

## **Phase 1 Ex Ante Review Findings**

**Table Error! No text of specified style in document.-1: Project Information**

<b>IOU</b>	PG&E
<b>Application ID</b>	2K12082150, 2K12082153, 2K12082155, 2K12082157, 2K12082160, 2K12082163, 2K12082168
<b>Application Date</b>	3/12/2012
<b>Program ID</b>	PGE 21011
<b>Program Name</b>	Calculated Incentives
<b>Program Year</b>	2012
<b>Itron Project ID</b>	X087
<b>IOU Ex Ante Savings Date</b>	11/5/12
<b>ED Measure Name</b>	Efficient Telecommunication switched-mode rectifiers (SMRs)
<b>Project Description</b>	This project involves replacing legacy Ferro-resonant rectifiers with energy-efficient switched-mode rectifiers (SMRs) at several locations of a telecommunications company.
<b>Date of ED Review(s)</b>	1/16/2013
<b>Primary Reviewer and Firm</b>	Keith Rothenberg/Energy Metrics
<b>Review Supervisor and Firm</b>	Joseph Ball/Itron
<b>Type of Review (Desk, On-site, Full M&amp;V, Tool)</b>	Desk Review
<b>ED Recommendation</b>	ED conditionally approves the project to proceed to the implementation phase, pending fulfillment of data request for more information. The ex ante savings for this project will be frozen based on the results of post installation true-up of the savings calculations.

## **Measure Description**

The project proposes to install 796 high efficiency switched-mode rectifiers (SMR) in numerous customer facilities throughout the IOU's territory. They will replace less efficient Ferro-resonant (Ferro) rectifiers. The project is considered a "normal replacement" and the baseline has been determined to be the currently widely adopted SMR efficiency. The customer proposes to install the higher efficiency SMRs which have recently become commercially available. The savings are a result of the latest generation SMR's higher AC-DC / DC-AC conversion efficiency compared to the current industry standard practice SMR efficiency. This increased conversion efficiency also reduces the amount of waste heat that must be removed using the building's mechanical cooling systems, however the IOU review team concluded that HVAC interactive effects should not be claimed for this project because of complexities associated with the various rectifier and HVAC system configurations at the customer's facilities. The IOU has created seven separate applications for the project. All seven projects are included in this ED review.

The total IOU estimated ex ante annual energy savings for the seven applications is 2,583,833 kWh with an on-peak demand reduction of 294.9 kW. With a total cost of \$5,540,828, an incentive of \$295,403 is estimated for the project.

## **Summary of Review**

Documents provided for review include the following:

- Program application and application update pdf files
- Site address verification form
- Site address electric meter monthly billing information that includes previous 12 months from March 2012
- The energy-efficient SMR data specification sheet that gives input and output power specifications for the model types
- Energy savings methodology document that gives a brief explanation for the savings methodology, the savings inputs, and the assumptions used
- Savings calculation spreadsheet that contains individual site savings. The spreadsheet contains more sites than those claimed in the program application
- The IOU Data Center Baseline document dated November 30, 2011, effective January 1, 2012.
- E-mail memo correspondence between IOU program personnel and customer's contracted sponsor, equipment lease terms agreement document, and customer tax information (W-9).

The review focused primarily on the savings calculation spreadsheet and the savings methodology document to review the savings estimates. Numerous meetings and discussions have been held with the IOU implementation team and customer representatives. Additionally,

ED representatives visited two of the sites. The direct rectifier energy savings approach uses two variables – rectifier model efficiency and rectifier utilization (load %). The rectifier efficiency is dependent on the specific model and its utilization. The calculation spreadsheet contains rectifier efficiency versus utilization data that it uses to determine rectifier efficiency from a given utilization (load %). The utilization for each rectifier is determined by dividing the plant load (in amps) by the sum of the individual rectifier capacities (also in amps). The rectifier efficiency curves are in 10 percent increments of utilization so efficiency values are linearly interpolated for the proposed rectifiers when utilization does not directly correspond to the efficiency data points. The IOU reviewer used a polynomial to estimate the efficiency for the baseline rectifiers. Energy savings is determined using the following assumptions:

