

**Subject** Focus on Energy Evaluation

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**Review of ACES New Construction Project Tracking**

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**From** Ronald Swager, David Kramer, Chris Burger,  
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In a previous Focus on Energy evaluation memo<sup>1</sup>, evaluators noted difficulties in verifying energy savings for measures implemented as part of new construction projects. The files for the projects they were asked to verify did not consistently contain sufficient information on the baselines, calculation methodologies, and model inputs used to calculate the energy savings. The following was a key finding of that report:

Records were not always provided or available for calculation of savings for custom measures that would support a review of those calculations. Therefore, an engineering review of those calculations was not always possible and so the evaluation findings for these measures are limited in their value. We believe that an effort has been made to make reasonable estimates of savings. However, in the future, documentation of the calculations should be maintained in such a way that they can be provided to evaluators to facilitate a more informative review.

In response to this report, the ACES program team developed a plan for modifying their project tracking efforts to ensure adequate information was maintained for each ACES new construction project. This plan, *ACES New Construction Program Plan* (see Attachment A), was submitted to the evaluation team for review and it was agreed that the plan was reasonable and should be implemented.

PA Consulting Group (PA) has contracted with Patrick Engineering (Patrick) to review the status of WECC/Franklin Energy's new tracking process for ACES new construction projects and to determine if:

- The process is being implemented as planned
- A clear understanding is provided of how the savings estimates for these projects are



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<sup>1</sup> Ronald Swager, Lauren Erdmantis, and Chris Burger, Patrick Engineering. *ACES On-site Verification Inspections: Observations Summary*. March 31, 2009.

being established and tracked

- The baselines and modeling inputs and results are reasonable
- The information project tracking information is consistent with the information captured in WECC's program impacts tracking system.

In late fall of 2009, PA provided Patrick Engineering with an excerpt from the ACES database which contained the records for five randomly selected, recently completed ACES new construction projects from WECC's program impacts tracking system. These records contained contact information, measure descriptions, and the final energy savings and incentives determined for each measure. However, these records did not provide sufficient information on the calculations used to determine the recorded energy savings, such as calculations used and inputs for variables in the calculations. Patrick submitted a data request to Franklin Energy for the relevant back-up documentation on the selected sample projects that was requested in the ACES New Construction Program Plan.

Franklin Energy provided Patrick with a 10-step summary of the new construction project process, "ACES New Construction Process Summary" (see Attachment B), along with the project workbooks for five sample projects and their database entries. These project workbooks consist of a series of tabbed spreadsheets in a standardized format that track and document the project correspondence, savings and incentive calculations, and verification.

The projects reviewed were:

- Hillsi35924Clair54773
- Herita111Owen53716
- CLARKE1740PIERC53204
- Miles 800Nebra54902.

Reviva4711Jenew53711, where a project consisted of more than one building, had a separate project workbook for each different building configuration. A total of nine workbooks were reviewed.

To organize the review, the *ACES New Construction Project Tracking Plan* and the *ACES New Construction Process Summary* are included below in italics. Beneath each data tracking requirement and process step are comments on how the project workbooks support each measure and, where warranted, recommendations for changes or additions.

## ***ACES New Construction Project Data Tracking Plan***

*For all projects, a short report summarizing the project should be prepared. This report should detail the specific measures (or combinations of measures), assumptions for each measure, associated incentive for each, and key requirements and efficiency levels that need to be met to qualify for the incentive. This report will be clear, concise, and complete for the purposes of evaluation and program review. Additionally, the information required will be in easily located format.*

*For the reports, the following information is required:*

- 1. Focus Logo and Name, Date of the report, customer's name, project name, and name/contact information of the energy modeling firm*

The "Project Info" spreadsheet in the project workbook captures this data. No specific report date is given, but the sheet captures several milestone dates throughout the process.

RECOMMENDATION: Add a field to identify the "PKcustomerID" from the ACES database entry for an unambiguous connection between the project workbooks and the database.

