001918 (later in this document). If the relays fails, there would be only one source of protection at the Pu‘unene and Kanaha Substations. By proactively upgrading the relays, the Company will increase the reliability of the transmission system and the overall stability of the power system.

Why the Project and Expenditures are Prudent for 2015

The system security study conducted as part of the Company’s Power Supply Improvement Plan (PSIP) identified fault clearing time as a major issue. Page 4-39 of the Company’s PSIP states that an “...immediate improvement is to decrease the time required to reliably detect and clear faults on the systems’ transmission lines. Historically, a fault could be present on the system for 18–21 cycles (0.30–0.35 seconds) in almost all systems. Today, for faults that exist longer than 9–11 cycles (0.15–0.18 seconds), the faults can result in a total

system collapse... Critical clearing times less than 18 cycles require the use of communications assisted relaying on all transmission terminals.”

Upgrading these relays is part of the process to reduce this time to acceptable levels. There are many requirements to meet from that study. As part of its effort to reduce fault clearing times, the Company is planning to complete the relay upgrades within five years and needed to finish the Pu‘unene and Kanaha substation relay replacements in 2015 to stay on this schedule.

If the existing relays failed, fixing the failed relays would cost approximately \$150,000. A failed relay would not cause an outage if there is no fault on the transmission line since the backup relay would still be operational. If there is a fault, the backup relay would clear the fault. The restoration time would depend on the nature of the outage. An outage at Pu‘unene Substation would not result in any outages to customers at the substation, but under certain conditions, relay outage or operation, system maintenance, or communication issues could result in outages on the transmission feed impacting a potential of 2,526 customers at Kanaha Substation and a potential of 7,884 customers at Pukalani Substation and Kula Substation. An outage at Kanaha Substation could also result in interruptions of service for the number of customers mentioned above.

Relays for nine of the 69kV transmission lines have been upgraded. Six substations associated with these transmission lines have been upgraded with these new relays.

Affordability of Service

Without this upgrade, the reliability of the system will be impacted. Outages will cost more in equipment damage and customer complaints. In addition, replacing equipment after it fails could potentially cost more than replacing it proactively before it fails. If a relay fails in service and has to be replaced in an emergency, some additional cost would also arise from rush ordering the material, overtime hours for work crews, switching time to attempt to restore power around the failed equipment, and possible additional equipment damage caused by the longer fault duration.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Potentially wider spread customer outages.
- Impact to system: A failed relay increases the risk of a wider spread outage during a fault condition, and Maui Electric would be operating with increased clearing times placing the entire grid at risk of voltage collapse versus containing outages to localized areas.

M0001335 Kula Substation Circuit Breaker Replacement

Estimated cost: \$271,675

Project Description

Replace the oil circuit breaker at the Kula Substation with a new SF6 gas circuit breaker. This project is expected to be placed into service in December 2015.

Customer Benefit/Customer Value

Circuit breakers are electrical devices designed to protect an electrical circuit from damage caused by overload or short circuit conditions. Their basic function is to interrupt

current flow. They are typically operated automatically by the protective relaying when a fault is detected or manually by system operators to energize or de-energize equipment and circuits.

The existing circuit breaker at the Kula Substation is oil-filled, has reached the end of its expected life with replacement parts no longer available, and should be replaced to prevent failure. Oil-filled circuit breakers require more maintenance than a gas circuit breaker, as maintaining oil breakers involves the sampling of oil, inspecting and repairing gaskets, air valves, compressors, belts, hoses, etc. as needed. According to the manufacturers, the new SF6 breakers do not require any maintenance for ten years.

SF6 breakers also have clearing times of three cycles, which is required by the Company's system security studies and faster than the five cycles in the existing oil-filled circuit breaker. The SF6 circuit breakers have less moving parts that could break, making them more reliable.

Removing the old oil circuit breaker also removes the potential for oil leaks—an environmental hazard.

Oil circuit breakers also entail the possibility of catching fire if they fail as does any oil-filled equipment. While these failures are not overly common, they do happen. Maui Electric had an oil-filled recloser fail and catch fire, then explode during 2014 on Wakea Ave in Kahului. There was an interruption to service caused by this while burned devices were replaced or repaired. The system was left in a diminished protective capacity in its temporary configuration until a replacement unit could be built and shipped over from the mainland.

Why the Project and Expenditures are Prudent for 2015

The system security study conducted as part of the Company's PSIP identified fault clearing time as a major issue. Replacing circuit breakers is part of the process to reduce this time to acceptable levels. There are many requirements to meet from that study. Similar to the upgrading of protection relays, the Company is planning to replace oil-filled circuit breakers within five years as part of its effort to reduce fault clearing times, and needs to change out the Kula circuit breaker in 2015 to stay on this schedule.

The circuit breaker was installed in 1975. Due to the configuration of the substation and the Upcountry transmission loop, if this breaker failed and had to be taken out of service, the Company would be left with a very undesirable system configuration that would cause issues with supplying power to the Company's customers. The customers served by the substation would be out of service until a troubleman could get to the site, identify the breaker as the source of the fault, isolate it, and energize the substation from the remote ends. This process could take from a few hours to considerably longer depending on the conditions of the fault and the system at the time. Some important customers served by that substation are the Haleakala National Park and the Maui Memorial Medical Center - Kula Hospital.

The configuration the system would be left in after the breaker was removed from service, but not yet replaced, would potentially cause more frequent and longer lasting outages for all of the customers served by the substation. Currently, with the circuit breaker in service, if a fault occurs on the transmission lines out of the substation to either Pukalani Substation or Kealahou Substation, the circuit breaker at Kula can be tripped to isolate the fault and the loads served by the substation can be switched over to be served by the other incoming transmission line. Without the circuit breaker in service, there is no way to isolate the fault to just one of the incoming lines without tripping them off at the far ends and completely cutting supply to the Kula Substation. Power would not be able to be restored until a troubleman could get out to the

substation to attempt to switch around whatever side the fault occurred on. This process, again, could take from a few hours to considerably longer depending on the conditions of the fault and the system at the time.

The above outage time is the estimate if only that substation went out due to breaker failure. There is a much larger concern about the system security study and tripping times. The entire system could fail due to voltage collapse if the breaker does not fail but is unable to isolate the fault quickly enough. This would cause an island-wide outage that could take days to restore.

Affordability of Service

Without this upgrade, the reliability of the system will be impacted. Outages will cost more in equipment damage and customer complaints. In addition, replacing equipment after it fails could potentially cost more than proactively replacing it before it fails. Not only would the personnel hours to replace it be more, but if the unit caught fire and/or exploded, it would most likely damage the surrounding disconnect switches, conductor, conduit, buswork, and even possibly the control cable and steel structures. If all of these items had to be replaced instead of just the circuit breaker, the outage time would be substantial and cost many times more dollars.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Potentially wider spread customer outages.
- Impact to system: Maui Electric would be operating unreliably: with the safety and environmental risk of an oil circuit breaker catching fire due to a catastrophic failure; with the environmental risk of an oil circuit breaker leaking oil; and with increased clearing times putting the whole grid at risk of voltage collapse versus containing outages to localized areas.

M0001445 Haiku 23kV Transmission Line Switch

Estimated costs: \$138,710

Project Description

Remove an existing outdated 23kV transmission switch and replace it with new a new 38kV transmission switch. Install 500 feet of fiber optic cable from the new switch to the Remote Terminal Unit (RTU) at the Haiku Substation for remote switching capabilities and transmission line information. This project was completed in September.

Customer Benefit/Customer Value

A transmission line switch is an electrical component that is used to sectionalize a transmission line to allow the Company to isolate a fault or reroute power as required by system needs. The installation of the new switch will allow the Company to better monitor the 23kV transmission system in the Upcountry and Hana areas via SCADA, and permit the Company to perform switching remotely through SCADA without the aid of a Primary Troubleshooter. This will speed up the switching times during outages and switching procedures, plus reduce labor costs. Maui Electric will also be able to generate more information on the system regarding outages, loading, and voltage issues, which aids in faster restoration times and trouble shooting.

Why the Project and Expenditures are Prudent for 2015

This project is necessary to provide increased reliability and decreased system interruption duration in the Upcountry vicinity. The new switch will allow the Company to do switching remotely without a Primary Troubleshooter, and eliminate the need for a Troubleshooter to drive to the physical location of the switch in order to implement the switching.

Affordability of Service

Installing a remotely-operated SCADA switch will decrease electrical costs by eliminating the need for a Primary Troubleshooter to physically perform the switching on site.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Potentially outage duration will increase.
- Impact to system: Should Maui Electric choose not to do this project, the switching capabilities for the transmission system in the Upcountry and Hana areas will be severely diminished and outage times will continue to increase.

M0001708 Customer-Owned Switchgear Vault Installation

Estimated cost: \$121,745

Project Description

Install PME-3 switchgear to provide a clear demarcation between Maui Electric and customer facilities. This will eliminate the need for Maui Electric to operate the customer's equipment to isolate cables as well as provide a safe work environment for Maui Electric personnel. This project is expected to be placed in service in November 2015.

Customer Benefit/Customer Value

This project is required to meet the Company's obligation to update this service to current electrical and safety standards. Failure to comply places the Company's employees at risk and compromises the commitment to maintain a strong safety culture and safe work conditions. Currently, no clear demarcation exists between the Maui Electric primary equipment and the customer's primary equipment.

In order to perform switching in the existing condition, the Troublemakers must enter the customer's primary vault, a confined space with exposed live primary cables and equipment. This situation subjects personnel to the possibility of arc flash and equipment explosion within a confined area. The Company does not have a maintenance record on the customer's equipment.

The new equipment will allow the Troublemakers to do all of their switching outside the vault, in a safe open area with no exposure to live cables or equipment. The Company will also be able to maintain equipment and completely eliminate the need to switch the customer's primary equipment.

Why the Project and Expenditures are Prudent for 2015

This project is necessary to ensure the Primary Troublemakers are not subjected to the existing unsafe conditions in the customer's vault.

Affordability of Service

Preventing unnecessary costs for safety incidents will save customers money and maintain affordable electrical service.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Prolonged outage if Maui Electric personnel are not able to work safely during switching of customer's equipment.
- Impact to system: The lack of demarcation has created a severe safety hazard to Maui Electric personnel when cable isolation is required. Further, this equipment is located in a flood zone, adding to the safety implications. If Maui Electric decides not to complete this project, Company personnel will continue to be required to perform switching in the customers' equipment and carry on this switching in an unsafe condition.

M0001894 Keanae Substation Reconstruction

Estimated cost: \$282,784

Project Description

Replace two deteriorated platform structures of the Keanae Substation which serves approximately 90 customers. The existing platforms were installed in 1986 and were made of wood planks that sit on steel beams. The wood was badly deteriorated and rotting. The new platforms are made of aluminum. This project was completed in September 2015.

Customer Benefit/Customer Value

The replacement of the deteriorated platforms will minimize the risks of substantial outages and safety concerns. There are two platforms: one supports three transformers and one supports three voltage regulators. If either platform were to fail, the outage would be substantial and would continue until another structure could be erected and replacement equipment ordered. The initial outage due to a failure of either platform would affect an additional 6,530 customers because the Pukalani to Hana 23kV transmission line would be dropped, and most likely cause the system to become unstable.

Why the Project and Expenditures are Prudent for 2015

In late 2013, a substation inspection determined that the platform structure was deteriorated and posed a safety concern. Failure to replace will result in extended outages and pose environmental concerns from the oil contained within the equipment on the platform.

Affordability of Service

Both platforms are badly deteriorated. If either failed, the equipment would be destroyed, subjecting customers to extended outages and environmental hazards.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Prolonged customer outages.
- Impact to system: Failure to replace the aging platforms which support the transformers and regulators could result in a substantial outage, safety, and environmental concerns.

M0001918 MPP-PUK-PUU Communications Additions

Estimated cost: \$293,350

Project Description

Install various devices and materials required to obtain direct communication via fiber or microwave between the following substations: Ma‘alaea to Pu‘unene, Pu‘unene to Kanaha, Kanaha to Pukalani, and Ma‘alaea to Waiinu. This project is expected to be placed in service in December 2015.

Customer Benefit/Customer Value

This protection communication allows for differential and permission overreaching transfer tripping (POTT) schemes to be enabled, which will increase reliability of the transmission system and overall stability of Maui Electric’s power system. In addition, it will allow the Company to operate more reliably with the renewable resources currently on the grid. Though communication to these substations and between them currently exists, in some instances, there is not a sufficient amount of dedicated fiber optic cables for the current services as well as the new protection schemes to operate the way they are designed to. Increased data needs have necessitated the additional equipment to make better use of the available fiber optic cables. Although it is not ideal to use multiplexors for protective communication, it is a much more economical option and still very reliable. If multiplexors were not used, the Company would need to pull new fiber between the stations, which would cost millions of dollars to reach all of these substations.

Why the Project and Expenditures are Prudent for 2015

The system security study conducted as part of the PSIP identified fault clearing time as a major issue. Page 4-39 of the Company’s PSIP states that an “immediate improvement is to decrease the time required to reliably detect and clear faults on the systems’ transmission lines. Historically, a fault could be present on the system for 18–21 cycles in almost all systems. Today, for faults that exist longer than 9–11 cycles, the faults can result in a total system collapse... Critical clearing times less than 18 cycles require the use of communications assisted relaying on all transmission.”

Utilizing these protection schemes is part of the process to reduce this time to acceptable levels. There are many requirements to meet from that study. They need to be started now so that the Company’s effort to reduce fault clearing times could stay on schedule to be finished within five years.

The scope of work planned for this project includes the following at each substation:

- Pu‘unene Substation: Install one Focus Multiplexor, one communication power distribution unit, and all required fiber cables between new devices and existing fiber patch panel and protective relaying.

- Ma‘alaea Power Plant Substation: Install one Focus Multiplexor, two new fiber patch panels, one new 36 fiber cable between the old blockhouse and the newer blockhouse, and all required fiber cables between new devices and fiber patch panels and protective relaying.
- Waiinu Substation: Install one Focus Multiplexor, and all required fiber cables between new devices and existing fiber patch panel and protective relaying.
- Kanaha Substation: Install one Focus Multiplexor, one communication power distribution unit, and all required fiber cables between new devices and existing fiber patch panel and protective relaying.
- Pukalani Substation: Install one Focus Multiplexor; one communication power distribution unit; and all required fiber cables between new devices and existing fiber patch panel, protective relaying, and microwave communication systems.

Affordability of Service

Without the upgrades, the reliability of the transmission system will be compromised. Outages will cost the company more in terms of damage repair and customer dissatisfaction.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Potentially wider spread customer outages.
- Impact to system: Maui Electric would be operating with increased clearing times, placing the entire grid at risk of voltage collapse versus containing outages to localized areas.
- Other impacts: The Company’s five year budget has many projects that must be completed. Every delayed project has a ripple effect, causing other necessary projects to be delayed as well. If too many projects are delayed for too long, the system could be in danger of falling short of reliability expectations.

M0001919 Upcountry Recloser Replacement,	Estimated cost: \$208,231
M0001920 West Maui Recloser Replacement,	Estimated cost: \$167,406
M0001921 North Shore Recloser Replacement, and	Estimated cost: \$161,688
M0001922 Central Maui Recloser Replacement	Estimated cost: \$555,610

Project Description

M0001919: Replace two existing 12kV oil-filled reclosers (#496 and #518) located in Upcountry Maui with two vacuum reclosers.

M0001920: Replace two existing 12kV oil-filled reclosers (#528 and #530) located outside the Napili Substation with two vacuum reclosers.

M0001921: Replace two existing 23kV oil-filled reclosers (#2354 and #2305) located between Peahi Substation and Hana Substation with two vacuum reclosers.

M0001922: Replace three existing oil-filled reclosers (#522, #4049, and #2015) located in Central Maui with three vacuum reclosers. Add SCADA functionality to these reclosers to allow for customer renewable projects to be integrated into the Maui Electric system.

These four projects are expected to be placed in service in November 2015 and December 2015.

Customer Benefit/Customer Value

Reclosers are electrical devices capable of detecting faults on the system. They are equipped with a mechanism that can automatically close the circuit back in after it has been opened due to a fault. Reclosers improve service continuity by attempting to automatically restore power to the line after a momentary fault. They will try to close the circuit back in up to a preset number of times before locking out and isolating the circuit from the system.

There are several customer benefits to replacing the existing oil-filled reclosers with vacuum reclosers. First, vacuum reclosers will decrease operation and maintenance costs, as oil-filled recloser maintenance typically includes yearly oil testing and cleaning; vacuum reclosers do not require this maintenance. Second, removing existing oil-filled reclosers removes the potential for oil leaks, a hazard costly to both the Company and the environment. Third, removing existing oil-filled reclosers removes a potential safety hazard, as vacuum reclosers do not have oil, so they do not have the potential to burn in a catastrophic failure scenario.