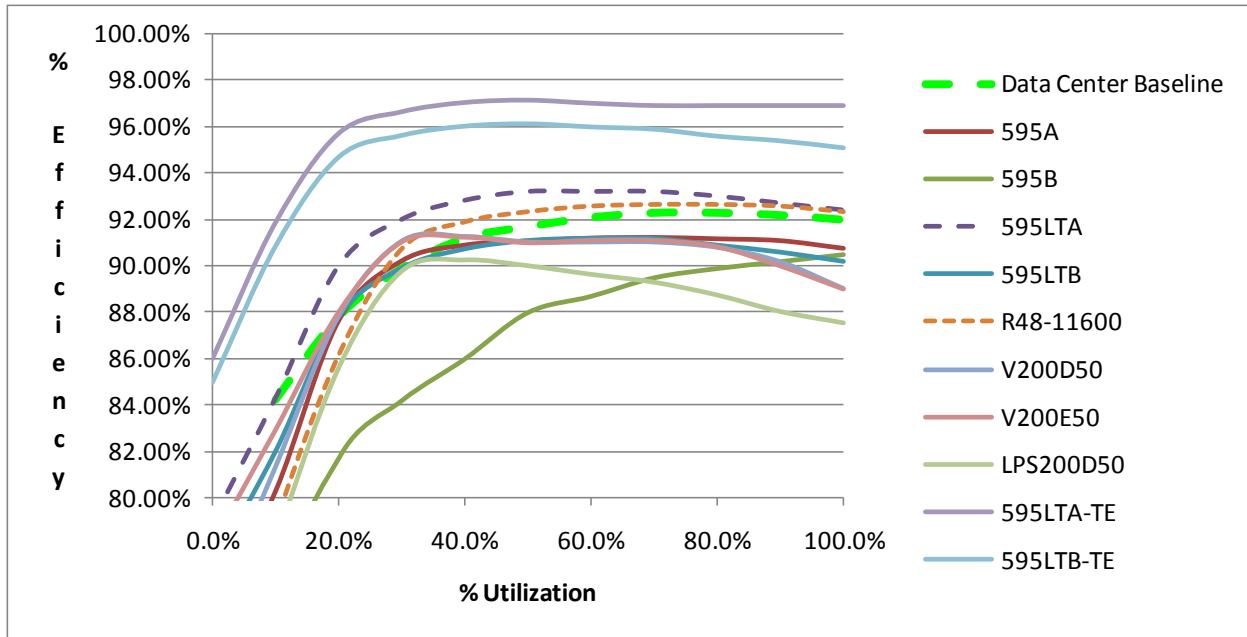
- 8,760 hour operation; 24 hours per day, 365 days per year
- Operating plant rectifier voltage of 52 volts
- Individual location plant load in amps (hard entered and site specific)

Site specific information including the plant voltage, plant load in amps, and existing rectifier data specifications (including the rectifier efficiency versus utilization curves) are used in the calculation spreadsheet.

The IOU analysis has used the rectifier efficiency curve from the IOU Data Center baseline document. ED requested that the IOU provide the basis of the data center proposed baseline efficiency for rectifiers. The IOU was not able to cite the source or provide the data that were used to derive these curves.

The data provided by the IOU contained efficiency and cost information for various rectifiers collected by the customer for the project. ED analyzed the data provided and determined that there are 7 SMR type rectifiers with a capacity similar to that proposed for this project (200 amps) in addition to the two rectifiers models that are proposed for this project (595LTA TE and 595LTB TE). ED identified two rectifiers (595LTA and R48-11600) with efficiency versus utilization curves similar to the efficiency proposed by the IOU in the data center baseline document. Exhibit 1 shows the efficiency versus utilization for the rectifiers ED analyzed.

