

1. OVERALL REVIEW SUMMARY	
1.1 Submission Information	Title: Prescriptive Whole House Retrofit Program (PWHRP) Work paper: PGECOALL104 071310 IOUs: PG&E Date: 7/12/2010
1.2 Summary	This work paper (WP), together with any referenced WPs, covers a prescriptive whole house retrofit program designed to provide downstream incentives to customers for installation of a prescriptive package of energy-efficiency measures targeting single-family residences. Only one prescriptive package is proposed comprising four measures: HVAC duct test and sealing, attic/ceiling insulation, blower door-directed infiltration weatherization, and domestic hot water (DHW) pipe insulation. For residences where this package of prescriptive measures is not suitable, homeowners may wish to consider the ‘performance’ version of the Whole House Retrofit program, i.e., custom measures.
1.3 Measure Categorization	Sectors: Residential Categories: HVAC and DHW
1.4 DEER Applicability	While there are DEER measures available that are similar for some of the proposed prescriptive package of measures, there are no DEER measures that match the specifications for the proposed measures exactly nor does DEER account for the interactive effects between multiple measures installed in the same facility as is the case for this proposed program.
1.5 Measure Package Status	<i>Resubmission with all recommendations addressed is required for approval.</i>
1.6 Recommendations	The Energy Division, Data Management and Quality Control reviewers (ED/DMQC) have developed the following recommendations. IMPORTANT NOTE: The first two recommendations below are mutually exclusive. 1.6.1. The large discrepancies in EnergyPro simulation results between versions 5.0.23.4 and 5.1.0.0 should be clarified and the more reliable results resubmitted along with recalibrated baseline simulation UECs for all climate zones targeted by this program. Owing to the significant discrepancies detected in this review between different versions of EnergyPro, the EnergyPro results must demonstrate good agreement with DEER results and procedures for all targeted climate zones as follows: a) The duct seal and attic insulation measure should be re-run independently (i.e., as single measures) and be shown to agree within 10% of DEER/Miser single measure results

	<p>for the same measures.</p> <p>b) The simulations for all measures should be re-run in a cascade of individual measures (that accumulates into the total package of measures, i.e., one measure added per run to a growing package of interacting measures. In this manner, incremental impacts for each run can be demonstrated while the interactive effects between multiple measures in the package of measures is fully accounted for. Predicted savings for individual measures from this cascaded set of runs must compare within 10% of the savings for individual measures and within 5% of the total package of measures predicted by the DEER/eQUEST-based results prepared by ED in the course of this program planning and development (provided as an attachment herewith).</p> <p>c) The simulations must be conducted in a manner that prevents the HVAC units from resizing (e.g., down sizing) from one run (measure) to the next due to altered (e.g., reduced) thermal load. In other words, the HVAC unit size assumed in the baseline simulation must be carried through to all subsequent measure runs for each prototype and climate zone.</p> <p><u>OR</u></p> <p>1.6.2. Owing to the short time that remains available to roll out the PWHRP, an alternative recommendation is to adopt the PWHRP energy savings estimates for measures previously prepared by ED in support PWHRP planning (provided as an attachment herewith).</p> <p>Further recommendations:</p> <p>1.6.3. An additional measure, low-flow showerheads and/or low-flow showerheads with integral thermostatic shutoff valve, should be included in the PWHRP package of prescriptive measures to allow a statewide average savings of approximately 10% be attained.</p> <p>1.6.4. Specific language must be added to the PWHRP WP describing how double counting savings for low-flow shower devices will be avoided by avoiding the use of low-flow shower devices that may have already participated in midstream and upstream incentive programs. As an example, requiring participating contractors to purchase low-flow showerhead devices directly from the program implementer who will develop a bulk purchase arrangement separate and aside from core program offerings, as was recently suggested by PG&E, would be an acceptable approach.</p> <p>1.6.5. While inclusion of all five measures for each PWHRP</p>
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	<p>participant should be the goal, this is not required. Specific language should be added to the PWHRP WP indicating the following rules for PWHRP participation:</p> <ul style="list-style-type: none"> a) The PWHRP was designed for residences with central air conditioners and furnaces (i.e., homes with HVAC ducts), however, residences without HVAC ducts (i.e., without central AC or furnaces) may participate in the program. For participating residences with HVAC duct systems, the duct sealing measure is required. b) Infiltration air sealing is required for all participating residences and is understood to occur as part of the combustion safety testing and directed by the use of blower door testing. c) Blown-in attic insulation will be added to all assessable ceiling/roof areas so as to provide an average R-value of R-38. d) DHW pipe wrap insulation will be added to all accessible un-insulated DHW HW piping. e) Low-flow showerheads should be direct installed whenever possible and when approved by the customer; however, the installation of low-flow shower heads and/or low-flow thermostatic shut off valves is not required for PWHRP program participation.
<p>1.7 Reviewer Contact</p>	<p>Reviewer: DMQC/James J. Hirsch and Associates Name: Marlin Addison and Kevin Madison Date: July 26, 2010 Contact Information: marlin.addison@doe2.com</p>
<p><explanation of the general format for following sections></p>	<p>Each of the sections is completed by the reviewer of the workpaper to include the following:</p> <p><u>Summary</u> - Summarize information of in the workpaper with respect to the topic in the left column. For example, if the topic is "EUL" then the summary should state what the workpaper recommends for the EUL.</p> <p><u>Discussion</u> - Provide a discussion of the approaches in the workpaper and outline any concerns with approaches. If workpaper is missing information and that information is necessary to review the measure, examples of how that information can be presented are a good way to inform the IOU of ways to address the missing information.</p> <p><u>Recommendation</u> - Brief but specific description of additional work or revisions needed for workpaper to be acceptable.</p>
<p>2. BASE CASE REVIEW</p>	