Why the Project and Expenditures are Prudent for 2015

The projects were planned for 2015, and long-lead materials were already on Maui when the 2015 capital budget was reprioritized in the second quarter 2015. Removing oil-filled reclosers from the Maui Electric system mitigates major reliability, environmental, and safety risks. It ensures that the Maui Electric system maintains reliable service to its customers. Removing oil-filled reclosers also eliminates the safety risk of oil-filled equipment catching fire.

As an example, in 2014, an oil-filled recloser on Wakea Avenue caught on fire. Approximately 12,400 customers were affected; the last customers restored were without power for over two hours. Fortunately, no injuries or major public property damage occurred in the incident.

Affordability of Service

Replacing these reclosers will reduce maintenance costs as well as eliminate potential environmental and safety hazards caused by oil-filled equipment.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Potential for customer outages.
- Impact to system: Maui Electric would be operating with the safety risk of an oil-filled recloser burning in a catastrophic failure scenario. Maui Electric would also be operating with the environmental risk of an oil-filled recloser leaking oil.

M0002063 Moloka'i East End Regulators (E60)

Estimated cost: \$141,252

Project Description

Install voltage regulators near pole E-60 on the Kamehameha V Highway to remedy the low voltage problem and comply with the tariffed voltage requirements on the east end of Moloka'i, circuit CB111A. The project is expected to be placed in service in December 2015.

Customer Benefit/Customer Value

This project will benefit the customers on the east end of Moloka'i by maintaining the voltage requirements of Rule No. 2 of Maui Electric's Tariff (480V-Tariff No. 2, Section B.1.c) and eliminating the current low voltage problems on the circuit CB111A and potential voltage oscillation.

Why the Project and Expenditures are Prudent for 2015

This project is required to meet the voltage standards approved by the Commission in Rule No. 2 of Maui Electric's Tariff (5% plus/minus of the nominal voltage) and eliminate the current low voltage problems on the east end of Moloka'i on circuit CB111A. (Please refer to Rule No. 2, Section B.3.a.) In the area near pole E-60 off of Kamehameha V Highway, the current voltage spread is 31.4V (248.1V–216.7V) due to load growth. Maui Electric's tariff level spread is 24V (252V–228V). An increased load necessitated this project. With the installation of regulators, the Company can bring the voltage up, reduce the voltage spread, and stabilize voltages.

Affordability of Service

Preventing under-voltage conditions and voltage oscillations will ensure affordability of service by safeguarding the Company against customer equipment failures and the replacement costs of those failures.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Potential for customer outages.
- Impact to system: Should Maui Electric choose not to complete this project, the PUC-mandated voltages will not be met and possible customer equipment failures could occur due to the low voltage problems.

**EXHIBIT V.
GENERATION PLANT RELIABILITY IMPROVEMENT PROJECT
DESCRIPTIONS**

M0001736 M14/16 Inverter/Battery Charger System

Estimated cost: \$445,549

Project Description

Upgrade the M14/16 inverter/battery charger system because it has become unreliable. The M14/16 inverter/battery charger system is expected to be placed in service in December 2015.

Customer Benefit/Customer Value

Steady, uninterrupted power to the control systems for M14/16 is required to reliably operate the units. The M14/16 inverter/battery charger system provides this power. Completing the project will help avoid costly unit outages and maintain the reliability of generating units, computers, servers, and many other critical system equipment that depend on uninterrupted power supplies. In addition, an outage caused by these inverters will disable approximately 58 MW of generation capacity, leading to the inability to meet Maui's electrical demands.

Project and Expenditures

M14/16's station inverter/ battery charger is over 20 years old, and its ability to continue to provide safe, reliable, uninterrupted power when required is suspect. The condition of the equipment has steadily decreased over the years; its ability to perform satisfactorily under high power demand is questionable. The vibration of its internal magnetic core has steadily increased to the point it has become excessive. In 2014, various internal component failures made back up power unavailable and, thus, put the generation associated with the CT's at risk because the redundancy to survive reasonable contingencies had failed. Upgrading units now will help to avoid these problems in the future.

Affordability of Service

Outages will cost the Company more in terms of equipment damage and complaints from customers. There is also a potential higher cost associated with the rental of replacement generation equipment.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Loss of service due to Maui Electric's inability to meet the Maui system demand without its largest generators (CT-14 and 16) totaling 58 MW. If other generators are operated instead or if rental of replacement generation occurs, increased costs would result.
- Impact to system: Detrimental impact to the system as these units are required to meet system load and provide the grid stability that allows Maui Electric to bring on more renewable energy.

M0001757 Lana‘i Caterpillar Controls Upgrade

Estimated cost: \$467,045

Project Description

Upgrade the Lana‘i Caterpillar controls to better manage system reliability and recover from potential outages. The Lana‘i Caterpillar controls upgrade is expected to be placed in service in October 2015.

Customer Benefit/Customer Value

This project has a direct impact on system stability and Maui Electric’s ability to recover from unforeseen loss of generators. The existing controls for units 7 and 8 were the original controls installed when the units were commissioned and are approximately 20 years old. Technology has advanced over that time such that the controls available today allow for better monitoring and control of the units, facilitate early detection of problems before they lead to an interruption of service for customers, and allow the units to be started remotely. The ability to remotely start the units is especially important on Lana‘i because, the majority of the time, the facility is staffed by just one employee who would have to leave the control room to start a unit, taking the system operator away from his or her Lana‘i system monitoring and other control room related duties.

Project and Expenditures

The new system provides the Company better visibility of generating equipment and how they respond during normal and upset conditions, which allows for better integration and understanding of renewable projects on the island of Lana‘i. The upgrade also improves the Company’s ability to control, operate, and troubleshoot this generation equipment when a fault or unit trips occurs. This is made possible because the upgraded controls provide more point specific data and built-in historical data capture that was not available on the old controls. This project is in line with controls standardization and upgrade that began with Moloka‘i units 7, 8, and 9, which were completed last year and helped to modernize our generating fleet.

New controls for Caterpillar generating units 7 and 8 on Lana‘i will standardize the unit start sequence time and also provide tighter governor controls. The new digital excitation system allows for better voltage response to system disturbances and provides added protection to the generator. The new flexible controls improve load and voltage response by allowing the Company to monitor and tune the engine governor and generator voltage regulator.

Affordability of Service

Improves the Company’s ability to control, operate, and troubleshoot this generation equipment.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Lower power quality and increased outage frequency and durations.
- Impact to system: Lower power quality and decreased ability to integrate more variable renewable resources.

M0001954 M11 Replacement Lube/Oil Filter Housing
M0001955 M10 Replacement Lube/Oil Filter Housing

Estimated cost: \$171,343
Estimated cost: \$159,196

Project Description

Replaced the lube oil filter housings because they are obsolete and cannot be properly maintained. These projects were completed in September 2015.

Customer Benefit/Customer Value

Replacing the obsolete lube oil filter housings that are no longer supported by the manufacturer allows the Company to continue to operate M10 and M11 reliably. These units require the lube oil be filtered so that harmful material in the lube oil can be removed. Without this filtering, harmful material in the lube oil will damage the internal components of the engine. In order to maintain the units, the Company must be able to readily obtain replacement parts. Once this is no longer the case, proactively replacing the obsolete part at a time when sufficient generation for the island can be maintained with an outage on the unit being worked on minimizes interruptions of service to customers—as compared to the case of running the part to failure to initiate the replacement, especially if the outage duration required for the work is lengthy. Given current system load and generation capacity, the project enabled 24 MW of reliable generation to be available for the grid—critical to maintaining reliable service to customers.

Project and Expenditures

M10 and M11 both play a key role in supplying generation to the grid, as they are two of the more efficient and reliable firm power producers. The K-1 lube oil filters used on M10 and M11 are no longer supported for parts and thus obsolete and will not be available for purchase. Replacing the K-1 filter with a new K-8 filter allows the filters to be standardized across the four Mitsubishi units because M12 and M13 were delivered with the new style filters, and minimize warehouse inventory.

Affordability of Service

Without a functioning lube oil filter, the M10 and M11 units would not be available for power production. If this happened, the Company would need to operate less efficient units or potentially lease or contract additional generation, thus increasing costs.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Loss of service due to Maui Electric's inability to meet the Maui system demand without 24 MW of generation. If other generators are operated instead or if rental of replacement generation occurs, increased costs would also result.
- Impact to system: Decreased reliability if the units are not available to be operated. Increased difficulties in scheduling outages and down time for other units needing to be overhauled or have repairs done.

M0001981 Hana 1 Generator Replacement

Estimated cost: \$100,949

Project Description

Replaced the generator on the Hana 1 unit because its age posed a risk to system reliability and signs of future failure were present. The Hana 1 Generator Replacement project was completed in June 2015.

Customer Benefit/Customer Value

The unit was 35 years old, which is 15 years past its recommended life cycle. A test of the generator showed a weakening of its windings, potentially causing the generator to fail abruptly because of an imbalance that stress loading would imposed upon the windings.

The project helped to avoid costly emergency repairs and extending outages for Hana if the generator had failed during storms, overhead line outages, or at other inopportune times.

Project and Expenditures

The Hana 1 unit generates half the power for the Hana community. If Hana 1 was inoperable and offline, only part of Hana's commercial load could be served. Because Hana's commercial loads are on separate circuits, a single unit cannot serve all the circuits. The Hana 2 unit is too small for the load it would have to serve if the Hana 1 unit was inoperable and offline. If the Hana 1 unit was not replaced, the Hana 2 unit eventually would have failed.

Affordability of Service

The existing generator served for close to double its expected life before needing to be replaced, which in turn delayed the need for the expenses related to replacement.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Increased frequency and/or duration of outages.
- Impact to system: Increased frequency and/or duration of outages.

M0002062 E-Cell EDI Module Stacks Replacement

Estimated cost: \$85,745

Project Description

Replaced the E-Cell EDI "A" module stack because its product flow rate had deteriorated. The E-Cell EDI Modules are necessary for the combined cycle water treatment plant. They eliminate hazardous chemicals, residual salts, and other aqueous species (such as carbon dioxide, silica, ammonia, and boron) from water sources to provide purified water to the Company's boiler feed and NOx control. This enables the plant to comply with ISO 14000 environmental pollution prevention. The demineralized water also supports the diesel plant and is used to cool the diesel units. The E-Cell EDI Module Stacks project was placed in service in September 2015.

Customer Benefit/Customer Value

Demineralized water is as critical to gas turbine operation as is fuel. The E-Cells were replaced because the present EDI module stacks were at the end of their useful life. They would

not have produced adequate quantities of water to operate the four CTs for much longer. The Company has two sets of E-Cells because the system requires redundancy. Operating on one set does not allow the Company to operate reliably. Without redundancy, any time a single E-Cell stack was inoperable, the CT operation must be reduced until the problem is resolved.

Project and Expenditures

The E-Cell's flow rate had been declining from an optimal 135 gallons per minute (gpm) down to 80 gpm. The E-Cell's minimum allowable flow rate for the Company's system is 67.5 gpm. That minimum would soon have been reached if the project was not completed.

Affordability of Service

This system supports approximately 116 MW of capacity. Having this capacity unavailable would require the Company to lease or contract additional generation, thus increasing costs. The stacks' life expectancy is normally two years. By properly maintaining the stacks and system, Maui Electric was able to extend the useful life to three to four years.

Impacts

Not completing this project will have the following impacts:

- Impact to customers: Loss of service due to Maui Electric's inability to meet the Maui system demand without its largest generators (CT-14, 16, 17, and 19) totaling 116 MW. If other generators are operated instead of the CTs or if rental of replacement generation occurs, increased costs would also result.
- Impact to system: Detrimental impact to the system as these units are required to meet system load and provide the grid stability that allows Maui Electric to bring on more renewable energy.

COST ESTIMATE

PROJECT TITLE: Puunene Substation Relay Replacement
BUDGET ITEM: M0001265

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 51,935
OVERHEAD	<u>90,524</u>
Sub-Total	142,459
MATERIALS	41,598
OUTSIDE SERVICES	57,174
OTHER	17,450
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>7,460</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$266,141</u>

COST ESTIMATE

PROJECT TITLE: Kanaha Substation Relay Replacement
BUDGET ITEM: M0001266

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 48,969
OVERHEAD	<u>84,269</u>
Sub-Total	133,238
MATERIALS	39,413
OUTSIDE SERVICES	66,495
OTHER	12,855
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>8,428</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$260,429</u>

COST ESTIMATE

PROJECT TITLE: Kula Substation Circuit Breaker Replacement
BUDGET ITEM: M0001335

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 55,935
OVERHEAD	<u>96,276</u>
Sub-Total	152,211
MATERIALS	57,648
OUTSIDE SERVICES	58,335
OTHER	-
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>3,480</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$271,675</u>

COST ESTIMATE

PROJECT TITLE: Haiku 23kV Transmission Line Switch
BUDGET ITEM: M0001445

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 14,437
OVERHEAD	<u>26,058</u>
Sub-Total	40,495
MATERIALS	70,279
OUTSIDE SERVICES	4,716
OTHER	-
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>23,220</u>
<u>TOTAL COST OF PROJECT</u>	<u>\$138,710</u>

COST ESTIMATE

PROJECT TITLE: Keanae Substation Reconstruction
BUDGET ITEM: M0001894

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 65,184
OVERHEAD	<u>113,271</u>
Sub-Total	178,455
MATERIALS	85,151
OUTSIDE SERVICES	7,417
OTHER	-
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>11,762</u>
<u>TOTAL COST OF PROJECT</u>	<u>\$282,784</u>

COST ESTIMATE

PROJECT TITLE: Upcountry Recloser Replacement
BUDGET ITEM: M0001919

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 34,719
OVERHEAD	<u>57,763</u>
Sub-Total	92,482
MATERIALS	76,117
OUTSIDE SERVICES	20,443
OTHER	1,000
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>18,189</u>
<u>TOTAL COST OF PROJECT</u>	<u>\$208,231</u>

COST ESTIMATE

PROJECT TITLE: West Maui Recloser Replacement
BUDGET ITEM: M0001920

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 21,437
OVERHEAD	<u>39,301</u>
Sub-Total	60,738
MATERIALS	71,296
OUTSIDE SERVICES	28,557
OTHER	2,000
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>4,815</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$167,406</u>

COST ESTIMATE

PROJECT TITLE: North Shore Recloser Replacement
BUDGET ITEM: M0001921

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 9,838
OVERHEAD	<u>27,802</u>
Sub-Total	37,640
MATERIALS	100,627
OUTSIDE SERVICES	15,956
OTHER	2,000
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>5,466</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$161,688</u>

COST ESTIMATE

PROJECT TITLE: Central Maui Recloser Replacement
BUDGET ITEM: M0001922

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 106,200
OVERHEAD	<u>189,223</u>
Sub-Total	295,423
MATERIALS	183,061
OUTSIDE SERVICES	57,154
OTHER	2,000
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>17,973</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$555,610</u>

COST ESTIMATE

PROJECT TITLE: Molokai East End Regulators (E60)
BUDGET ITEM: M0002063

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 27,535
OVERHEAD	<u>44,930</u>
Sub-Total	72,465
MATERIALS	42,561
OUTSIDE SERVICES	25,000
OTHER	-
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>1,226</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$141,252</u>

COST ESTIMATE

PROJECT TITLE: Customer Owned Switchgear Vault
BUDGET ITEM: M0001708

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 10,712
OVERHEAD	<u>30,696</u>
Sub-Total	41,408
MATERIALS	43,186
OUTSIDE SERVICES	35,000
OTHER	-
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>2,152</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$121,745</u>

COST ESTIMATE

PROJECT TITLE: MPP-PUK-PUU Communications Additions
BUDGET ITEM: M0001918

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 42,789
OVERHEAD	<u>87,974</u>
Sub-Total	130,763
MATERIALS	97,688
OUTSIDE SERVICES	54,990
OTHER	-
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>9,909</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$293,350</u>

COST ESTIMATE

PROJECT TITLE: M14-16 Inverter/Battery Charger System
BUDGET ITEM: M0001736

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 9,285
OVERHEAD	<u>18,394</u>
Sub-Total	27,679
MATERIALS	348,133
OUTSIDE SERVICES	60,833
OTHER	0
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>8,904</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$445,549</u>

COST ESTIMATE

PROJECT TITLE: LAN Cat Controls Upgrade
BUDGET ITEM: M0001757

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 54,023
OVERHEAD	<u>58,997</u>
Sub-Total	113,020
MATERIALS	299,026
OUTSIDE SERVICES	44,295
OTHER	4,900
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>5,804</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$467,045</u>

COST ESTIMATE

PROJECT TITLE: M11 Repl L/O Filter Housing
BUDGET ITEM: M0001954

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 12,109
OVERHEAD	<u>17,535</u>
Sub-Total	29,644
MATERIALS	99,917
OUTSIDE SERVICES	37,412
OTHER	0
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>4,370</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$171,343</u>

COST ESTIMATE

PROJECT TITLE: M10 Repl L/O Filter Housing
BUDGET ITEM: M0001955

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 16,752
OVERHEAD	<u>20,731</u>
Sub-Total	37,483
MATERIALS	95,510
OUTSIDE SERVICES	22,649
OTHER	0
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>3,554</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$159,196</u>

COST ESTIMATE

PROJECT TITLE: Hana 1 Generator Replacement
BUDGET ITEM: M0001981

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 22,193
OVERHEAD	<u>21,209</u>
Sub-Total	43,402
MATERIALS	55,533
OUTSIDE SERVICES	0
OTHER	1,387
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>627</u>
<u>TOTAL COST OF PROJECT</u>	<u>\$100,949</u>

COST ESTIMATE

PROJECT TITLE: E-Cell EDI Module Stacks
BUDGET ITEM: M0002062

<u>Cost Category</u>	<u>TOTALS</u>
LABOR	\$ 2,130
OVERHEAD	<u>4,098</u>
Sub-Total	6,228
MATERIALS	78,286
OUTSIDE SERVICES	0
OTHER	0
ALLOWANCE FOR FUNDS USED DURING CONSTRUCTION	<u>1,231</u>
 <u>TOTAL COST OF PROJECT</u>	 <u>\$85,745</u>



**Maui Electric Company
Power Supply Improvement Plan
MECO System
Years – 2015, 2016, 2017, 2023, 2030**

Project # 14-0373

August 8, 2014

John DL Hieb
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Hawaiian Electric Company
MECO PSIP – 2015, 2016, 2017, 2023, 2030

Summary of Changes

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Executive Summary



1 Introduction

Boundary conditions were established for the expected generation scenarios for the years 2015, 2016, 2017, 2023, and 2030. These years were chosen due to the large changes that occur during this time period, including additions of renewable energy (2015, 2016, 2017), peak load (2023), and additions of new generation units and changes in system loads (2030). The boundary conditions were identified by configuring the generation dispatches to stress the system to determine the stability and contingency reserve requirements for the system.