Exhibit 1 200 Amp Capacity SMRs



ED’s baseline for this project is the average efficiency of the two rectifiers with efficiency versus utilization curves similar to the efficiency proposed by the IOU in the data center baseline document (595LTA and R48-11600). ED views these rectifiers as being representative of equipment that is available in the market place in a capacity suited for this project. Exhibit 2 shows the efficiency of the two rectifiers used as the ED baseline for the project (595 LTA and R48-11600), the IOU proposed baseline and the performance curves of the proposed high efficiency rectifiers (595 LTA TE and 595 LTB TE). Exhibit 3 shows the average efficiency of the two rectifiers used as the ED baseline for the project (595 LTA and R48-11600), the IOU proposed baseline and the performance curves of the proposed high efficiency rectifiers (595 LTA TE and 595 LTB TE). **The average efficiency of the two rectifiers (595 LTA and R48-11600) is established as the ED baseline for the project.**

Exhibit 2- ED Baseline Rectifiers, IOU Baseline and Proposed High Efficiency Rectifiers

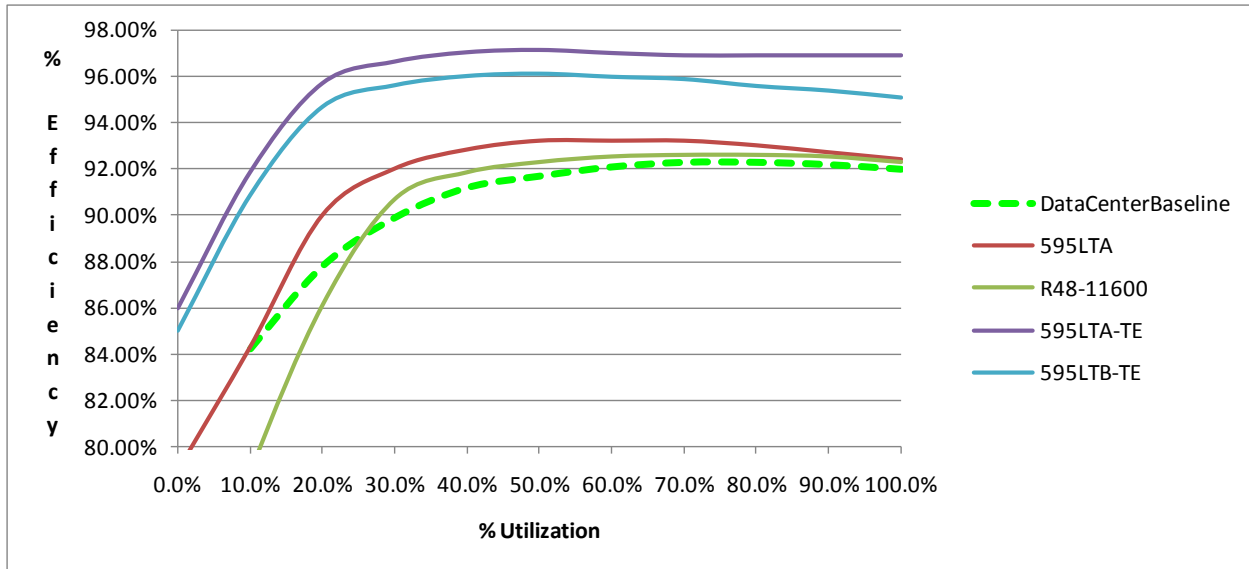
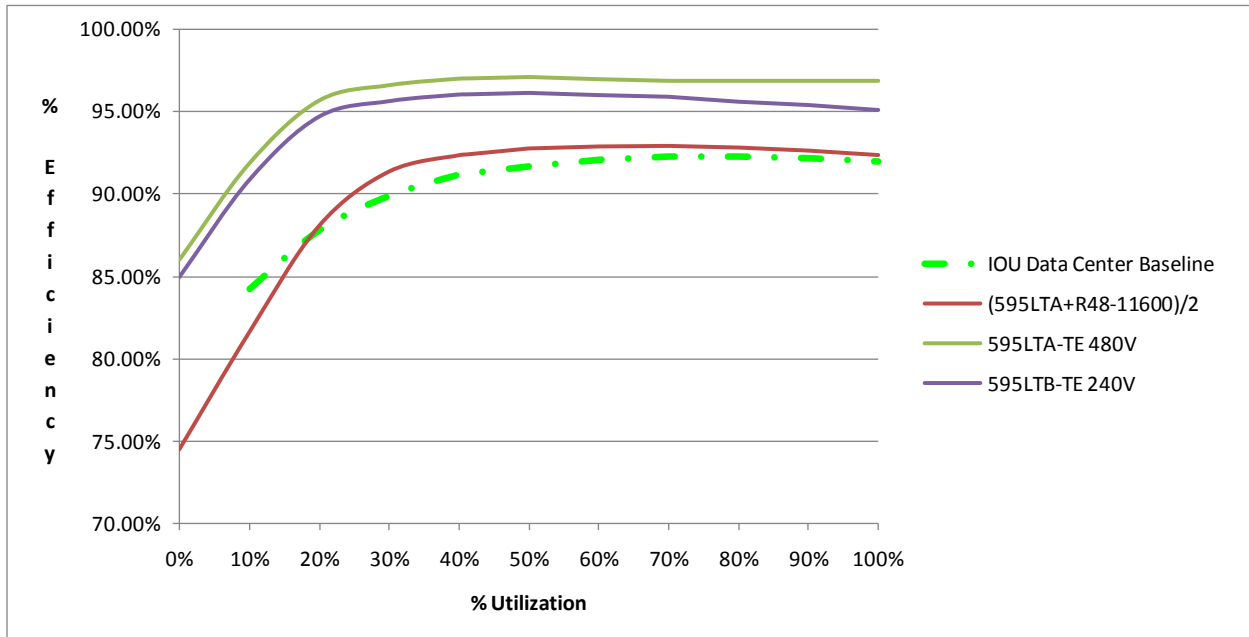