<p>2.1 Eligibility and Documentation</p>	<p><u>Summary</u> Eligibility is restricted to current PG&E single-family residential customers’ existing residences (not applicable to new construction). All work is to be performed by a licensed contractor. Other contractor qualification requirements are stipulated in the Program Implementation Plan. The program should primarily target residences with central (i.e., ducted) air conditioning, though this is not required for participation.</p> <p><u>Discussion</u> No test-in or screening procedures are described in the WP. Baseline energy consumption was estimated using DEER simulation models for the oldest two DEER vintages (pre-1978 and 1978-1992). These two vintages represent approximately 85% of the single-family residential housing in the targeted service territory, hence CPUC/ED requires no specific screening based on residence age, however, see the recommendations below for measure-specific screening suggestions.</p> <p><u>Recommendations</u> While inclusion of all five measures for each PWHRP participant should be the goal, this is not required. See section 3.3.3 for required rules for PWHRP participation.</p>
<p>2.2 Code Implications</p>	<p><u>Summary</u> Title 24 covers new construction and major retrofits for single family residences. This WP proposes efficiency measures that represent minor retrofit for existing homes only, therefore, no energy code implications apply.</p> <p><u>Discussion</u></p> <p><u>Recommendations</u></p>
<p>2.3 Energy – Base Case Technology Enduse Energy Consumption</p>	<p><u>Summary</u> The proposed measures were modeled using EnergyPro version 5.0.23.4. Review comments from previous PG&E PWHRP WPs directed PG&E to ensure that the simulated baseline energy reflected annual end use energy consumption levels consistent with the most recent RASS EUCs for the most populous climate zone (CZ03).</p> <p><u>Discussion</u> Review of simulation results submitted with this WP found that while the total simulated annual electric and natural gas usage tracked fairly closely with DEER 2008 (Miser) simulation results, the cooling end use EUCs from the simulations did not reflect DEER 2008 (Miser) EUCs, e.g., EnergyPro cooling electric was more than twice the DEER 2008 amount.</p> <p>EnergyPro input files for selected cases were also re-run as a spot check of simulation results. The re-runs were performed using the</p>

	<p>version of EnergyPro that was released immediately following v5.0.23.4, i.e., v 5.1.0.0. Comparison of these re-run results with the original (submitted) results revealed identical results for non-HVAC end uses but very significant differences in cooling (re-runs 30%-50% lower than original runs), heating (re-runs 40%-70% higher than original runs) and indoor HVACC fan results (re-runs 30%-50% higher than original runs).</p> <p>Additional discussion, comments and requirements are provided in previous PWHRP WP review comments (attached).</p> <p><u>Recommendations</u> See Section 3.3.3 below.</p>
<p>2.4 Effective Useful Life</p>	<p><u>Summary</u> See measure/impacts section.</p>
<p>2.5 Cost</p>	<p><u>Summary</u> See measure/impacts section.</p>
<p>3. MEASURE/IMPACT REVIEW</p>	
<p>3.1 Eligibility and Documentation</p>	<p><u>Summary</u> See section 2.1 above.</p>
<p>3.2 Code Implications</p>	<p><u>Summary</u> None.</p>
<p>3.3.1 Energy Impacts - Summary</p>	<p><u>Summary</u> The predicted energy savings for the measures were found to be significantly inconsistent with the DEER-based simulation results prepared by ED and used in the PWHRP planning with the IOUs.</p> <p><u>Discussion</u> See the following section.</p> <p><u>Recommendations</u> See the following section.</p>