2 Methodology

The reduction in system inertia and system response due to displacement of conventional generation units by variable energy will result in a less robust power system. This can potentially increase the amount of stages of the Under Frequency Load Shed system (UFLS) that will activate for unit trips and result in lower critical clearing times for all transmission and subtransmission faults.

2.1 System Improvement Assumptions

It is assumed that dual primary, communications assisted relaying is installed on all MECO 69 kV and 46 kV circuits and all N-1 faults are cleared in less than 9 cycles.

The extreme variation in feeder loading during daytime and nighttime conditions require an adaptive relaying scheme for the under frequency load shedding system. This system is assumed to be in service in 2017. Due to the requirements of the under frequency loadshed scheme, SCADA control of all distribution circuits will be required for the new system. It is assumed that SCADA control will be established to all substations by 2017.

Control of all distributed generation (DG) PV is assumed in 2017. Control of DG would allow the curtailed PV to provide 10-minute reserves to replace regulation reserves used to counter ramping of the variable generation.

2.2 PV Assumptions

It was assumed that only 10 MW of the total DG installed would utilize legacy trip settings for voltage and frequency. The remaining PV was assumed to have extended ride through characteristics allowing the PV to remain online during system contingencies. The settings used for the legacy and extended PV capability are shown below in Table 2-1.

Table 2-1 PV Settings

PV Type	Protection Type		Settings 1		Settings 2	
			Set Point (Hz or (sec)	Time (sec)	Set Point (Hz or (sec)	Time (sec)
Legacy	Voltage	Over	1.10	0.99	1.2	0.157
		Under	0.88	1.99	0.5	0.157
	Frequency	Over	60.5	0.157	-	-
		Under	59.3	0.157	-	-
Extended	Voltage	Over	1.10	0.99	1.2	0.157
		Under	0.88	1.99	0.5	0.49
	Frequency	Over	63	19.99	-	-
		Under	57	19.99	-	-

It is important to note that the legacy PV has an under frequency trip setting of 59.3 Hz and a relay time of 0.157 seconds. Based on these settings, an under frequency event is likely to result in tripping of the legacy PV, further depressing system frequency following its tripping. The legacy PV also trips on over frequency at 60.5 Hz also in 0.157 seconds. The loss of legacy PV following a transmission fault will decrease system security. The extended PV settings have an under frequency set point of 57.0 Hz and a relay time of 20 seconds, resulting in minimal PV tripping during under frequency events.

2.3 Criteria

The criteria for the system security studies are based on HECO's adopted planning document TPL-001. The planning document outlines the transmission and generation contingencies and the acceptable performance of the system. A copy of the planning criteria is attached.

The generation planning criteria BAL-502 also contains required characteristics of future energy resources that were used in the system studies. A copy of the generation planning standard is also attached.

The overriding criteria used for the analysis was that the system should not activate more than the Stage 1 of the UFLS system during single unit outages, loss of a wind farm or PV source. Stage 1 currently results in the loss of customers that is acceptable to the planning criteria in TPL-001. The settings used for the existing UFLS system are shown below in Table 2-2.

Table 2-2 UFLS Settings

UFLS Stage	Set Point (Hz)	Intentional Delay (Sec)	Breaker Time (sec)
Stage 1	58.7	0.000	0.083
Stage 2	58.5	0.000	0.083
Stage 3	58	0.000	0.083

2.4 Contingency Reserves Analysis

The replacement of traditional generation with variable generation will require additional contingency reserves. Energy Storage Systems (ESS) were added to the system provide system stability and meet the performance requirements of TPL-001.

During analysis, if the simulation resulted in a frequency below 58.7 Hz for a single contingency event, the contingency reserves were increased in 5 MW increments until the frequency stayed above 58.7 Hz. The amount of contingency reserves that just prevented the Stage 2 of UFLS is defined as the minimum level of contingency reserves for the system.

2.5 Contingencies

Contingencies of major 69 kV lines with 5 cycle clearing times were utilized to verify system stability for each generation configuration. Unit outages consisted of the larger MECO units or a single contingency wind farm line or transformer. These contingencies were used to identify the level of contingency reserves required to meet the reliability standards set forth in TPL-001. A list of contingencies used for the study is shown below in Table 2-3.

Table 2-3 Contingencies

	Disturbance	From Bus	To Bus	'ID'	Clearing Time (Cycles)
Unit Trips	MPP 14	301	-	1	-
	MPP 10	108	-	0	-
	MPP 16	302	-	2	-
	HC&S	804	-	4	-
	MPP 15	303	-	3	-
	AWF	90991	-	S3	-
	KWP	90971	-	1	-
Faults	Kanaha_6923	602	202	4	7
	Puunene_6923	4002	4	1	7
	Waiinu_6923	636	236	1	7
	Maa-Lahaluna	39	97	2	5
	Maa-KWP	39	636	1	5
	Maa-Kihei	39	35	1	5
	Kanaha-Puunene	602	401	1	5
	Lahaina-Lahaluna	34	84	1	5

2.6 Load and PV Levels

The forecast load growth increases from current peak load levels near 200 MW to 218 MW in 2023, and decreasing through 2030 to 206 MW. DG connected to the system is projected to increase through the years with 130 MW projected in 2030. Table 2-4 shows the projected load and DG levels for this study.

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Table 2-4: MECO Load and PV Levels

	Minimum	Day Minimum	Day Peak	Evening Peak
2015 Load Levels	86.3	135.3	183.6	195.4
2016 Load Levels	87.3	138.7	186.1	197.7
2017 Load Levels	90.7	142.7	191.3	203.7
2023 Load Levels	97.2	154.0	205.6	218.5
2030 Load Levels	91.8	148.5	195.1	206.3

	Nameplate Capacity	Sunny (MW)	Cloudy (MW)
2015 PV Gen	75.0	63.8	7.5
2016 PV Gen	90.0	76.5	9.0
2017 PV Gen	96.0	81.6	9.6
2023 PV Gen	116.0	98.6	11.6
2030 PV Gen	130.0	110.5	13.0

3 2015

Power flow cases were created for the day minimum and day peak load times. The day minimum cases assumed a load of 135 MW, with renewable generation resources consisting of 75 MW of distributed PV (12 MW legacy PV) and 72 MW of wind. The day peak cases assumed a load of 183 MW.

The assumptions used for the 2015 cases are listed below:

- These cases assume that 12 MW of PV has legacy trip settings (59.3 Hz/ 60.5 Hz), all other PV has extended ride through
- KPP 3, KPP 4, DTCC1 are baseloaded
 - Sensitivity cases were run with ½ DTCC2 baseloaded
- Existing protection clearing times were used
- No curtailment of DG resources

3.1 2015 – Generation Dispatches

Prior to the correction of the PV trip settings, the loss of 12 MW of PV during an under frequency event results in the worst case scenario for the system. Consequently, only the daytime cases were run for the 2015. For line fault contingencies, it is critical that only 12 MW of PV utilize the 60.5 Hz trip setting. With DTCC1, KPP 3, KPP 4 online, the wind must be curtailed for the daytime minimum cases. Details of the generation dispatches for the 2015 study year are shown in Table 3-1.

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Table 3-1 2015 Dispatch Cases – KPP 3, KPP 4, DTCC1 Baseloaded

2015								
Wind Level	Daytime Minimum Load Level				Daytime Peak Load Level			
	Windy	Windy	Calm	Calm	Windy	Windy	Calm	Calm
Solar Gen (Cap)	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
Curtailed Solar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Gen (MW)	63.8	7.5	63.8	7.5	63.8	7.5	63.8	7.5
KPP 1								
KPP 2								
KPP 3	7.0	8.0	8.0	11.0	7.5	8.0	10.0	11.0
KPP 4	7.0	8.0	8.0	11.0	7.5	8.0	10.0	11.0
MPP 14	18.0	17.5	17.0	16.5	17.0	18.0	16.0	19.8
MPP 15	8.0	7.7	8.0	11.5	7.5	8.0	8.0	13.0
MPP 16	18.0	17.5	17.0	16.8	17.0	18.0	16.2	20.0
MPP 17				18.0		17.0	19.0	19.5
MPP 18				11.5		6.0	9.0	10.5
MPP 19				18.0			19.0	19.5
HC&S	11.0	9.0	11.0	12.0	11.0	11.0	10.0	11.0
MPP 10						10.0		12.0
MPP 11								11.5
MPP 12								11.0
MPP 13								
Wind Total	0.0	60.0	0.0	0.0	51.0	72.0	0.0	0.0
Load	132.8	135.2	132.8	133.8	182.3	183.5	181.0	182.8
Reg Up	19.0	20.3	19.0	17.5	20.5	23.6	23.6	8.0
Reg Down	21.0	19.7	21.0	36.5	19.5	29.6	24.4	60.1

3.2 2015 – Results

The minimum frequency results are shown below for the 2015 cases.

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Table 3-2: 2015 Stability Results - 12 MW PV that Trips at 59.3 Hz

	Day Min				Day Peak			
	wnd_sun	wnd_cld	clm_sun	clm_cld	wnd_sun	wnd_cld	clm_sun	clm_cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min
M14	58.3	59.4	59.4	59.5	59.4	59.5	59.6	59.6
MGS10						59.7		59.7
M16	58.4	59.4	59.4	59.5	59.5	59.5	59.5	59.5
HC&S	59.6	59.7	59.6	59.6	59.6	59.7	59.7	59.7
M15	59.7	59.8	59.7	59.7	59.8	59.8	59.8	59.7
AWF		59.6			59.6	59.7		
KWP		58.6			58.3	59.0		
Kanaha_6923	59.8	59.8	59.7	59.7	59.9	59.9	59.7	59.8
Puunene_6923	59.8	59.9	59.8	59.8	59.9	59.9	59.8	59.8
Waiinu_6923	59.8	59.6	59.8	59.7	59.7	59.7	59.8	59.7
Maa-Lahaluna	59.8	59.8	59.8	59.6	59.9	59.8	59.7	59.5
Maa-KWP	59.6	59.6	59.6	59.4	59.8	59.8	59.3	59.4
Maa-Puunene	59.0	59.9	58.6	59.2	59.6	59.8	58.9	59.1
Maa-Kihei	59.8	59.9	59.8	59.7	60.0	59.9	59.7	59.6
Kanaha-Puunene	59.8	59.8	59.8	59.8	59.9	59.9	59.8	59.9
Lahaina-Lahaluna	58.9	59.5	59.0	59.3	59.6	59.8	59.2	59.3
	Stage 1	Stage 2	Stage 3					

The M14, M16, and KWP unit trip simulations resulted in stage 2 of load shedding. It should be noted that these results assume only 12 MW of PV trip at the current over frequency setting of 60.5 Hz. Following a line fault, it is critical that no additional PV trip for the high frequency condition. If additional PV is retrofitted such that only 10 MW of PV capacity has the 59.3/60.5 Hz trip settings, the results are slightly improved. Table 3-3 shows the contingency results when this retrofit is completed.

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Table 3-3: 2015 Stability Results – 10 MW PV that Trips at 59.3 Hz

	Day Min				Day Peak			
	wnd_sun	wnd_cld	clm_sun	clm_cld	wnd_sun	wnd_cld	clm_sun	clm_cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min
M14	58.5	59.4	59.4	59.5	59.4	59.5	59.6	59.6
MGS10						59.7		59.7
M16	58.5	59.4	59.4	59.5	59.5	59.5	59.5	59.5
HC&S	59.6	59.7	59.6	59.6	59.6	59.7	59.7	59.7
M15	59.7	59.8	59.7	59.7	59.8	59.8	59.8	59.7
AWF		59.6			59.6	59.7		
KWP		58.6			58.3	59.0		
Kanaha_6923	59.8	59.8	59.7	59.7	59.9	59.9	59.7	59.8
Puunene_6923	59.8	59.9	59.8	59.8	59.9	59.9	59.8	59.8
Waiinu_6923	59.8	59.6	59.8	59.7	59.7	59.7	59.8	59.7
Maa-Lahaluna	59.8	59.8	59.8	59.6	59.9	59.8	59.8	59.5
Maa-KWP	59.6	59.6	59.6	59.4	59.8	59.8	59.5	59.4
Maa-Puunene	59.1	59.9	58.9	59.2	59.6	59.8	59.2	59.1
Maa-Kihei	59.8	59.9	59.8	59.7	60.0	59.9	59.7	59.6
Kanaha-Puunene	59.8	59.8	59.8	59.8	59.9	59.9	59.8	59.9
Lahaina-Lahaluna	59.1	59.5	59.1	59.3	59.6	59.8	59.3	59.3
	Stage 1	Stage 2	Stage 3					

The minimum frequency improved with the lower PV levels, but was not enough to prevent the second stage of load shedding.

We studied the impact that a direct transfer trip would have on the minimum system frequency in 2015. In this scenario, the unit breaker was used to directly trip the first stage of UFLS instead of relying on frequency decay to initiate the trip. The results of these simulations are shown below in Table 3-4.

Table 3-4: 2015 Stability Results – 12 MW PV that Trips at 59.3 Hz – Transfer Trip Stage 1

	Day Min				Day Peak			
	wnd_sun	wnd_cld	clm_sun	clm_cld	wnd_sun	wnd_cld	clm_sun	clm_cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.5	59.7	59.5	59.7	59.6	59.7	59.7	59.8
MGS10						59.8		59.8
M16	59.5	59.7	59.5	59.7	59.7	59.7	59.7	59.8
HC&S	59.7	59.8	59.7	59.8	59.7	59.8	59.8	59.8
M15	59.8	59.8	59.8	59.8	59.8	59.9	59.8	59.8
AWF		59.8			59.8	59.8		
KWP		59.2			58.5	59.5		
	Stage 1	Stage 2	Stage 3					

With the transfer trip of stage 1, the second stage of load shedding can be avoided. If the transfer trip could be enabled for the loss of any of the combustion turbines, or the KWP plant, the system would meet the reliability criteria.

4 2016

Power flow cases were created for the day minimum and day peak load times. The day minimum cases used a load of 138 MW, with renewable generation resources consisting of 90 MW of distributed PV (12 MW legacy PV) and 72 MW of wind. The day peak cases used a load of 186 MW.