Exhibit 3- ED Baseline Rectifiers Averaged, IOU Baseline and Proposed High Efficiency Rectifiers



ED utilized the SMR rectifier performance data provided in the IOU analysis. The performance data were provided in 10% increments of utilization. ED’s analysis used a linear interpolation to estimate the efficiency values in 1% increments of utilization. The interpolated data were used to estimate the baseline and proposed annual energy consumption of the rectifier plants at the various customer facilities. ED’s preliminary analysis estimates the total project impacts to be a

demand reduction of 253 kW with an annual energy savings of 2,213,385 kWh. This is approximately 14% less than the IOU estimated impacts of 295 kW with an annual energy savings of 2,583,833 kWh. The results of the preliminary analysis performed by ED and the IOU are shown in Exhibit 4 below.

Exhibit 4 Summary of ED Preliminary and IOU Ex Ante Savings Impacts

	kW	kWh	Total Incremental cost
IOU	294.9	2,583,833	TBD
ED Preliminary	252.7	2,213,385	\$ 66,068
% difference	14%	14%	

The main reasons for the discrepancy between the IOU analysis results and the ED preliminary analysis results are that ED’s baseline efficiency is slightly higher than the IOUs and that ED used interpolated values in 1% increments of utilization for the both the baseline and proposed rectifier efficiency in the analysis. The IOU estimated the baseline performance using a polynomial and the proposed new rectifier efficiency was estimated using interpolated values of the 10% increments of utilization.

HVAC Interactive affects were removed from the savings calculations by the IOU review team because of the complexity in calculating their impacts. Some of the rectifier plants are located in ventilated spaces and receive secondary cooling from the HVAC systems in the facilities. Other plants are located in areas that could affect the HVAC energy usage.