- 2. Timeline of project milestones and contacts.*

The "Project Info" spreadsheet in the project workbook captures this data. Another spreadsheet alternately labeled "communications" or "task log" also captures the dates of various activities. Some of the project workbooks included embedded documents on this spreadsheet, while others used a simple table to track events. The actual events tracked varied project to project. Contact information is limited unless one digs into application forms or other documents embedded in the spreadsheet.

RECOMMENDATIONS: Add street address for building and phone numbers for project contacts to Project Info sheet. Standardize format and content of "communications/tasklog" spreadsheet.

- 3. Summary of the energy savings measures (ESMs), including key parameters used in energy modeling for the baseline model and "proposed building" model.*

The "Summary" spreadsheet provides a list of all baseline assumptions and energy savings measures in five categories: plumbing system, envelope improvement, mechanical system, lighting, and appliances. Each ESM is indicated as deemed or custom. For custom measures, the modeling software is indicated. While not all the model inputs are available here, this requirement is met.

4. *The energy modeling software used.*

The “Summary” spreadsheet captures this information. In nearly all cases, it has been either eQuest or an FES Excel spreadsheet. In addition, copies of the output files of the modeling software are embedded as PDF files in the spreadsheet tabbed “Embedded Calcs.”

5. *Energy usage / savings information (kW, kWh, and Therms)*

The “Summary” spreadsheet lists the calculated energy savings. For custom measures, the spreadsheet tabbed “Energy Modeling Scope” lists calculated energy usage information under different modeling assumptions. No usage information is captured for ESMs with deemed savings.

6. *kW number should be out to two decimal places. kWh and Therms can be 0 decimals.*

The “Energy Modeling Scope” spreadsheet shows kW, kWh, and therms to the precision requested. The “Summary” spreadsheet shows kW and kWh to three and two decimal places respectively. In three of the project workbooks, the “Energy Modeling Scope” spreadsheet was alternatively labeled “Model Rpt. AL & MC”, “kW, kWh, and therms,” or “model rpt-Ind Living.”

RECOMMENDATIONS: Round to the same precision on both spreadsheets. Be consistent on the spreadsheet designation.

7. *Baseline energy use (without any efficiency improvements)*

The “Energy Modeling Scope” spreadsheet shows the results of the modeling calculations for the baseline construction assumptions. This requirement is met.

8. *Proposed energy use with efficiency improvements*

The “Energy Modeling Scope” spreadsheet shows the results of the modeling calculations for various combinations of proposed ESMs, and with the finalized list of ESMs to be implemented. This requirement is met.

9. *Energy savings (Baseline - Proposed)*

The “Summary” spreadsheet lists the calculated energy savings (baseline-proposed) for each measure and the total for the building.

RECOMMENDATIONS: Link the results on the “Energy Modeling Scope” spreadsheet to the “Summary” spreadsheet to indicate where numbers are derived from and to avoid transcription errors. Add “Savings = Baseline - Proposed” columns to the right on the “Energy Modeling Scope” spreadsheet.

*10. Energy cost savings, including % of cost saved over baseline.*

The “Summary” spreadsheet includes a calculation of the percentage energy cost savings for each measure calculated. This requirement is met.

*11. Estimated and actual incentive based on the tier system and clearly show the percent of energy cost saved and tie this to the appropriate incentive tier.*

The “Summary” spreadsheet includes these calculations and indicates the incentive tier. There is no indication of whether these numbers are estimated or actual, but it is assumed that the percentages of energy cost savings shown on the “Summary” spreadsheet are final. Preliminary estimates of incentives are included on other tracking documents, such as the proposal form, embedded in the “Project Info” spreadsheet.

*12. Electric and natural gas utility rates and how these were determined - directly from applicable utility rate (specify which rate and the effective date) or from prior 12 months utility bills (if the new facility will be on same rate as an existing facility for the customer) are the preferred methods.*

Utility rates are shown on the “Summary” spreadsheet but there is no data on the source of these numbers included in the project workbook.