The assumptions used for the 2016 cases are listed below:

- These cases assume that 12 MW of PV has legacy trip settings (59.3 60.5 Hz), all other PV has extended ride through
 - Sensitivity cases run with 10 MW
- KPP 3, KPP 4, and DTCC1 are baseloaded
- Existing protection clearing times were used
- No curtailment of DG resources
- DTCC1 minimum generation is reduced to allow more renewable generation

4.1 2016 – Generation Dispatches

As for the 2015 cases, only the daytime cases were run for 2016. The loss of legacy PV due to under-frequency trip settings will worsen the unit trip scenarios, and the PV will also reduce the net load on each stage of load shed. For line fault conditions, it is critical that the legacy PV be limited to only 12 MW of PV for over frequency conditions. With DTCC1, KPP 3, KPP 4 online, the wind must be curtailed for the daytime minimum cases. Details of the generation dispatches for the 2016 study year are shown in Table 4-1.

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Table 4-1: 2016 Dispatch Cases

2016								
Wind Level	Daytime Minimum Load Level				Daytime Peak Load Level			
	Windy	Windy	Calm	Calm	Windy	Windy	Calm	Calm
Solar Gen (Cap)	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Curtailed Solar	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Solar Gen (MW)	76.5	9.0	76.5	9.0	76.5	9.0	76.5	9.0
KPP 1								
KPP 2								
KPP 3	3.5	7.0	7.5	10.0	5.0	9.0	11.0	10.5
KPP 4	3.5	7.0	7.5	10.0	5.0	9.0	11.0	10.5
MPP 14	8.4	14.7	15.0	16.2	10.0	17.0	13.6	18.8
MPP 15	4.0	6.0	6.0	12.0	5.0	7.5	7.0	13.0
MPP 16	8.4	14.8	15.0	18.0	10.0	17.0	15.0	19.5
MPP 17				19.0		17.0	17.0	19.5
MPP 18				12.0		6.0	8.0	12.0
MPP 19				19.0				19.0
HC&S	8.0	8.0	8.4	12.0	8.5	11.0	12.0	12.0
MPP 10						11.5	12.0	12.0
MPP 11								12.0
MPP 12								12.0
MPP 13								
MPP 4								5.5
MPP 6								
MPP 8								
MPP 9								
Wind Total	23.0	72.0	0.0	0.0	64.5	72.0	0.0	0.0
Load	135.3	138.5	135.9	137.2	184.5	186.0	183.1	185.3
Reg Up	52.2	30.5	28.6	15.6	44.5	22.6	21.0	7.0
Reg Down	4.8	26.5	28.4	55.4	12.5	47.6	46.2	78.0

The minimum frequency results for 2016 are shown below in Table 4-2.

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4.2 2016 – Results

Table 4-2: 2016 Stability Results - 12 MW PV that Trips at 59.3 Hz

	Day Min				Day Peak			
	wnd_sun	wnd_cld	clm_sun	clm_cld	wnd_sun	wnd_cld	clm_sun	clm_cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.7	59.5	59.5	59.6	59.7	59.5	59.6	59.6
MGS10						59.7	59.6	59.7
M16	59.7	59.5	59.5	59.5	59.7	59.5	59.6	59.6
HC&S	59.7	59.7	59.7	59.6	59.7	59.7	59.6	59.7
M15	59.8	59.8	59.8	59.7	59.8	59.8	59.8	59.7
AWF		59.7			59.7	59.7		
KWP	58.7	58.6			58.5	59.0		
Kanaha_6923	59.8	59.7	59.8	59.7	59.8	59.9	59.8	59.8
Puunene_6923	59.9	59.9	59.9	59.8	59.9	59.9	59.8	59.8
Waiinu_6923	59.7	59.4	59.8	59.7	59.6	59.7	59.8	59.7
Maa-Lahaluna	60.0	59.7	59.8	59.6	59.8	59.9	59.7	59.6
Maa-KWP	60.0	59.5	59.7	59.4	59.8	59.9	59.4	59.4
Maa-Puunene	59.9	59.8	59.5	59.2	59.8	59.8	59.1	59.1
Maa-Kihei	60.0	59.7	59.8	59.7	59.9	60.0	59.8	59.6
Kanaha-Puunene	59.8	59.6	59.9	59.8	59.7	59.9	59.8	59.9
Lahaina-Lahaluna	59.6	59.6	59.3	59.2	59.6	59.8	59.3	59.3
	Stage 1	Stage 2	Stage 3					

The loss of the KWP plant can result in stage 2 load shedding for the high PV/ minimum daytime load condition.

The impact of reducing the legacy PV to only 10 MW is shown in Table 4-3.

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Table 4-3: 2016 Stability Results – 10 MW PV that Trips at 59.3 Hz

	Day Min				Day Peak			
	wnd_sun	wnd_cld	clm_sun	clm_cld	wnd_sun	wnd_cld	clm_sun	clm_cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.7	59.5	59.5	59.6	59.7	59.5	59.6	59.6
MGS10						59.7	59.6	59.7
M16	59.7	59.5	59.5	59.5	59.7	59.5	59.6	59.6
HC&S	59.7	59.7	59.7	59.6	59.7	59.7	59.6	59.7
M15	59.8	59.8	59.8	59.7	59.8	59.8	59.8	59.7
AWF		59.7			59.7	59.7		
KWP	58.7	58.6			58.5	59.0		
Kanaha_6923	59.8	59.7	59.8	59.7	59.8	59.9	59.8	59.8
Puunene_6923	59.9	59.9	59.9	59.8	59.9	59.9	59.8	59.8
Waiinu_6923	59.7	59.4	59.8	59.7	59.6	59.7	59.8	59.7
Maa-Lahaluna	60.0	59.7	59.8	59.6	59.8	59.9	59.7	59.6
Maa-KWP	60.0	59.5	59.7	59.4	59.8	59.9	59.4	59.4
Maa-Puunene	59.9	59.8	59.5	59.2	59.8	59.8	59.1	59.2
Maa-Kihei	60.0	59.7	59.8	59.7	59.9	60.0	59.8	59.6
Kanaha-Puunene	59.8	59.6	59.9	59.8	59.7	59.9	59.8	59.9
Lahaina-Lahaluna	59.6	59.6	59.3	59.2	59.6	59.8	59.3	59.3
	Stage 1	Stage 2	Stage 3					

The minimum frequency did improve with the lower PV and was able to prevent the second stage of load shedding.

In order to prevent the second stage of load shedding for the loss of a generation unit, we studied the impact that a direct transfer trip would have on the minimum system frequency in 2016. The results of these simulations are shown below in Table 4-4.

Table 4-4: 2016 Stability Results – 12 MW PV that Trips at 59.3 Hz – Transfer Trip Stage 1

	Day Min				Day Peak			
	wnd_sun	wnd_cld	clm_sun	clm_cld	wnd_sun	wnd_cld	clm_sun	clm_cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.5	59.7	59.5	59.7	59.6	59.7	59.7	59.8
MGS10						59.8		59.8
M16	59.5	59.7	59.5	59.7	59.7	59.7	59.7	59.8
HC&S	59.7	59.8	59.7	59.8	59.7	59.8	59.8	59.8
M15	59.8	59.8	59.8	59.8	59.8	59.9	59.8	59.8
AWF		59.8			59.8	59.8		
KWP		59.2			58.7	59.5		
	Stage 1	Stage 2	Stage 3					

With the transfer trip the second stage of load shedding can be avoided with 12 MW PV that trips at 59.3 Hz. The transfer trip should be enabled for the loss of any of the combustion turbines, or the KWP plant.

5 2017

Power flow cases were created for the minimum, day minimum, day peak, and peak load times. Renewable generation resources consist of 96 MW of distributed PV (10 MW legacy PV) and 72 MW of wind.

The year 2017 was selected for analysis due to the large jump in PV between 2015 and 2017, without additional security reserves or dispatchable generation added to counter the increase.

The assumptions used for the 2017 cases are listed below:

- These cases assume that 10 MW of PV has legacy trip settings, all other PV has extended ride through
 - Sensitivity cases run with 10 MW
- KPP 3, KPP 4, DTCC1, and ½ DTCC2 are baseloaded
 - Sensitivity cases were run without ½ DTCC2 baseloaded
 - Sensitivity cases were run without KPP 3 and KPP 4 baseloaded (mimick's 2019 case)
 - Sensitivity cases were run with only DTCC1 baseloaded
- Upgraded protection times were used such that all faults are cleared in 5 cycles
- PV installed after the beginning of 2015 can be curtailed
- DTCC1 minimum generation is reduced to allow more renewable generation

5.1 2017 – Generation Dispatches

With KPP 3, KPP 4, DTCC1, and ½ DTCC2 online, the wind must be curtailed for the daytime minimum cases. Details of the generation dispatches for the 2017 study year are shown in Table 5-1.

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Table 5-1: 2017 Dispatch Cases

2017												
Wind Level	Minimum		Daytime Minimum Load				Daytime Peak Load Level				Peak Load	
	Windy	Calm	Windy	Windy	Calm	Calm	Windy	Windy	Calm	Calm	Windy	Calm
Solar Gen (Cap)	0.0	0.0	81.6	9.6	81.6	9.6	81.6	9.6	81.6	9.6	0.0	0.0
Curtailed Solar			34.0	4.0			11.5					
Solar Gen (MW)			47.6	5.6	81.6	9.6	70.1	9.6	81.6	9.6		
KPP 1												
KPP 2												
KPP 3	3.5	8.0	3.5	3.5	7.0	11.0	3.5	9.0	10.0	11.0	11.0	11.5
KPP 4	3.5	8.0	3.5	3.5	7.0	11.0	3.5	9.0	10.0	11.0	11.0	11.5
MPP 14	9.0	18.3	8.9	13.1	8.7	17.7	8.7	16.5	13.9	18.8	17.5	19.7
MPP 15	4.0	12.0	4.0	6.5	5.0	12.0	4.0	8.0	7.0	12.0	8.0	12.0
MPP 16	9.0	18.2	9.0	13.0	9.5	18.0	9.0	16.5	13.9	18.5	17.5	20.0
MPP 17	14.4	18.0	14.5	16.0	16.0	19.0	14.5	17.0	17.0	19.0	18.0	20.0
MPP 18	4.5	7.0	4.1	5.0	5.0	12.0	4.5	8.0	8.0	10.5	9.0	12.0
MPP 19						19.0		17.0	17.0	19.0	18.0	20.0
HC&S												
MPP 10				12.0		12.0		9.0	10.0	12.0	10.0	12.0
MPP 11										12.0	10.0	12.0
MPP 12										12.0		12.0
MPP 13										12.0		12.0
MPP 4										5.5		5.5
MPP 6										5.5		5.5
MPP 8												5.4
MPP 9												5.4
MPP 1										2.5	2.5	2.5
MPP 2												2.5
MPP 3												2.5
Wind Total	42.0	0.0	46.0	64.5	0.0	0.0	72.0	72.0	0.0	0.0	72.0	0.0
Load	89.9	89.5	141.1	142.7	139.8	141.3	189.8	191.6	188.4	190.9	204.5	204.0
Reg Up	57.4	15.8	55.8	43.0	45.1	12.4	55.6	31.1	34.3	10.4	26.5	6.6
Reg Down	6.4	48.0	6.0	23.2	16.7	59.0	6.2	37.3	31.1	78.8	47.5	90.5

With KPP 3, KPP 4, DTCC1, and ½ DTCC2 online, the wind and solar must be curtailed for the daytime minimum cases.

We also created some sensitivity dispatch cases that did not have KPP 3 and KPP 4 online. These cases were created to mimic the 2017 system response to the loss of a generating unit. It is noted that the 2017 cases do not have the transmission upgrades necessary to deal with the steady state overload and voltage concerns related to the loss of a transmission line. The cases were only created for the minimum and daytime minimum cases when the baseload assumption changes the dispatch scenarios. These sensitivity case dispatches are shown below in Table 5-2 through Table 5-4.

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Table 5-2: 2017 Dispatch Cases - KPP Not Baseloaded

2017 - KPP Not Baseloaded						
Wind Level	Minimum Load Level		Daytime Minimum Load Level			
	Windy	Calm	Windy	Windy	Calm	Calm
Solar Gen (Cap)	0.0	0.0	81.6	9.6	81.6	9.6
Curtailed Solar			34.0			
Solar Gen (MW)			47.6	9.6	81.6	9.6
MPP 14	8.9	19.4	9.4	13.2	15.3	18.3
MPP 15	4.0	12.0	4.0	6.5	7.0	12.0
MPP 16	8.0	19.5	9.0	13.0	15.0	18.0
MPP 17	14.4	19.0	14.5	16.0	16.0	19.0
MPP 18	4.5	7.5	4.1	5.0	5.0	12.0
MPP 19						19.0
HC&S						
MPP 10		12.3		12.0		12.0
MPP 11						11.0
MPP 12						11.0
MPP 13						
Wind Total	51.0	0.0	53.0	67.5	0.0	0.0
Load	90.8	89.7	141.6	142.8	139.9	141.9
Reg Up	42.5	5.9	39.3	26.9	28.0	13.5

Table 5-3: 2017 Dispatch Cases – DTCC2 Not Baseloaded

2017 - DTCC2 Not Baseloaded						
Wind Level	Minimum Load Level		Daytime Minimum Load Level			
	Windy	Calm	Windy	Windy	Calm	Calm
Solar Gen (Cap)	0.0	0.0	81.6	9.6	81.6	9.6
Curtailed Solar			34.0	4.0		
Solar Gen (MW)			47.6	5.6	81.6	9.6
KPP 1						
KPP 2						
KPP 3	3.5	8.0	3.5	3.5	9.0	11.0
KPP 4	3.5	8.0	3.5	3.5	9.0	11.0
MPP 14	8.6	18.3	9.5	13.1	11.4	17.7
MPP 15	3.7	12.0	4.0	6.5	5.5	12.0
MPP 16	8.5	18.2	9.0	13.0	11.4	18.0
MPP 17		18.0		16.0		19.0
MPP 18		7.0		5.0		12.0
MPP 19						19.0
HC&S					12.0	
MPP 10				12.0		12.0
MPP 11						
MPP 12						
MPP 13						
Wind Total	63.0	0.0	64.5	64.5	0.0	0.0
Load	90.8	89.5	141.6	142.7	139.9	141.3
Reg Up	50.2	15.8	46.5	43.0	29.7	12.4
Reg Down	4.8	48.0	6.5	23.2	27.3	59.0

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Table 5-4: 2017 Dispatch Cases – Only DTCC1 Baseloaded

2017 - DTCC1 Only Baseloaded Unit						
Wind Level	Minimum Load Level		Daytime Minimum Load Level			
	Windy	Calm	Windy	Windy	Calm	Calm
Solar Gen (Cap)	0.0	0.0	81.6	9.6	81.6	9.6
Curtailed Solar			21.7			
Solar Gen (MW)			59.9	9.6	81.6	9.6
KPP 1						
KPP 2						
KPP 3						
KPP 4						
MPP 14	9.1	19.4	8.6	13.2	15.3	18.3
MPP 15	3.5	12.0	3.5	6.5	7.0	12.0
MPP 16	8.0	19.5	8.0	13.0	15.0	18.0
MPP 17		19.0		16.0	16.0	19.0
MPP 18		7.5		5.0	5.0	12.0
MPP 19						19.0
HC&S						
MPP 10		12.3		12.0		12.0
MPP 11						11.0
MPP 12						11.0
MPP 13						
Wind Total	70.5	0.0	61.5	67.5	0.0	0.0
Load	91.1	89.7	141.5	142.8	139.9	141.9
Reg Up	34.4	5.9	32.9	26.9	28.0	13.5
Reg Down	4.6	47.3	4.1	23.3	23.8	50.9

In order to define the boundary conditions an additional dispatch case was created for each of the sensitivity cases listed above based on the baseloaded units. These dispatch cases are shown below in Table 5-5.

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Table 5-5: 2017 Dispatch Cases – Boundary Definition
2017 - Boundary Definition Cases

Wind Level	Day Peak		Day Minimum Load Level	
	Windy	Windy	Windy	Windy
Solar Gen (Cap)	81.6	81.6	81.6	81.6
Curtailed Solar	34.0	34.0	34.0	23.0
Solar Gen (MW)	47.6	47.6	47.6	58.6
KPP 1				
KPP 2				
KPP 3	11.5	9.0		
KPP 4	11.5	9.0		
MPP 14	18.4	16.5	16.2	19.0
MPP 15	13.0	11.0	8.0	13.0
MPP 16	20.0	17.5	17.0	20.0
MPP 17	20.0		17.0	
MPP 18	7.1		5.0	
MPP 19				
HC&S				
Wind Total	40.3	30.0	30.0	30.0
Load	189.4	140.6	140.8	140.6
Reg Up	1.8	13.0	17.0	1.0
Reg Down	60.0	40.0	28.7	36.0

The first column of Table 5-5 shows the boundary case with KPP3, KPP4, DTCC1, and ½ DTCC2 baseloaded. The second column shows the boundary case without DTCC2. The third column lists the boundary case without KPP, and the last column has only DTCC1. These boundary cases were setup to determine the contingency reserves required to prevent stage 2 load shedding without relying on thermal generation.