ED conducted net-to gross reviews for this project. During a recent interview the customer representatives implied that the project was an early retirement of the existing rectifiers. Other customer representatives stated that the project was being implemented because the customer realizes that the rectifiers are reaching the end of their useful life and the rectifier plants are likely to experience an exponential increase in failures as the plants age. ED has found that the Ferro rectifiers in the facilities visited were installed in the 1970’s, 1980’s and 1990’s. ED further determined that the existing Ferro rectifiers have not been manufactured for more than 10 years, and that all new projects installed by the customer in the past 10-12 years have utilized SMRs. During recent project conference calls, the IOU has stated that they are proposing a “Normal Replacement” baseline for this project. ED concurs with the IOU’s assessment and finds that the preponderance of evidence is that this is a normal replacement project.

ED notes that the IOU has provided the full cost of the project as the basis for the IOU incentive cap for this project. Normal replacement projects must use incremental cost basis for the calculation of the incentive. ED has found that there is a marginal cost difference between the proposed high efficiency rectifiers and the baseline rectifiers that ED has identified from the equipment data provided by the customer. ED estimates that the cost of the proposed high

efficiency rectifier is approximately \$1,816 each, and the baseline rectifier cost is \$1,733 each. These estimates include the 45% discount shown in the customer's equipment list. The incremental cost difference is \$83 per rectifier, less than 5% of the total cost. ED has estimated the total incremental cost for this project to be approximately \$66,000.

During a recent ED/IOU conference call, the IOU acknowledged that it commonly uses full project cost as the cost basis for retrofit projects of all types. ED suggests that the IOU modify its policy to match ED's policy on this issue. ED requests that the IOU ensure that all its implementation teams and reviewers be fully informed to use a full cost basis for early replacement, equipment add-ons, and RCx projects, and use an incremental cost basis for normal replacement, new construction and capacity expansion projects where code or industry standard practice applies.

ED's preliminary project impact estimate was performed to establish the project baseline efficiency and to verify the IOU's analysis approach. ED requires that the frozen ex ante savings estimates be based on trued up post installation verified plant amps, installed rectifier quantity and actual performance characteristics of installed rectifiers..

ED notes that the customer is planning to lease the equipment for this project. ED requests that the IOU provide the EUL for this measure and cap the measure life at lesser of the lease term or DEER EUL, assuming that the lease term is not less than five years required by the program for the measure to be in place. Provide a copy of the lease for ED review that clearly shows the term of the lease.

### **Review Conclusion**

ED conditionally approves the project to proceed to the implementation phase, pending fulfillment of data request for more information. The ex ante savings for this project will be frozen based on the results of post installation true-up of the savings calculations.

### **Summary of ED Requested Action by the IOU**

In order to complete an ex ante review the ED recommends that the IOU submit the following documentation as it becomes available:

1. Post-install inspection reports
2. Final post installation analysis trued up based on total plant operating amps, actual installed rectifier quantity and efficiency
3. Provide installed rectifier data specification sheets including the efficiency versus utilization curves
4. Provide verified total plant amps for each rectifier plant after the installation is complete

5. Provide the effective useful life (EUL) estimates for the new rectifiers
6. Provide an incremental cost documentation and analysis at the completion of the project

ED requests that the IOU:

1. Revise its policy related to using a full cost basis for all projects, and modify the policy to match ED's policy. Normal replacement projects, replace on burnout projects, capacity expansion projects and new construction projects should use an incremental cost basis. ED requests that for all future projects the IOU ensure that all its implementation teams and reviewers be fully informed of when to use a full cost basis and when to use an incremental cost basis for a project. The 2012 data center baseline document prepared by PG&E provides guidance on estimating baseline and incremental costs (pages 13-14).
2. Keep ED informed of the progress and next steps on this project.
3. Inform ED of any future site visits including the post-installation inspection, with sufficient lead time, in case it chooses to send a representative on-site.
4. Provide sufficient opportunity for ED to review the requested data, analysis and calculations prior to the freezing of ex ante savings impacts for this project.