RECOMMENDATION: Include Utility Rate source data in the project workbook.

*13. As a follow-up to the report, provide clear direction on whether each measure/groups of measures was accepted by the customer or not.*

The signed proposal agreement that is embedded in the “Project Info” spreadsheet shows the measures agreed to by the customer. The spreadsheet tabbed “Verification” includes those measures that have been verified as implemented.

RECOMMENDATION: A simple checkbox on the summary list of measures to indicate client agreement would be a simpler, clearer way to show this information.

*14. Provide clear direction on whether measures / groups of measures are additive (i.e., modeling run 1 = measure 1, modeling run 2 = measure 1 and measure 2, etc.) or mutually exclusive (modeling run 1 = HVAC system type 1, modeling run 2 = HVAC system type 2).*

The “Energy Modeling Scope” spreadsheet shows the results of the modeling calculations for various combinations of proposed ESMs, and with the finalized list of ESMs to be implemented. Colored highlighting clearly indicates the ESMs included in each run. In addition, the model output sheets embedded in the spreadsheet tabbed “Embedded Calcs” or “Calcs” indicate incremental effects of additional ESMs. It was noted that in the workbooks reviewed, no lighting ESMs were modeled in conjunction with envelope or mechanical ESMs to assess their interaction.

15. *For lighting measures, provide some guidance / explanation of how the lower lighting power density is achieved. Examples: keep lighting levels to minimum required for the space type, use high performance T8 components, choice of fixture type (direct/indirect fluorescent, high bay fluorescent), reduce number of lamps, reduce number of fixtures, etc.*

Some explanation of the lighting ESMs is provided on the “Summary” sheet” and additional information is available in the embedded calculation spreadsheets. Numbers and types of lamps are collected. The “Measure Description” field in the database also contains some information on the lighting system configuration.

16. *Separate from the report, provide detailed input / output for reports from the energy modeling software and a copy the actual modeling files for both the baseline and proposed versions of the energy model. This information should be kept separately from the report that is sent to the customer, and is needed for the Focus on Energy program evaluators.*

The embedded calculation spreadsheets contain the necessary input and output data within the spreadsheet. Output files from eQuest modeling are also embedded in the “Calcs” spreadsheet. Some of the input assumptions for the eQuest models are provided in the “Energy Modeling Scope” spreadsheet, but complete modeling input files are not collected. The “Energy Modeling Scope” spreadsheet does indicate that DOE 2 reports are available upon request but are not included because of their size. These reports would be necessary, in addition to the project workbook, for a third party evaluator to recreate the modeling calculations.

17. *Any supporting information and documentation that sufficiently explains the project to the evaluators and program staff.*

Application forms, signed agreements, verification forms, and payment requests are captured and embedded as PDF files on the “Project Summary” sheet. Preliminary recommendations and subsequent proposals are captured on separate tabs in the Project Workbook. There are no explanatory narratives of the project included.

## **ACES New Construction Process Summary**

1. *For a new lead, request that a project team member submit a completed ACES NC application, providing valuable details about the project as well as contact information for the most important project team members.*

The “Project Summary” spreadsheet in the project workbook captures the Application and some of the contact information.

RECOMMENDATION: Copy additional location and contact information to the Project workbook on either the “Project Summary” spreadsheet or a separate tab.

2. *Create a database entry and hard copy folder shortly within a week of receiving a completed application.*

RECOMMENDATION: This process summary should include creating the project workbook file at this point, and that the “PKCustomerID,” the location information and contact information from the database entry be included in the project workbook

3. *Start creating database Notes summarizing substantial communication with project team members (and enter them retroactively prior to the receipt of the application, back to the time of initial contact).*

The project workbook captures these notes on the “Communications/Task Log” spreadsheet.