5.2 2017 – Results

The contingencies were simulated for each of the dispatch cases listed in Table 5-1 through Table 5-5. Table 5-6 shows the simulation results with KPP3, KPP4, DTCC1, and ½ DTCC2 baseloaded.

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Table 5-6: Minimum Frequency Results with KPP 3, KPP 4, DTCC1 and ½ DTCC2 Baseloaded

	Minimum		Daytime Minimum				Daytime Peak				Peak	
	Windy	Calm	Windy	Windy	Calm	Calm	Windy	Windy	Calm	Calm	Windy	Calm
			Sun	Cld	Sun	Cld	Sun	Cld	Sun	Cld		
Outage	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.7	59.3	59.7	59.6	59.7	59.5	59.7	59.6	59.6	59.6	59.6	59.6
MGS10				59.6		59.7		59.7	59.7	59.7	59.7	59.7
M16	59.7	59.3	59.7	59.6	59.7	59.5	59.7	59.6	59.6	59.6	59.6	59.6
HC&S												
M15	59.8	59.6	59.8	59.8	59.8	59.7	59.9	59.8	59.8	59.7	59.8	59.7
AWF	60.0		59.8	59.7			59.7	59.7			59.7	
KWP	59.2		58.8	58.9			58.6	59.1			59.2	
Kanaha_6	59.5	59.8	59.5	59.6	59.8	59.7	59.4	59.8	59.8	59.8	59.8	59.8
Puunene_	59.9	59.8	59.9	59.9	59.9	59.7	59.9	59.8	59.8	59.8	59.8	59.8
Waiinu_6	59.4	59.7	59.4	59.5	59.8	59.7	59.3	59.8	59.8	59.7	59.8	59.7
Maa-Laha	59.7	59.7	59.7	59.7	59.8	59.6	59.3	60.0	59.7	59.5	60.0	59.5
Maa-KWP	59.7	59.7	59.7	59.7	59.7	59.6	59.4	60.0	59.7	59.5	60.0	59.5
Maa-Kihe	59.7	59.7	59.7	59.8	59.7	59.6	59.5	60.0	59.7	59.6	60.0	59.6
Kanaha-P	59.6	59.8	59.6	59.6	59.9	59.8	59.5	59.9	59.8	59.9	59.9	59.9
Lahaina-L	59.5	59.9	59.5	59.5	59.9	59.8	59.3	59.7	59.8	59.9	59.8	59.9
	Stage1	Stage2	Stage3									

Table 5-6 shows that stage 2 of load shedding can be averted without any additional contingency reserves as long as MECO adheres to the HSIS regulating reserve requirements. Stage 2 was not used even with the boundary case dispatch. The high frequencies encountered in these simulations indicate that if the HSIS regulation requirement is met during all periods of the day, the regulation requirement is larger than the contingency requirement.

Table 5-7 shows the minimum frequency results for the 2017 cases without the KPP 3 and KPP4 units baseloaded.

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Table 5-7: Minimum Frequency Results with DTCC1 and ½ DTCC2 Baseloaded

	0 MW BESS						10 MW BESS					
	Minimum		Daytime Minimum				Minimum		Daytime Minimum			
	Windy	Calm	Windy	Windy	Calm	Calm	Windy	Calm	Windy	Windy	Calm	Calm
			Sun	Cld	Sun	Cld			Sun	Cld	Sun	Cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.6	58.6	59.5	59.5	59.3	59.5	59.6	59.4	59.6	59.6	59.4	59.6
MGS10		59.5		59.5		59.6		59.6		59.6		59.7
M16	59.6	58.6	59.6	59.5	59.3	59.5	59.7	59.4	59.6	59.6	59.4	59.6
HC&S												
M15	59.8	59.6	59.8	59.8	59.7	59.7	59.8	59.7	59.8	59.8	59.7	59.7
AWF	59.5		59.5	59.6			59.6		59.6	59.7		
KWP	58.4		58.1	58.5			58.9		58.6	59.1		
Kanaha_6923	59.4	59.8	59.4	59.6	59.8	59.8	59.4	59.8	59.4	59.5	59.9	59.8
Puunene_6923	59.9	59.8	59.9	59.9	59.8	59.8	59.9	59.8	59.9	59.9	59.9	59.8
Waiinu_6923	59.4	59.7	59.4	59.5	59.8	59.7	59.4	59.7	59.4	59.4	59.9	59.7
Maa-Lahaluna	60.0	59.7	60.0	60.0	59.6	59.6	60.0	59.8	59.9	60.0	59.5	59.8
Maa-KWP	60.0	59.7	60.0	60.0	59.6	59.6	60.0	59.8	59.9	60.0	59.5	59.8
Maa-Kihei	60.0	59.8	60.0	60.0	59.6	59.7	60.0	59.8	60.0	60.0	59.5	59.8
Kanaha-Puunene	59.5	59.9	59.5	59.6	59.9	59.9	59.5	59.9	59.4	59.5	59.9	59.9
Lahaina-Lahaluna	59.5	59.9	59.5	59.5	59.8	59.8	59.5	59.9	59.4	59.5	59.9	59.9
	Stage1	Stage2	Stage3									

Table 5-7 shows the minimum frequency results for the sensitivity cases without KPP 3 and KPP 4. The loss of the KWP generation causes the frequency to decay below the stage 2 trip settings. In order to prevent the second stage of load shedding, 10 MW of BESS was added to the simulation. The minimum frequency results with a 10 MW BESS are shown on the right side of Table 5-7.

Similar analysis was performed assuming that the DTCC2 would not be baseloaded. The results are shown in Table 5-8.

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Table 5-8: Minimum Frequency Results with KPP3, KPP4, and DTCC1 Baseloaded

	0 MW BESS						10 MW BESS					
	Minimum		Daytime Minimum				Minimum		Daytime Minimum			
	Windy	Calm	Windy	Windy	Calm	Calm	Windy	Calm	Windy	Windy	Calm	Calm
			Sun	ClD	Sun	ClD			Sun	ClD	Sun	ClD
Outage	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.7	59.3	59.6	59.6	59.6	59.5	59.7	59.6	59.7	59.7	59.7	59.6
MGS10				59.6		59.7				59.7		59.7
M16	59.7	59.3	59.7	59.6	59.6	59.5	59.8	59.5	59.7	59.7	59.7	59.6
HC&S					59.6						59.6	
M15	59.9	59.6	59.8	59.8	59.8	59.7	59.9	59.7	59.9	59.8	59.8	59.7
AWF	59.6		59.6	59.7			59.7		59.7	59.7		
KWP	58.5		58.2	58.9			59.0		58.7	59.3		
Kanaha_6923	59.4	59.8	59.3	59.6	59.8	59.7	59.3	59.8	59.3	59.6	59.9	59.8
Puunene_6923	59.8	59.8	59.8	59.9	59.9	59.7	59.8	59.8	59.8	59.9	59.9	59.8
Waiinu_6923	59.3	59.7	59.3	59.5	59.9	59.7	59.3	59.7	59.3	59.5	59.9	59.7
Maa-Lahaluna	59.4	59.7	59.6	59.7	59.8	59.6	59.1	59.7	59.1	59.8	59.8	59.5
Maa-KWP	59.4	59.7	59.6	59.7	59.8	59.6	59.1	59.7	59.3	59.8	59.8	59.5
Maa-Kihei	59.5	59.7	59.6	59.8	59.8	59.6	59.3	59.7	59.3	59.8	59.8	59.6
Kanaha-Puunene	59.4	59.8	59.3	59.6	59.9	59.8	59.4	59.9	59.3	59.6	59.9	59.9
Lahaina-Lahaluna	59.3	59.9	59.3	59.5	59.9	59.8	59.3	59.9	59.3	59.5	59.9	59.9
	Stage1	Stage2	Stage3									

Table 5-8 shows the minimum frequency results for the sensitivity cases without DTCC2. The loss of the KWP generation causes the frequency to decay below the stage 2 trip settings. In order to prevent the second stage of load shedding, 10 MW of BESS was added to the simulation. The minimum frequency results with a 10 MW BESS are shown on the right side of Table 5-8.

Similar analysis was performed assuming that only DTCC1 would be baseloaded. The results are shown in Table 5-9.

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Table 5-9: Minimum Frequency Results with Only DTCC1 Baseloaded

	0 MW BESS						20 MW BESS					
	Minimum		Daytime Minimum				Minimum		Daytime Minimum			
	Windy	Calm	Windy	Windy	Calm	Calm	Windy	Calm	Windy	Windy	Calm	Calm
			Sun	Cld	Sun	Cld			Sun	Cld	Sun	Cld
Outage	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min	Min
M14	59.4	58.6	59.4	59.5	59.3	59.5	59.6	59.5	59.6	59.6	59.5	59.7
MGS10		59.5		59.5		59.6		59.6		59.7		59.7
M16	59.6	58.6	59.5	59.5	59.3	59.5	59.7	59.5	59.7	59.7	59.5	59.6
HC&S												
M15	59.8	59.6	59.8	59.8	59.7	59.7	59.9	59.7	59.9	59.8	59.8	59.8
AWF	59.4		59.4	59.6			59.6		59.6	59.7		
KWP	57.9		57.3	58.5			58.8		58.8	59.3		
Kanaha_6923	58.9	59.8	59.1	59.6	59.8	59.8	58.9	59.8	59.1	59.5	59.9	59.8
Puunene_6923	59.7	59.8	59.7	59.9	59.8	59.8	59.7	59.8	59.7	59.9	59.9	59.8
Waiinu_6923	58.9	59.7	59.1	59.5	59.8	59.7	58.9	59.8	59.1	59.4	59.8	59.8
Maa-Lahaluna	59.8	59.7	59.8	60.0	59.6	59.6	59.9	59.5	59.4	59.9	59.4	59.7
Maa-KWP	59.8	59.7	59.8	60.0	59.6	59.6	59.9	59.5	59.4	59.9	59.4	59.7
Maa-Kihei	59.9	59.8	59.8	60.0	59.6	59.7	59.9	59.5	59.5	59.9	59.4	59.7
Kanaha-Puunene	58.9	59.9	59.1	59.6	59.9	59.9	58.9	59.9	59.1	59.5	59.9	59.9
Lahaina-Lahaluna	58.9	59.9	59.1	59.5	59.8	59.8	59.0	59.8	59.1	59.5	59.8	59.9
	Stage1	Stage2	Stage3									

Table 5-9 shows the minimum frequency results for the sensitivity cases with only DTCC1 baseloaded. The loss of the KWP generation causes the frequency to decay below the stage 3 trip settings. In order to prevent the second stage of load shedding, 20 MW of BESS was added to the simulation. The minimum frequency results with a 20 MW BESS are shown on the right side of Table 5-9.

The worst case contingency for the boundary cases was also the loss of the KWP plant at full output. With minimum reserve on the generation units, the minimum frequency was much lower for these dispatch cases. The minimum frequency for the loss of the KWP plant at full output with several levels of additional BESS support is shown below in Table 5-10.

Table 5-10: Minimum Frequency Results for Boundary Cases

	Baseloaded Units	DTCC1	DTCC1	DTCC1	DTCC1
		KPP3,KPP4	KPP3,KPP4		
		1/2 DTCC2		1/2 DTCC2	
Additional BESS	0 MW	58.6	57.7	57.7	38.6
	5 MW	58.7	58	58.1	45.6
	10 MW	59.3	58.4	58.4	53.2
	15 MW	59.4	58.7	58.7	57.8
	20 MW	59.4	59.3	59.1	58.3
	25 MW	59.5	59.3	59.2	58.7

The results from Table 5-10 define the contingency reserve requirement for the 2017 year as 20 MW of additional BESS being required to prevent Stage 2 UFLS.

6 2023

Power flow cases were created for the peak load times. The 2023 year was selected to identify the operating restrictions required to prevent line overloads and low voltage conditions for the peak load in the study time frame. The year has the addition of several new generation units added between 2019 and 2023 and can be used as a judge for the security of the 2019-2023 period. The peak load is 218.5 MW in 2023 and will drop to 206.3 MW in 2030.

The assumptions used for the 2023 cases are in the list below:

- These cases assume that the Kamalii line upgrade does not take place
 - Sensitivity cases were run with the line upgrade to confirm that the upgrade resolves the low voltage issues
- The Waiinu – Kanaha line upgrade is included in all cases
- The MPP – Puunene and MPP – Waiinu lines are reconducted in all cases
- Only the peak loading case was studied
- Only steady state analysis was performed

6.1 2023 – Generation Dispatches

Only the peak cases were run for 2023 since it has the highest peak load in the study time frame. Details of the generation dispatches for the 2023 study year are shown in Table 6-1.

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Table 6-1 2023 Peak Generation Dispatch

2023			
	Peak Load Level		
Wind Level	Windy	Calm	Windy
MPP 14	17.7	19.2	18.0
MPP 15	8.0	11.5	11.5
MPP 16	17.7	19.0	19.0
MPP 17	17.5	20.0	20.0
MPP 18	9.0	12.0	12.0
MPP 19	18.0	20.0	20.0
HC&S			8.0
MPP 10	10.0	12.0	12.0
MPP 11	10.0	12.0	12.0
MPP 12	10.0	12.0	12.0
MPP 13	10.0	12.0	12.0
MPP 4		5.4	5.4
MPP 6		5.4	
MPP 8		5.4	
MPP 9		5.4	
MPP 1	2.5	2.5	2.5
MPP 2	2.5	2.5	2.5
MPP 3		2.5	
WPP ICE 1	7.5	8.0	8.0
WPP ICE 2		8.0	8.0
WPP ICE 3		8.0	8.0
S.Maui ICE 1			
S.Maui ICE 2			
S.Maui ICE 3			
Wind Total	72.0	0.0	36.0
Load	220.4	218.8	226.9
Reg Up	31.6	10.8	15.0
Reg Down	47.5	100.8	77.9

Each of the 2023 peak cases listed in Table 6-1 do not have generation online in South Maui in order to stress the transmission around the South Maui area. The third dispatch was setup as a boundary case that mirrors previous studies performed for MECO and has a system load that is 3% higher than predicted for 2023.

6.2 2023 – Results

The MPP – Kihei outage is the critical contingency without the new Maalaea – Kamalii line. The loss of this line will cause low voltages, line overloads, and potential voltage collapse in the South Maui area. Figure 6-1 shows the impact that this outage has on the South Maui transmission system with the MPP – Kihei outage.

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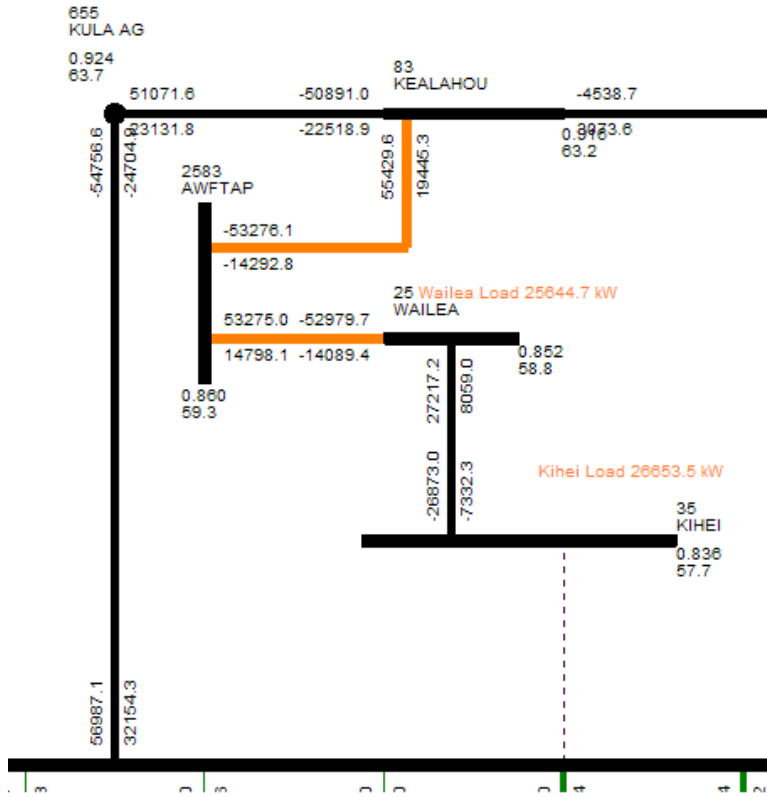


Figure 6-1: MPP - Kihei Outage - Boundary Case

With the MPP – Kihei line out of service, the voltage at the Kihei bus is 0.836 pu, and is nearing voltage collapse. The Kealahou – AWFTAP and AWFTAP – Wailea lines are also overloaded. We studied this contingency with several load levels to determine the generation requirements needed in the South Maui area to prevent these low voltage and overload issues. The Kihei voltage remains above 0.90 for load levels below 173 MW with the loss of the MPP – Kihei line. Load levels above 173 MW require generation in South Maui. One 8 MW Wartsilla engine would be sufficient until the load level reaches 193 MW at which time a second unit would be required. When the load level reaches 223 MW, a third unit is required. Table 6-2 shows the generation requirements in South Maui to prevent low voltages for various system load levels.