**Table 1-2: Project Overview**

Description	IOU Proposed Ex Ante Data	ED Recommendations
<b>Project Baseline Type (Early Replacement, Normal Replacement, Capacity Expansion, New Construction, System Optimization, Add-on Measures)</b>	Normal Replacement	Approved
<b>Project Cost Basis (Full Cost, Incremental Cost)</b>	Not provided but appears to be full cost	Incremental cost should be used
<b>RUL (Early retirement projects only, otherwise N/A (not applicable))</b>	NA	NA
<b>EUL</b>	Not provided	TBD. Provide EUL of new equipment, consider the lease term and the program requirement.
<b>First Year kWh Savings</b>	2,583,833	TBD
<b>First Year Peak kW Savings</b>	295	TBD
<b>First Year Therms Savings</b>	0	TBD
<b>kWh Savings (RUL Period)</b>	NA	NA
<b>Peak kW Savings (RUL Period)</b>	NA	NA
<b>Therms Impact (RUL Period)</b>	NA	NA
<b>kWh Savings (EUL thru RUL Period)</b>	2,583,833	TBD
<b>Peak kW Savings (EUL thru RUL Period)</b>	295	TBD
<b>Therms Savings (EUL thru RUL Period)</b>	0	TBD
<b>Annual Non-IOU Fuel Impact (RUL Period)</b>	N/A	N/A
<b>Annual Non-IOU Fuel Impact (EUL thru RUL Period)</b>	N/A	N/A
<b>Net-to-Gross Ratio</b>	Not provided	Assessment not finalized



**Table 1-3: Detailed Review Findings**

<b>Reviewed Parameter</b>	<b>Analysis</b>
<b>Project Gross Savings Baseline</b> (for early retirement projects only, include RUL through EUL baseline)	IOU Proposal: Normal replacement
	ED Assessment: Correct
	ED Recommendation: Approved
<b>Project Cost Basis</b> (for early retirement projects only, include RUL through EUL cost basis treatment)	IOU Proposal: Not provided, but appears to be full cost
	ED Assessment: Incremental cost should be used for “Normal replacement” projects.
	ED recommendation: Provide final incremental project cost documentation at the completion of the project.
<b>RUL</b> (required for early retirement projects only, otherwise n/a)	IOU Proposal: N/A
	ED Assessment: Correct
	ED recommendation: None
<b>EUL</b>	IOU Proposal: Not provided
	ED Assessment: Provide EUL. Consider lesser of the lease term or program requirement of five years as a cap for the EUL.
	ED Recommendation: Provide a copy of the lease showing the term of the lease.
<b>Savings Assumptions</b>	IOU Proposal: Savings assumptions include plant voltage, plant load in amps, rectifier utilization and its associated rectifier efficiency. All rectifiers are assumed to operate 8,760 hours per year
	ED Assessment: Post installation plant load in amps should be substantiated with some source of site specific input. Actual installed rectifier efficiency should be used to estimate the final impacts.
	ED Recommendation: Revise calculations after the installation is complete using actual installed rectifier efficiency data from the manufacturer and plant operating amps, and submit to ED for freezing of final savings estimates.
<b>Calculation Methods/Tool review</b>	IOU Proposal: Spreadsheet calculations using savings assumptions documented above.
	ED Assessment: The method used appears adequate as long as the savings

<b>Reviewed Parameter</b>	<b>Analysis</b>
	input assumptions can be verified through the pending data request.
	ED Recommendation: Method approved. Use ED's rectifier efficiency as the baseline.
<b>Pre- or Post-Installation M&amp;V Plan</b>	IOU Proposal: Not clearly stated
	ED Assessment: Post installation plant amps data collected on an hourly basis over a two-week period and actual installed rectifier quantity and efficiency should be used to true-up the project impacts.
	ED Recommendation: Ex ante savings will be estimated based on post installation plant amps data collected on an hourly basis over a two-week period and actual installed rectifier quantity and efficiency.
<b>Net-to-Gross Review</b>	IOU Proposal: Not provided
	ED Assessment: Assessment not finalized
	ED Recommendation: TBD