<p>3.3.3 Enduse Energy Impacts</p>	<p><u>Summary</u> The simulation-predicted energy savings for the attic insulation measure was found to provide the majority (~90%) of the total package benefit while the duct sealing measure was found to provide a significant penalty (i.e., increase in energy use) for many cases. These and other results are significantly inconsistent with the DEER-based simulation results prepared by ED and used in the PWHRP planning discussions with the IOUs.</p> <p><u>Recommendations</u> IMPORTANT NOTE: Recommendations 1 and 2 below are mutually exclusive. PG&E may opt to implement either 1 or 2.</p> <ol style="list-style-type: none"> 1) The large discrepancies in EnergyPro simulation results between versions 5.0.23.4 and 5.1.0.0 should be clarified and the more reliable results resubmitted along with recalibrated baseline simulation UECs for all climate zones targeted by this program. Owing to the significant discrepancies detected in this review between different versions of EnergyPro, the EnergyPro results must demonstrate good agreement with DEER results and procedures for all targeted climate zones as follows: <ol style="list-style-type: none"> a) The duct seal and attic insulation measure should be re-run independently (i.e., as single measures) and be shown to agree within 10% of DEER/Miser single measure results for the same measures. b) The simulations for all measures should be re-run in a cascade of individual measures (that accumulates into the total package of measures, i.e., one measure added per run to a growing package of interacting measures. In this manner, incremental impacts for each run can be demonstrated while the interactive effects between multiple measures in the package of measures is fully accounted for. Predicted savings for individual measures from this cascaded set of runs must compare within 10% of the savings for individual measures and within 5% of the total package of measures predicted by the DEER/eQUEST-based results prepared by ED in the course of this program planning and development (provided as an attachment herewith). c) The simulations must be conducted in a manner that prevents the HVAC units from resizing (e.g., down sizing) from one run (measure) to the next due to altered (e.g., reduced) thermal load. In other words, the HVAC unit size assumed in the baseline simulation must be carried through to all subsequent measure runs for each prototype and climate zone.
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	<p><u>OR</u></p> <p>2) Owing to the short time that remains available to roll out the PWHRP, an alternative recommendation is to adopt the PWHRP energy savings estimates for measures previously prepared by ED in support PWHRP planning (attached).</p> <p>Further recommendations:</p> <p>3) One additional measure, low-flow showerheads and/or low flow showerheads with integral thermostatic shutoff valves, should be included in the PWHRP package of prescriptive measures to allow a statewide average savings of approximately 10% to be attained. See the discussion and recommendations specifically addressing the Low-Flow Showerhead WP and measure inclusion in PWHRP provided in the review comments for the SCE-SCG PWHRP WP (attached).</p> <p>4) Specific language must be added to the PWHRP WP describing how double counting savings for low-flow shower devices will be avoided by avoiding the use of low-flow shower devices that may have already participated in midstream and upstream incentive programs. As an example, requiring participating contractors to purchase low-flow showerhead devices directly from the program implementer who will develop a bulk purchase arrangement separate and aside from core program offerings, as was recently suggested by PG&E, would be an acceptable approach.</p> <p>5) While inclusion of all five measures for each PWHRP participant should be the goal, this is not required. Specific language should be added to the PWHRP WP indicating the following rules for PWHRP participation:</p> <p>a) The PWHRP was designed for residences with central air conditioners and furnaces (i.e., homes with HVAC ducts), however, residences without HVAC ducts (i.e., without central AC or furnaces) may participate in the program. For participating residences with HVAC duct systems, the duct sealing measure is required.</p> <p>b) Infiltration air sealing is required for all participating residences and is understood to occur as part of the combustion safety testing and directed by the use of blower door testing.</p> <p>c) Blown-in attic insulation will be added to all assessable ceiling/roof areas so as to provide an average R-value of R-38.</p> <p>d) DHW pipe wrap insulation will be added to all accessible un-insulated DHW HW piping.</p> <p>e) Low-flow showerheads should be direct installed whenever possible and when approved by the customer; however, the installation of low-flow shower heads and/or low-flow thermostatic shut off valves is not required for PWHRP</p>
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	program participation.
3.3.4 Whole Building Energy Impacts/HVAC Interactive Effects	<p><u>Summary</u> The whole building energy impacts and the necessary interactive effects between measures and end uses ('secondary effects') should be adequately treated in this analysis.</p> <p><u>Discussion</u> Implementing either recommendation 1 or 2 under Section 3.3.3 above should meet this requirement adequately.</p> <p><u>Recommendations</u> None.</p>
3.3.5 Impact Load Shape	<p><u>Summary</u> None.</p> <p><u>Discussion</u></p> <p><u>Recommendations</u></p>
3.3.6 Peak Demand Impact	<p><u>Summary</u> None.</p> <p><u>Discussion</u></p> <p><u>Recommendations</u></p>
3.4 Effective Useful Life	<p><u>Summary</u> None.</p> <p><u>Discussion</u></p> <p><u>Recommendations</u></p>
3.5 Cost	
4. MEASURE/PROGRAM EFFECTIVENESS	
4.1 Incentive Levels	<p><u>Summary</u></p>
4.2 Net-To-Gross Ratio	<p><u>Summary</u> Proposes NTG = 0.8 as per row 46 in the DEER TNG spreadsheet, 'Updated DEER NTG Values for 2006-07 final 2008-10-10.xls', "Default values for new measures or delivery methods where no previous NTG results are available."</p> <p><u>Discussion</u> The NTG value cited in the WP is intended for use in 2009 Bridge Funding period reporting. The correct source for NTG values for 2009-2011 planning is 'Updated DEER NTGR Values - 053008.xls'. The same NTG spreadsheet provides for a default NTG value of 0.85 for cases of "Existing Direct Installed measures for Hard to Reach markets" (see row 58).</p> <p><u>Recommendation</u></p>

	ED recommends NTG = 0.85 for the PWHRP.
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