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Table 6-2: Generation Required in South Maui to Prevent Low Voltage

Description	# Units in South Maui to keep Kihei 69kV Voltage > 0.90	System Net Generation
With 7.2 MVAR of cap banks online, Peak Load 223	3	If System load >223
With 7.2 MVAR of cap banks online, High Load of 193	2	If System load >193
With 7.2 MVAR of cap banks online, Medium Load of 173	1	If System load >173
With 7.2 MVAR of cap banks online, Medium Load of 173	0	If System load <173

7 2030

Power flow cases were created for the minimum, day minimum, day peak, and peak load times. Renewable generation resources consist of 130 MW of distributed PV (10 MW legacy PV) and 72 MW of wind. These focus on the generation associated with the Non-Transmission Alternatives which rely on firm generation in the South Maui area to relieve transmission constraints.

The assumptions used for the 2030 cases are in the list below:

- Cases with the Maalaea – Kamalii line addition were run
 - Non-Transmission Alternative cases were also run (NTA)
- NTA generation was run with Pumped Storage Hydro (PSH)
 - The use of 8 MW Wartsilla internal combustion engines was also analyzed
- DTCC1 and ½ DTCC2 are baseloaded
 - Sensitivity cases were run with only DTCC1 baseloaded
- Distributed generation was curtailed before the KWP1 plant since the KWP plant is the largest single generation contingency.

7.1 2030 – Generation Dispatches

The table below shows the dispatch cases created for the 2030 analysis.

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Table 7-1: Dispatch Cases with DTCC1 and ½ DTCC2 Baseloaded

2030												
	Minimum Load Level		Daytime Minimum Load Level				Daytime Peak Load Level				Peak Load Level	
Wind Level	Windy	Calm	Windy	Windy	Calm	Calm	Windy	Windy	Calm	Calm	Windy	Calm
Solar Gen (Cap)	0.0	0.0	110.5	13.0	110.5	13.0	110.5	13.0	110.5	13.0	0.0	0.0
Curtailed Solar			62.9		6.0		31.5					
Solar Gen (MW)			47.6	13.0	104.5	13.0	79.0	13.0	110.5	13.0		
KPP 1												
KPP 2												
KPP 3												
KPP 4												
MPP 14	9.9	18.0	9.5	12.5	9.3	18.5	9.2	16.2	14.8	18.2	17.0	18.8
MPP 15	4.0	12.0	4.0	6.5	4.0	12.0	4.0	8.5	7.0	11.0	8.0	11.5
MPP 16	9.0	19.0	9.0	13.0	9.0	18.0	10.0	16.5	14.8	18.0	17.0	19.0
MPP 17	14.4	18.0	14.5	14.5	14.5	18.0	14.5	17.0	15.5	19.0	18.0	20.0
MPP 18	4.5	7.0	4.1	4.5	4.1	10.0	4.5	8.0	5.0	10.5	9.0	12.0
MPP 19						18.0		17.0		19.0	18.0	20.0
HC&S												
MPP 10		10.0		12.0		10.0		9.0		12.0	10.0	12.0
MPP 11						11.0		9.0	9.0	11.0	10.0	12.0
MPP 12						11.0		9.0	9.0	11.0	10.0	12.0
MPP 13										11.0		12.0
MPP 4												5.4
MPP 6												
MPP 8												
MPP 9												
MPP 1											2.5	2.5
MPP 2												
MPP 3												
WPP ICE 1									6.0	8.0	7.5	8.0
WPP ICE 2										8.0		8.0
WPP ICE 3										8.0		8.0
S.Maui ICE 1		6.5				7.5				8.0	8.0	8.0
S.Maui ICE 2										8.0		8.0
S.Maui ICE 3												8.0
Wind Total	50.0	0.0	58.5	72.0	0.0	0.0	72.0	72.0	0.0	0.0	72.0	0.0
Load	91.8	90.5	147.2	148.0	145.4	147.0	193.2	195.2	191.6	193.7	207.0	205.2
Reg Up	40.5	10.6	39.2	29.6	39.4	16.3	38.1	32.6	32.2	16.5	30.1	11.4
Reg Down	7.3	41.6	6.6	20.6	6.4	45.1	6.7	28.8	25.5	79.9	44.5	95.8

Each of these dispatch cases adheres to the HSIS reserve requirements. We created some sensitivity cases to determine the defining boundary cases. These boundary definition dispatch cases are shown below in Table 7-2.

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Table 7-2: Dispatch Cases with DTCC1 Baseloaded and 2 Boundary Case Dispatch Cases

2030								
	Minimum Load Level	Daytime Minimum Load Level			Daytime Peak Load Level		Boundary Case Dispatches	
Wind Level	Windy	Windy	Calm	Windy	Windy	Calm	Windy	Windy
Solar Gen (Cap)	0.0	130.0	130.0	13.0	130.0	130.0	130.0	130.0
Curtailed Solar		57.9			12.5		28.2	41.9
Solar Gen (MW)	0.0	52.6	110.5	13.0	98.0	110.5	82.3	68.6
MPP 14	10.6	9.6	9.4	19.5	9.0	20.0	19.9	20.0
MPP 15	4.0	4.0	4.0	13.0	4.0	12.0	13.0	13.0
MPP 16	9.0	9.0	9.0	19.6	10.0	19.5	20.0	20.0
MPP 17			12.4			20.0	20.0	
MPP 18						7.2	7.2	
MPP 19								
HC&S								
MPP 10								
MPP 11				11.0				
MPP 12								
MPP 13								
MPP 1						2.5		
MPP 2								
MPP 3								
Wind Total	68.0	72.0	0.0	72.0	72.0	0.0	30.0	72.0
Load	91.6	147.2	145.3	148.1	193.0	191.7	192.4	193.6
Reg Up	31.4	30.4	35.8	2.2	30.0	1.6	0.2	0.0
Reg Down	7.6	6.6	10.9	39.2	6.0	41.2	44.6	36.0

The dispatch cases listed in Table 7-2 were created to show the impact that removing ½ DTCC2 from the baseload commitment would have on the system stability constraints. The ‘Boundary Case Dispatches’ were created to show the system response to a contingency assuming all regulating reserve is being carried by battery systems. One of the boundary case dispatches assumed that DTCC1 and ½ DTCC2 were baseloaded, while the other assumed that only DTCC1 was baseloaded.

Simulations were run to determine the size of the regulating reserves needed in addition to the currently installed BESS systems, to prevent the second stage of load shedding. If the system frequency dropped low enough to trigger stage 2 of load shedding, then additional regulating reserves were added in 5 MW increments until the frequency stayed above the stage 2 load shedding setpoint.

7.2 2030 – Results

The worst case event for each of the dispatch cases simulated was the loss of the KWP unit at maximum output. Since two alternatives for the non-transmission alternative were studied, the pumped storage hydro results are shown because this alternative has a slightly worse frequency response, but does not change the conclusions related to the size of BESS necessary to prevent stage 2 load shedding. Table 7-3 and Table 7-4 below show the minimum frequency results for the loss of the KWP plant.

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Table 7-3: Minimum Frequency for Loss of KWP – DTCC1 + ½ DTCC2 (Thermal Reserves)

Case	Loss of KWP				
	Thermal Reserve	0 MW BESS	5 MW BESS	10 MW BESS	
m_wnd	40.5	58.4	58.6	59.7	*Stage 1
m_clm	10.6	-	-	-	*Stage 2
dm_wnd_sun	39.2	58.1	58.4	58.5	
dm_wnd_cld	29.6	58.6	58.7	58.9	
dm_clm_sun	39.4	-	-	-	
dm_clm_cld	16.3	-	-	-	
dp_wnd_sun	38.1	58.2	58.4	58.5	
dp_wnd_cld	32.6	59.1	59.2	59.2	
dp_clm_sun	32.2	-	-	-	
dp_clm_cld	16.5	-	-	-	
p_wnd	30.1	59.2	59.3	59.3	
p_clm	11.4	-	-	-	

Table 7-4: Minimum Frequency for Loss of KWP – DTCC1 Only (Thermal Reserves)

	Loss of KWP				
	Thermal Reserve	10 MW BESS	15 MW BESS	20 MW BESS	
m_wnd	31.4	58.4	58.7	58.9	*Stage 1
dm_wnd_sun	30.4	58.2	58.5	58.8	*Stage 2
dm_wnd_cld	35.8	58.5	58.9	59.1	
dm_clm_sun	-	-	-	-	
dp_wnd_sun	30	58.1	58.5	58.8	
dp_wnd_cld	1.6	58.7	59.2	59.3	

With reserves carried on the thermal units, a BESS system is still required to prevent the second stage of load shedding. From Table 7-3, 49.2 MW contingency reserves (39.2 MW thermal reserves + 10 MW BESS) are required to prevent stage 2 for the dm_wnd_sun dispatch case. When DTCC1 is the only thermal unit online, the total contingency reserves required is approximately 50.4 MW (30.4 MW thermal reserves + 20 MW BESS). If ½ of DTCC2 is online, the additional BESS support can be reduced to 10 MW but would have additional thermal reserves online, and additional renewable curtailment.

When the system has all the reserve carried on the BESS systems, the total BESS required to prevent stage 2 load shedding is higher. The results for these cases are shown in Table 7-5 below.

Table 7-5: Minimum Frequency for Loss of KWP with Boundary Cases – (BESS Reserves)

	Loss of KWP						
	Thermal Reserve	0 MW	10 MW	15 MW	20 MW	25 MW	
DTCC1 Only	0	-	-	-	58.5	58.9	*Stage 1
DTCC1+1/2 DTCC2	0	Collapse	57.9	58.4	58.6	-	*Stage 2
							*Stage 3

If all the reserves are carried on the thermal units, 20 MW of additional BESS support is required with DTCC1 + ½ DTCC2 online. 25 MW of additional BESS support is required with only DTCC1 online.

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8 Conclusions

EPS has completed analysis for the MECO system defining the boundary conditions as to the operations of the system for the 2015, 2016, 2017, 2023, and 2030 case years. The boundary conditions represent the likely operating requirements due to the large additions of renewable energy and changes in load and generation expected in the future.

To aid in clarifying the different results, security tables were created showing the operating requirements for each year and each configuration within that year. The security tables include data values as to the minimum number for thermal units required, the ramp rate requirements, the regulation requirements, contingency reserves, and 30 minute reserves.

The ramp rate requirement was assumed to be 10% / minute for both PV and wind energy resources. This value was derived from analysis EPS has completed that is not part of this report.

The regulation requirements include values for day time and night time periods. The daytime regulation reserve is calculated as the summation of 20% of the installed DG PV, and 1:1 MW up to 50% of the installed wind. The night time regulation reserve is calculated as only 1:1 MW up to 50% of the installed wind.

For years 2017 and beyond the contingency reserve is calculated as the amount of reserves (energy storage) required in order to meet criteria for the largest unit / wind farm outage. For years before 2017 the contingency reserve is calculated as the amount of spinning reserves required in order to meet criteria for the largest unit / wind farm outage. The 30 minute reserves are equal to the largest unit / wind farm outage and is the required amount of energy to be brought online to displace the short term contingency reserves.

8.1 Security Tables

The security tables for the 2015 and 2016 years assume that the utilities are unable to acquire a storage system, and therefore must meet the criteria with their operating practices with their current fleet of units and up to 10 MW of BESS for either contingency or regulation.

Table 8-1: 2015 Security Table

MECO 2015- Min Thermal Units, No ESS									
		Capacity (MW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30 Minute Reserves	DTT Scheme Required
	Wind	72	DTCC1 + KPP 3, KPP 4	12.5 MW	47.25 MW	36 MW	24 MW	40.2 MW	Yes
PV Level	DG	75							
	Largest Unit	30							
	Wind	72	DTCC1 + 1/2 DTCC2 KPP 3, KPP 4	12.5 MW	47.25 MW	36 MW	45 MW	40.2 MW	No
PV Level	DG	75							
	Largest Unit	30							
Notes:	1: DTT Scheme refers to a direct transfer trip of Stage 1 of load shedding for select unit outages. In order to prevent the tripping of the second stage of load shedding, the first stage of load shedding should be transfer tripped for the loss of the KWP plant or any of the combustion turbines.								

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Table 8-2: 2016 Security Table

MECO 2016- Min Thermal Units, No ESS									
		Capacity (MW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30 Minute Reserves	DTT Scheme Required
	Wind	72	DTCC1 + KPP 3, KPP 4	14 MW	49.5 MW	36 MW	45 MW	40.2 MW	No
PV Level	DG	90							
Largest Unit		30							
Notes:	1: DTT Scheme refers to a direct transfer trip of Stage 1 of load shedding for select unit outages.								

The security tables for years after 2016 assume that the utility will have the capability to install an energy storage system to meet the criteria.

Table 8-3: 2017 Security Table

MECO 2017- Min Thermal Units, Maximum ESS									
		Capacity (MW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30 Minute Reserves	
	Wind	72	DTCC1	14.6 MW	50.4 MW	36 MW	25 MW	38.5 MW	
PV Level	DG	96							
Largest Unit		30							
	Wind	72	DTCC1 + 1/2 DTCC2	14.6 MW	50.4 MW	36 MW	10 MW	38.5 MW	
PV Level	DG	96							
Largest Unit		30							
	Wind	72	DTCC1 + KPP 3, KPP 4	14.6 MW	50.4 MW	36 MW	10 MW	38.5 MW	
PV Level	DG	96							
Largest Unit		30							
	Wind	72	DTCC1 + 1/2 DTCC2 KPP 3, KPP 4	14.6 MW	50.4 MW	36 MW	0 MW	38.5 MW	
PV Level	DG	96							
Largest Unit		30							
Notes:	1: The DTCC1 + 1/2 DTCC2 minimum unit combination closely matches the 2019 daytime cases since the load increase during the day is offset by the increase in the solar capacity. For this reason, 2019 cases were not run.								

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Table 8-4: 2030 Security Table – Baseline

MECO 2030 Baseline- Min Thermal Units, Maximum ESS									
		Capacity (MW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30-Minute Reserves	Transmission Constraint
	Wind	72	DTCC1	18 MW	55.5 MW	36 MW	25 MW	38.5 MW	No
PV Level	DG	130							
Largest Unit		30							
	Wind	72	DTCC1 + 1/2 DTCC2	18 MW	55.5 MW	36 MW	20 MW	38.5 MW	No
PV Level	DG	130							
Largest Unit		30							
Notes:	1. With the proposed transmission upgrades, the generation dispatch is not constrained by transmission								

Table 8-5: 2030 Security Table – NTA PSH Case

MECO 2030 NTA - PSH Min Thermal Units, Maximum ESS									
		Capacity (MW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30 Minute Reserves	Transmission Constraint
	Wind	72	DTCC1	18 MW	55.5 MW	36 MW	25 MW	38.5 MW	Yes
PV Level	DG	130							
Largest Unit		30							
	Wind	72	DTCC1 + 1/2 DTCC2	18 MW	55.5 MW	36 MW	10 MW	38.5 MW	Yes
PV Level	DG	130							
Largest Unit		30							
Notes:	1. With a 30 MW PSH located in South Maui, all transmission constraints can be relieved. Minimum frequency for unit trip events are slightly lower compared to the same contingencies with the proposed ICE units located in South Maui								

Table 8-6: 2030 Security Table – NTA ICE Case

MECO 2030 NTA - ICE Min Thermal Units, Maximum ESS									
		Capacity (MW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30-Minute Reserves	Transmission Constraint
	Wind	72	DTCC1	18 MW	55.5 MW	36 MW	25 MW	38.5 MW	Yes
PV Level	DG	130							
Largest Unit		30							
	Wind	72	DTCC1 + 1/2 DTCC2	18 MW	55.5 MW	36 MW	10 MW	38.5 MW	Yes
PV Level	DG	130							
Largest Unit		30							
Notes:	1. With a 24 MW of ICE units located in South Maui, all transmission constraints can be relieved. Minimum frequency for unit trip events are slightly better compared to the same contingencies with the proposed PSH unit located in South Maui. The difference in response between the PSH and ICE units does not warrant a change in the contingency reserve requirements								



August 12, 2014

Subject: Lanai PSIP 2030 Cases

Purpose

The purpose of this study was to identify the security requirements for various generation and load scenarios under study for the Lanai system. As such the cases were intended to establish the boundary conditions for the security analysis.

Assumptions

Several dispatch cases were created to determine the contingency reserve requirements of the Lanai grid for the 2030 year. The assumed load level and PV generation for the island are shown below in Table 1. MECO provided a zip file containing the Lanai power flow and dynamics database. The Lanai generation characteristics used in this study are listed in Table 2.

Table 1: Lanai 2030 Load and PV Generation Levels

	Minimum	Daytime Minimum	Daytime Peak	Peak
Load Level	1,734	4,020	5,300	5,600
Max PV	-	2,242	2,242	-
Net Load	2,550	1,180	3,058	5,600

Table 2: Lanai Generation Characteristics

	FUEL TYPE	UNIT TYPE	NTL (GROSS MW)	MIN. LOAD (GROSS MW)	Reactive Power Limit	Typically On AGC When Running	Regulating / Load Following Capability	Regulation Mode	MODE OF OPERATION	RAMP RATES (GROSS MW/ MIN)
LANAI GENERATING STATION										
LANAI1	No. 2 Diesel	ICE	1.19	0.25	0.95	No AGC	Yes	5% droop	Peaking	0.50
LANAI2	No. 2 Diesel	ICE	1.19	0.25	0.95	No AGC	Yes	5% droop	Peaking	0.50
LANAI3	No. 2 Diesel	ICE	1.19	0.25	0.95	No AGC	Yes	5% droop	Peaking	0.50
LANAI4	No. 2 Diesel	ICE	1.19	0.25	0.95	No AGC	Yes	5% droop	Peaking	0.50
LANAI5	No. 2 Diesel	ICE	1.19	0.25	0.95	No AGC	Yes	5% droop	Peaking	0.50
LANAI6	No. 2 Diesel	ICE	1.19	0.25	0.95	No AGC	Yes	5% droop	Peaking	0.50
L7,D-7	No. 2 Diesel	ICE	2.20	0.55	1.76	No AGC	Yes	Isoch	Baseload	1.10
L8,D-8	No. 2 Diesel	ICE	2.20	0.55	1.76	No AGC	Yes	5% droop	Baseload	1.10
L9,D-9	No. 2 Diesel	ICE	2.20	0.55	1.76	No AGC	Yes	5% droop	Peaking	1.10
L10,D-10	No. 2 Diesel	ICE	2.20	0.55	1.76	No AGC	Yes	5% droop	Peaking	1.10

Table 3 lists the PV trip settings used in this study, and is based on the IEEE 1547 PV trip settings, existing rule 14H settings, and the proposed 14H extended ride-through settings. The legacy PV has the IEEE 1547 trip settings which are a must-trip standard which means that the distributed generation must cease to energize the circuit by the specified delay times. Rule 14H is a standard that originally mimicked IEEE 1547 but has been modified to incorporate the unique characteristics of island power

systems and variable generation. The latest proposed modification to Rule 14H with extended ride-through settings increases the ride-through capability of the PV during severe system events. In addition, it is assumed that all PV that has the 14H (original modification and proposed ride-through settings) can also be curtailed.

Table 3: PV Trip Setting Comparison IEEE 1547 vs. Rule 14H

Frequency Settings	Under Frequency		Over Frequency						
	Hz	Delay	Hz	Delay					
IEEE 1547	59.3	0.167	60.5	0.167					
Rule 14H	57.0	0.167	60.5	0.167					
Rule 14H Extended	57.0	20.0	63.0	20.0					

Voltage Settings	Under Voltage 1		Under Voltage 2		Over Voltage 1		Over Voltage 2	
	PU	Delay	PU	Delay	PU	Delay	PU	Delay
IEEE 1547	0.5	0.167	0.9	2.000	1.1	1.000	1.2	0.167
Rule 14H	0.5	0.167	0.9	2.000	1.1	1.000	1.2	0.167
Rule 14H Extended	0.5	0.500	0.9	2.000	1.1	1.000	1.2	0.167

The database provided by MECO had no PV modeled in the power flow cases nor any associated under-frequency relays that would trip the PV generation at a frequency of 59.3 Hz. Therefore some assumptions were made as to modeling the different amounts / types of PV on the Lanai system. The PV was modeled in two different scenarios. Scenario “1” assumed 673 kW of legacy PV, 736 kW of Rule 14H PV, and 833 kW of proposed Rule 14H Extended PV based on the estimated installation dates. Scenario “2” assumed that 80 % of the Legacy PV plus Modified Rule 14H PV was retrofitted to proposed Rule 14H Extended PV, resulting in 280 kW of legacy PV and 1960 kW of Rule 14H Extended PV. The two different scenarios were created in order to determine the impact on the ESS recommendations due to an inability to upgrade / retrofit existing PV installations. The two scenarios are shown below in Table 4.

Table 4: PV Configuration Scenarios

PV Scenario	1	2
Legacy PV	673	282
Rule 14 PV	736	
Extended PV	833	1960
Total PV	2242	2242

Simulations were used to determine the size of the regulating reserves needed to prevent the second stage of load shedding. If the system frequency dropped low enough to trigger stage 2 of load shedding, then additional contingency reserves were added in 100 kW increments until the frequency stayed above the stage 2 load shedding setpoint. The energy storage system was configured to utilize auto-scheduling that would allow the battery to go to full output 6 cycles after a loss of a unit. It should be noted that it appears that the Lanai system consists of Stage 1 UFLS settings with slightly different frequency set points and relay timers between stage 1 and stage 2. Due to the characteristics of the Lanai system, it is possible to trip Stage 2 and not trip Stage 1 with the existing settings. It is recommended that the UFLS relays for 58.65 Hz and 0.4 second relay timer be changed to 0.2 second delay to allow for better coordination.

The load shedding settings listed in the provided database are shown below in Table 5.

LANAI PSIP 2030 CASES

Table 5: Under-Frequency Trip Settings

Stage	Frequency (Hz)	Delay (seconds)
Kicker 1	58	3.0
Kicker 2	58	4.5
Stage 1	58.65-58.5	0.2-0.4
Stage 2	57.5	0.25
Stage 3	57	0.1-0.12

Dispatch Cases

Table 5 shows the dispatch cases that were created for the Lanai 2030 cases.

Table 4: 2030 Dispatch Cases

Unit	Capacity		Day Minimum		Day Peak	
	Pmax	Pmin	A	B	A	B
LANAI1	1188	250	0	0	0	0
LANAI2	1188	250	0	0	0	0
LANAI3	1188	250	0	0	0	0
LANAI4	1188	250	0	250	0	250
LANAI5	1188	250	0	250	0	250
LANAI6	1188	250	0	0	0	0
L7,D-7	2200	550	2200	2200	2200	2200
L8,D-8	2200	550	550	550	920	550
L9,D-9	2200	550	0	0	0	0
L10,D-10	2200	550	0	0	0	0
Thermal Gen			2750	3250	3120	3250
Solar Available			2242	2242	2242	2242
Curtailed Solar			922	1422	0	130
Solar Generation			1320	820	2242	2112
System Load			4020	4020	5300	5300
Regulation Up			1650	3525	1280	3525
Regulation Dn			1650	1650	2020	1650

The cases were configured for the day minimum and day peak with a minimum generation scenario ("A") and a larger generation dispatch scenario ("B"). Note that the day minimum cases required curtailment of the PV close to 50%. The day peak cases require minimal curtailment, if any.

Results

The ESS size necessary to prevent the second stage of load shedding was tabulated for each of the dispatch cases and each of the PV configuration scenarios. These results are shown in Table 6.

Table 5: ESS Size Requirement

Dispatch	PV Scenario	Daytime Minimum	Daytime Peak
"A"	1	1600 kW	1500 kW
"A"	2	1400 kW	1300 kW
"B"	1	1400 kW	1300 kW
"B"	2	1100 kW	1100 kW

The results show that utilizing additional extended ride through PV settings can result in a decrease of ESS size by 200 – 300 kW. Also, adding additional units online can further decrease ESS size by 200 – 300 kW, especially for the daytime minimum case.

Security Tables

To aid in clarifying the different results, security tables were created showing the operating requirements. The security tables include data values as to the minimum number for thermal units required, the ramp rate requirements, the regulation requirements, contingency and 30 minute reserves, and required voltage support, and are shown in Table 7, below.

The ramp rate requirement was assumed to be 10% / minute for PV energy resources. This value was derived from analysis for other islands EPS has completed that is not part of this report.

The regulation requirements include values for day time and night time periods. The daytime regulation reserve is calculated as the summation of 20% of the installed PV. The night time regulation reserve is calculated as only 50% of the installed wind, and therefore is valued at 0 kW for the Lanai system due to a lack in wind energy resources.

The contingency reserve is calculated as the amount of reserves (energy storage and / or PV regulation) required in order to meet criteria for the largest unit outage. The 30 minute reserves are equal to the largest unit outage and is the required amount of energy to be brought online to displace the short term contingency reserves.

Table 7: Lanai Security Tables

Value		Capacity (kW)	# of Thermal units required	Ramp Rate Requirements	Regulation Reserves - Day time	Regulation Reserves - Night time	Contingency Reserves	30 Minute Reserves	Voltage Support (SVC)
PV Level	Station	0	2	224.2kW / Min	785 kW (20% of DG PV)	0 MW (50% of Wind)	1600 kW	2200 kW	0
	DG	2242							
Wind		0							
Largest Unit		2200							
PV Level	Station	0	4	224.2kW / Min	785 kW (20% of DG PV)	0 MW (50% of Wind)	1500 kW	2200 kW	0
	DG	2242							
Wind		0							
Largest Unit		2200							

If you have any questions, please feel free to give me a call at 907-646-5103.

Sincerely,

David W. Burlingame, P.E.
 Principal Engineer



August 12, 2014

Subject: Molokai PSIP 2030 Cases

Purpose

The purpose of this study was to identify the security requirements for various generation and load scenarios under study for the Molokai system. As such the cases were intended to establish the boundary conditions for the security analysis.

Assumptions

Several dispatch cases were created to determine the contingency reserve requirements of the Molokai grid for the 2030 year. The assumed load level and PV generation for the island are shown below in Table 1. MECO provided a zip file containing the Molokai power flow and dynamics database. The Molokai generation characteristics used in this study are listed in Table 2.

Table 1: Molokai 2030 Load and PV Generation Levels

	Minimum	Daytime Minimum	Daytime Peak	Peak
Load Level	2,550	3,950	5,200	5,600
Max PV	-	2,770	2,770	-
Net Load	2,550	1,180	2,430	5,600

Table 2: Molokai Generation Characteristics

	FUEL TYPE	UNIT TYPE	NTL (GROSS MW)	MIN. LOAD (GROSS MW)	Reactive Power Limit	Typically On AGC When Running	Regulating / Load Following Capability	Regulation Mode	MODE OF OPERATION	RAMP RATES (GROSS MW/ MIN)
PALAAU GENERATING STATION										
G01	No. 2 Diesel	ICE	1.25	0.4	1.00	No AGC	Yes	4% droop	Cycling	0.5
G02	No. 2 Diesel	ICE	1.25	0.4	1.00	No AGC	Yes	4% droop	Cycling	0.5
G03	No. 2 Diesel	ICE	0.97	0.4	0.78	No AGC	Yes	4% droop	Cycling	0.5
G04	No. 2 Diesel	ICE	0.97	0.4	0.78	No AGC	Yes	4% droop	Cycling	0.5
G05	No. 2 Diesel	ICE	0.97	0.4	0.78	No AGC	Yes	4% droop	Cycling	0.5
G06	No. 2 Diesel	ICE	0.97	0.4	0.78	No AGC	Yes	4% droop	Cycling	0.5
G07	No. 2 Diesel	ICE	2.20	1.1	1.76	No AGC	Yes	Isoch	Baseload	1.1
G08	No. 2 Diesel	ICE	2.20	1.1	1.76	No AGC	Yes	Isoch	Baseload	1.1
G09	No. 2 Diesel	ICE	2.20	1.1	1.76	No AGC	Yes	Isoch	Baseload	1.1
GT1	No. 2 Diesel	CT	2.22	1.1	1.78	No AGC	Yes	4% droop	Peaking	1.1

Table 3 lists the PV trip settings used in this study, and is based on the IEEE 1547 PV trip settings and the proposed 14H extended ride-through settings. The legacy PV has the IEEE 1547 trip settings which are a must-trip standard which means that the distributed generation must cease to energize the circuit by the specified delay times. The proposed Rule 14H is a ride-through standard that specifies that the distributed generation must stay connected to the system until the abnormal system conditions

have existed for at least as long as the delay. In addition, it is assumed that all PV that has the 14H extended ride through settings can also be curtailed.

Table 3: PV Trip Setting Comparison IEEE 1547 vs. Rule 14H

Frequency Settings	Under Frequency		Over Frequency					
	Hz	Delay	Hz	Delay				
IEEE 1547	59.3	0.167	60.5	0.167				
Modified Rule 14H	57.0	0.167	60.5	0.167				
Proposed 14H Extended	57.0	20.0	63.0	20.0				

Voltage Settings	Under Voltage 1		Under Voltage 2		Over Voltage 1		Over Voltage 2	
	PU	Delay	PU	Delay	PU	Delay	PU	Delay
IEEE 1547	0.5	0.167	0.9	2.000	1.1	1.000	1.2	0.167
Modified Rule 14H	0.5	0.167	0.9	2.000	1.1	1.000	1.2	0.167
Proposed 14H Extended	0.5	0.500	0.9	2.000	1.1	1.000	1.2	0.167

The database provided by MECO 30% of the PV being tripped at 59.3 Hz to account for the legacy PV installations. The database had 1,620 kW of distributed PV, resulting in approximately 490 kW of PV capacity that would trip offline using the IEEE 1547 trip settings. We performed a sensitivity analysis that focused on the impact that retrofitting the currently installed PV has on the contingency reserve requirement for the Molokai system.

We assumed that the amount of PV that trips at 59.3 Hz would be decreased from 30% to 20% (similar to the amount of PV for the MECO system). This assumption provides for a similar PV to peak system load ratio as seen on the HELCO, MECO, and HECO systems. The remaining PV utilize the proposed extended ride-through settings. The result would be 324 kW of PV capacity that would use the IEEE 1547 trip settings, and the remainder would use the proposed Rule 14H extended ride-through settings.

To illustrate the importance of retrofitting the existing PV, a case was completed assuming none of the existing PV would be retrofitted. This results in approximately 490 kW that would trip offline at a frequency of 59.3 Hz and 60.5 Hz, and the remaining 1,134 kW PV would use the modified Rule 14H settings and trip offline at 57 Hz with a 10 cycle delay with all other trip settings identical to the IEEE 1547 trip settings. All future PV would use the extended ride-through settings highlighted in Table 3. The two PV configuration scenarios are shown below in Table 4.

Table 4: PV Configuration Scenarios (Capacity)

PV Scenario	No Retrofit	With Retrofit
Legacy PV	490 kW	324 kW
Modified Rule 14 H PV	1,134 kW	-
Proposed 14H Extended	1,643 kW	2,939 kW
Total PV	3,263 kW	3,263 kW

Simulations were run to determine the size of the regulating reserves needed to prevent the second stage of load shedding. If the system frequency dropped low enough to trigger stage 2 of load shedding, then additional regulating reserves were added in 100 kW increments until the frequency stayed above the stage 2 load shedding setpoint. The battery system was configured to have a 1% droop response with a deadband of +/- 0.05 Hz.

The load shedding settings listed in the provided database are shown below in Table 5.

MOLOKAI PSIP 2030 CASES

Table 5: Under-Frequency Trip Settings

Stage	Frequency (Hz)	Delay (seconds)
Kicker 1	58.7	5.0
Kicker 2	57.75	2.5
Stage 1	57.5	0.16
Stage 2	57.25	0.75
Stage 3	56	0.5

Dispatch Cases

Table 6 shows the dispatch cases that were created for the Molokai 2030 cases with all values listed in kW.

Table 6: 2030 Dispatch Cases

Unit	Capacity		Minimum Solar						Maximum Solar					
			Daytime Minimum			Daytime Peak Load			Daytime Minimum			Daytime Peak Load		
	Max	Min	Base	Case 'A'	Case 'B'	Base	Case 'A'	Case 'B'	Case 'C'	Case 'D'	Case 'E'	Case 'C'	Case 'D'	Case 'E'
G07	2,200	1,100	2,178	2,066	1,107	2,199	2,196	2,200	1,176	1,113	1,138	1,592	1,192	1,119
G08	2,200	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
G09	2,200	1,100			1,100			1,100			1,100			1,100
G01	1,250	400		400			400			400			400	
G02	1,250	400												
G03	970	400												
G04	970	400												
G05	970	400												
G06	970	400												
GT1	2,220	1,100												
Solar Available			2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770	2,770
Curtailed Solar			2,220	2,490	2,240	590	990	1,680	1,220	1,570	2,270	0	0	620
Solar Generation			550	280	530	2,180	1,780	1,090	1,550	1,200	500	2,770	2,770	2,150
System Load			3,828	3,846	3,837	5,479	5,476	5,490	3,826	3,813	3,838	5,462	5,462	5,469
Regulation Up			1,122	2,084	3,293	1,101	1,954	2,200	2,124	3,037	3,262	1,708	2,958	3,281
Regulation Dn			1,078	966	7	1,099	1,096	1,100	76	13	38	492	92	19

The base and case 'C' dispatches only have 2 of the 2,200 kW units online. Case 'A' and case 'D' dispatches have two 2,200 kW units plus a 1,250 kW unit online. Case 'B' and case 'E' dispatches have three of the 2,200 kW units online. The base case, case 'A', and case 'B' are all dispatched with as much solar generation curtailed as possible. Case 'C', case 'D', and case 'E' are all accepting the maximum allowable solar generation. Even during the day peak load, case 'E' requires some solar curtailment.

The loss of either the G07 or the G08 unit was simulated for each of the dispatch cases listed above. A line fault and trip was also studied with 27 cycle clearing. This line goes from Palaau – Kamehameha (Bus 1012 – 1091)

Results

The BESS size necessary to prevent the second stage of load shedding was tabulated for each of the unit trips and dispatch cases. These results are shown in Table 7.

MOLOKAI PSIP 2030 CASES

Table 3: BESS Required to Prevent Stage 2 of Load Shedding

Dispatch	Retrofit		No Retrofit	
	Daytime Peak	Daytime Minimum	Daytime Peak	Daytime Minimum
Base	700 kW	700 kW	1,300 kW	900 kW
Case 'A'	200 kW	200 kW	700 kW	300 kW
Case 'B'	0 kW	0 kW	0 kW	0 kW
Case 'C'	100 kW	0 kW	900 kW	300 kW
Case 'D'	0 kW	0 kW	0 kW	0 kW
Case 'E'	0 kW	0 kW	0 kW	0 kW

Security Tables

Molokai 2030 Baseline- Min Thermal Units, Maximum ESS - WITH RETROFIT								
		Capacity (kW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30-Minute Reserves
	Wind	0	2x 2200 kW Units	320 kW	640 kW	0 kW	700 kW	2470 kW
PV Level	DG	3263						
Largest Unit		2200						
	Wind	0	2x 2200 kW Units + 1x 1200 kW Unit	320 kW	640 kW	0 kW	200 kW	2470 kW
PV Level	DG	3263						
Largest Unit		2200						
	Wind	0	3x 2200 kW Units	320 kW	640 kW	0 kW	0 kW	2470 kW
PV Level	DG	3263						
Largest Unit		2200						
Notes:	<p>1: This case represents the case with max PV/Wind with minimum thermal units required for system stability. It is the extreme case for the minimum number of operating thermal units on the system.</p> <p>2: The regulation capacity and the ramp rate limit are the total required for the system as a whole. Any curtailed PV can provide both regulation and/or contingency reserves however the quantity should be adjusted to the expected capacity available as opposed to the expected energy levels.</p> <p>3: This analysis assumes the largest single contingency of future PV/Wind resources is limited to the same level of contingency as the largest thermal unit.</p> <p>4: The regulating reserves and the contingency reserves are individual requirements and should be summed together to arrive at the total required reserves.</p>							

MOLOKAI PSIP 2030 CASES

Molokai 2030 Baseline- Min Thermal Units, Maximum ESS - NO RETROFIT								
		Capacity (kW)	# of Thermal units required (security constraint)	Ramp Rate Requirements	Regulation Reserves	Regulation Reserves - Night time	Contingency Reserves	30-Minute Reserves
	Wind	0	2x 2200 kW Units	320 kW	640 kW	0 kW	1300 kW	2617 kW
PV Level	DG	3263						
Largest Unit		2200						
	Wind	0	2x 2200 kW Units + 1x 1200 kW Unit	320 kW	640 kW	0 kW	700 kW	2617 kW
PV Level	DG	3263						
Largest Unit		2200						
	Wind	0	3x 2200 kW Units	320 kW	640 kW	0 kW	0 kW	2617 kW
PV Level	DG	3263						
Largest Unit		2200						
Notes:	<p>1: This case represents the case with max PV/Wind with minimum thermal units required for system stability. It is the extreme case for the minimum number of operating thermal units on the system.</p> <p>2: The regulation capacity and the ramp rate limit are the total required for the system as a whole. Any curtailed PV can provide both regulation and/or contingency reserves however the quantity should be adjusted to the expected capacity available as opposed to the expected energy levels.</p> <p>3: This analysis assumes the largest single contingency of future PV/Wind resources is limited to the same level of contingency as the largest thermal unit.</p> <p>4: The regulating reserves and the contingency reserves are individual requirements and should be summed together to arrive at the total required reserves.</p>							

If you have any questions, please feel free to give me a call at 907-646-5103.

Sincerely,

David W. Burlingame, P.E.

Principal Engineer

Maui Electric
2015 RAM Plant Addition Target

	(\$millions)
	Maui Electric
START Total RAM Allowed (Target Revenue)	12
Step 1 Allocated to Depreciation and Amortization	(3)
Step 2 Allocated to O&M	(3)
Step 3 Allocated to Rate Base	(5)
Total Allocated RAM	<u>(12)</u>
Unallocated RAM (should be 0)	<u>-</u>
 Step 4 RAM allocated to Rate Base is converted to Plant Additions:	
Allocated Rate Base RAM per Step 3	5
Less: 2014 Rate Base RAM	(5)
Incremental 2015 Rate Base RAM	<u>0</u>
Divide by After-Tax Rate of Return	11.70%
Change in Rate Base	<u>3</u>
Add: 2015 Depreciation and Amortization	23
Estimated 2015 Plant Additions	<u>27</u>
 Step 5 Estimated Plant Additions is converted to Capital Expenditures:	
Estimated 2015 Plant Additions per Step 4	27
Less: Adjustment for conversion to Capital Expenditures	(1)
Estimated 2015 Capital Expenditures	<u><u>26</u></u>

MAUI ELECTRIC COMPANY, LIMITED
DECOUPLING CALCULATION WORKBOOK
DETERMINATION OF CHANGE IN DEFERRED INCOME TAXES
REVISED FOR CHANGE TO ADDS AND REPAIRS BASE

Line No.	NARUC Account (a)	Reference (b)	Projected ADIT Change (c)
1	State Tax Depreciation	Schedule F1	1,034,586
2	Effective Federal Tax Rate	MECO-WP-F-001	32.8947%
3	Federal Deferred Tax on State Tax Depreciation		340,324
4	Add back State Tax Depreciation		(1,034,586)
5	Federal Tax Depreciation	Schedule F1	1,034,586
6	Federal/State Difference		-
7	Tax Rate on Federal Only Adjustment	MECO-WP-F-001	0.35
8	Federal Deferred Tax Adjustment		-
9	Total Federal Deferred Taxes		340,324
	STATE DEFERRED TAXES		
10	State Tax Depreciation	Schedule F1	1,034,586
11	Effective State Tax Rate	MECO-WP-F-001	6.0150%
12	Total State Deferred Taxes		62,231
13	TOTAL FED AND STATE DEFERRED TAXES		402,555
			<i>To Schedule D1</i>

NOTE: In accordance with the tariff, the change in ADIT in the RAM year is based on the temporary book/tax depreciation differences associated with the RAM year plant additions (major capital projects and baseline plant additions). It does not include any estimated ADIT related to the repairs deduction or CIAC on RAM year plant additions.

MAUI ELECTRIC COMPANY, LTD.
DECOUPLING CALCULATION WORKBOOK
DETERMINATION OF TAX DEPRECIATION

Line No.	LIFE	MECO-WP-F1-002		TOTAL	PROJECTS	PROGRAMS	TOTAL	FED YR 1	FED TAX RATE	FED TAX DEPR	STATE YR 1	STATE TAX RATE	STATE TAX DEPR
		PROJECTS	PROGRAMS										
1	Computer Data	397,106	107,730	504,836	0.94%	0.25%	504,836	1.19%					
2	Comp/OH Furn/Tools	19,960	139,892	159,852	0.05%	0.33%	159,852	0.38%					
3	Street Lights	90,196	132,616	223,014	0.21%	0.31%	223,014	0.53%					
4	Non-Steam Production	5,906,477	168,469	6,074,946	13.91%	0.40%	6,074,946	14.31%					
5	Communication	1,717,580	21,867	1,739,447	4.05%	0.05%	1,739,447	4.10%					
6	Steam Production	448,441	46,401	494,842	1.06%	0.11%	494,842	1.17%					
7	General	1,442,361	441,803	1,884,164	3.40%	1.04%	1,884,164	4.44%					
8	Transmission	2,208,383	864,708	3,073,091	5.20%	2.04%	3,073,091	7.24%					
9	Distribution	9,581,394	16,152,682	25,734,076	22.57%	38.04%	25,734,076	60.61%					
10	Structural	1,139,255	138,594	1,277,849	2.68%	0.33%	1,277,849	3.01%					
11	ROW	5,518	65,585	71,103	0.01%	0.15%	71,103	0.17%					
12	Land	-	(6,180)	(6,180)	0.00%	-0.02%	(6,180)	-0.02%					
13	Vehicles	202,038	1,027,920	1,229,958	0.48%	2.42%	1,229,958	2.90%					
14	TOTAL	23,138,709	19,302,289	42,440,998	54.54%	45.46%	42,440,998	100.00%					

Project and Program % Totals by Depreciable Life:

Life	Project %	Program %	Total %
5 yr	0.94%	0.25%	1.19%
7 yr	0.26%	0.64%	0.90%
15 yr	13.91%	0.40%	14.31%
20 yr	36.26%	41.28%	77.54%
39 yr	2.68%	0.33%	3.01%
50 yr	0.01%	0.15%	0.17%
Land	0.00%	-0.02%	-0.02%
Vehicles	0.48%	2.42%	2.90%
Total	54.54%	45.46%	100.00%

NOTE (1) Basis subject to 50% bonus depreciation

Life	Project %	Program %	Total %
5 yr	0.00%	0.00%	0.00%
7 yr	0.00%	0.00%	0.00%
15 yr	0.00%	0.00%	0.00%
20 yr	0.00%	0.00%	0.00%
39 yr	n/a	n/a	n/a
50 yr	n/a	n/a	n/a
Land	n/a	n/a	n/a
Vehicles	n/a	n/a	n/a
Total	0.00%	0.00%	0.00%

NOTE (1) The Tax Increase Prevention Act of 2014 allows 50% bonus depreciation for assets placed in service before January 1, 2015. Consequently, the entire basis of vintage 2015 is subject to regular depreciation.

Life	Project %	Program %	Total %
5 yr	0.94%	0.25%	1.19%
7 yr	0.26%	0.64%	0.90%
15 yr	13.91%	0.40%	14.31%
20 yr	36.26%	41.28%	77.54%
39 yr	2.68%	0.33%	3.01%
50 yr	0.01%	0.15%	0.17%
Land	n/a	n/a	n/a
Vehicles	n/a	n/a	n/a
Total	54.06%	43.05%	97.11%

Reconciliation from Baseline Plant Adds to Net Depreciable Plant Adds:

Baseline Capital Projects Plant Adds	32,000,000
Less: Repairs deduction	6,307,324
Net plant add basis	25,692,676
Less: Land and Vehicles (2.88% x 34,091,769)	741,491
Total	24,951,186

MECO-WP-F1-002

Category	Value
Net Depreciable Baseline Plant Adds	24,951,186
Major Capital Projects from Schedule F2	-
Total Depreciable Plant Adds	24,951,186
Fed Tax Depreciation To Schedule F	1,034,586
St. Tax Depreciation To Schedule F	1,034,586

**MAUI ELECTRIC COMPANY, Ltd.
TAX REPAIRS ADJUSTMENT
2015**

			Revised	A	B	C = A x B	D = A - C
			MECO-WP- F1-002 5-Year	Allocated	MECO-WP-F1- 001 pg.2 Repairs	Repairs	Depreciable
LIFE	Original	Ratio	AVERAGE	Plant Adds	Allocation	Deduction	Basis
Structural	39	1,277,849	3.01%	963,029			
Steam Production	20	494,842	1.17%	372,929	372,929	21.76%	81,133
Non-Steam Production	15	6,074,946	14.31%	4,578,278	4,578,278	21.76%	996,030
ROW	50	71,103	0.17%	53,586			
Transmission	20	3,073,091	7.24%	2,315,982	2,315,982	42.65%	987,833
Distribution	20	25,734,076	60.61%	19,394,043	19,394,043	21.68%	4,204,294
Distribution - Street Lights	7	223,014	0.53%	168,071	168,071	21.68%	36,435
Distribution - EV Fast Charger	7	9,789	0.02%	7,377	7,377	21.68%	1,599
Computer Data	5	504,836	1.19%	380,461			
Comp/Off/Furn/Tools	7	150,063	0.35%	113,092			
Vehicles	-	1,229,958	2.90%	926,937			
General	20	1,884,164	4.44%	1,419,968			
Communication	20	1,739,447	4.10%	1,310,904			
Land	-	(6,180)	-0.01%	(4,657)			
TOTAL		42,460,998	100.00%	32,000,000	26,836,681		6,307,324
							20,529,357

to Sch F1

NOTE> This schedule calculates the estimated amount of deductible tax repairs related to baseline plant additions for the RAM year. The deductible tax repairs amounts are carried forward to Schedule F1 and serve to reduce the depreciable tax basis for the baseline plant additions. The repairs percentages (column B) are calculated on MECO-WP-F1-001, page 2.

**MAUI ELECTRIC COMPANY, LTD.
REPAIRS DEDUCTION
2015**

Repairs %: Note 1				Note 2
		Distribution	Transmission	Generation
Book basis repairs				
1	2010	3,395,009	1,074,383	1,500,000
2	2011	5,109,057	948,114	2,430,000
3	2012	5,320,976	1,284,956	1,500,000
4	2013	8,212,829	2,099,894	1,500,000
5	2014	6,947,634	1,137,714	1,625,006
6	Total book basis repairs	<u>28,985,505</u>	<u>6,545,061</u>	<u>8,555,006</u>
Book basis adds				
7	2010	MECO WP-F1-002 20,785,394	1,536,304	5,011,827
8	2011	MECO WP-F1-002 15,784,899	2,095,102	7,869,318
9	2012	MECO WP-F1-002 29,582,294	5,615,857	8,236,091
10	2013	MECO WP-F1-002 33,883,264	3,523,926	10,736,684
11	2014	MECO WP-F1-002 33,671,758	2,573,753	7,469,383
12	Total book basis adds	<u>133,707,609</u>	<u>15,344,942</u>	<u>39,323,303</u>
Repairs % (Line 6 / Line 12)		21.678276%	42.652888%	21.755563%

NOTE 1> Price Waterhouse Coopers (PWC) assisted MECO in its analysis of identifying deductible repairs for tax accounting purposes. The repairs percentage for each functional group represents the five year weighted average of repairs costs included in book additions.

Note 2> In 2014, MECO is including an estimate of generation repairs based on an initial analysis of prior year repairs prepared by PWC.

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAI'I

In the Matter of the Application of

MAUI ELECTRIC COMPANY, LIMITED

For Approval to Recover Certain 2015 Plant
Addition Costs through the Rate Adjustment
Mechanism ("RAM") Above the RAM Cap

DOCKET NO.

CERTIFICATE OF SERVICE

I hereby certify that I have this date served two copies of the foregoing Application, together with this Certificate of Service, by hand delivery to the following and at the following address:

Division of Consumer Advocacy
Department of Commerce and Consumer Affairs
335 Merchant Street, Room 326
Honolulu, Hawai'i 96813

DATED: Honolulu, Hawai'i, October 30, 2015

HAWAIIAN ELECTRIC COMPANY, INC.



Michael J. Chu