4. *Within three weeks of receiving an application, issue a Preliminary Proposal, i.e., a broad set of potential energy efficiency measures, averaging four pages in length that is tailored to the building type (e.g., low- vs. high-rise, and with or without underground parking).*

The project workbook captures the preliminary and subsequent proposals as separate tabbed spreadsheets.

5. *Answer questions that project team members have about specific recommendations in the Preliminary Proposal and follow up with technical information regarding energy efficiency measures in which project team members express interest. Continue to create Notes documenting these dialogues.*

The project workbook captures these notes on the “Communications/Task Log” spreadsheet.

6. *Around the start of construction, begin to compile construction drawings, specs, and schedules necessary for energy modeling and other calculations of potential rewards.*

The project workbook captures some of this information in various places—square footage, number of floors, envelop R/U-values, mechanical system efficiencies—but the data collected is deficient in several items that would be necessary for a third-

party evaluator to validate modeling results by repeating the model, by hand calculations, or by an alternate model. Primarily, information on the shape and orientation of the building that would affect heat gains and losses is missing.

**RECOMMENDATION:** The project workbook should include a tab with additional information on the building. Specifically, the building's shape, dimensions, N/S orientation, foundation type, and whether there are conditioned spaces below ground level should be included.

7. *While documents are being received, review their energy implications and enter details for measures on the project workbook's Summary tab.*

This is accomplished.

8. *After savings are calculated, enter the numbers on the Summary tab, which computes the associated reward.*

This is accomplished.

9. *After calculating savings for multiple measures, issue a quantified Proposal (typically a page long). Issue substitute Proposals or amendments as new or different information is provided by project team members.*

The project workbook captures the proposal and substitute proposals as separate tabbed spreadsheets or as embedded PDF files.

10. *Around the time construction is scheduled to finish, make a site visit to verify installed measures listed on the most recent Proposal(s).*

The project workbook captures the verification form as an embedded PDF file and includes a tabbed sheet that contains photo verification of the implemented ESMs.

## ***Baseline Assumptions and Modeling Results***

We have reviewed the baseline assumptions, and the inputs and results of the modeling calculations in the nine project workbooks we were provided for review. Though we did not repeat or validate the calculations, in our engineering judgment there were no assumptions, inputs, or results that appeared unreasonable or unexpected.

## ***Correspondence between Project Workbooks and ACES Database***

The Project workbooks were spot-checked for their correspondence with the records in the ACES database. There were no discrepancies found in the calculated energy savings and incentives from the Workbooks and the entries in the ACES database. There was at least one entry (Measure ID RRA14) in the workbooks that appeared to be completed, with savings and

incentives calculated and installation verified, that had not been entered in the ACES database. It was not clear if this was an oversight or excluded for some other reason.

There were discrepancies in the use of the "Quantity" field in the ACES database. For example, Measure ID CST1 combines a mix of 183 plumbing fixtures in three types into one entry with a "Quantity" of one, where a similar application at another site separated the fixture types out into two measures, MK2 and MK3 with quantities of 8 and 12 respectively. Other types of equipment replacements with multiple units typically list the number of units under "Quantity." It is recommended that policy require the actual number of units be entered in the "quantity" field.

## ***Conclusion***

The ACES New Construction Project Tracking System appears to meet the planned requirements in the majority of instances. A few easily remedied deficiencies are noted above, but as a whole, the system should provide an adequate understanding of each project and allow for verification of the energy savings from the implemented energy savings measures.

## ***Attachment A***

### **ACES New Construction Program Plan**

For all projects, a short report summarizing the project should be prepared. This report should detail the specific measures (or combinations of measures), assumptions for each measure, associated incentive for each, and key requirements and efficiency levels that need to be met to qualify for the incentive. This report will be clear, concise, and complete for the purposes of evaluation and program review. Additionally, the information required will be in easily located format.

For the reports, the following information is required:

- Focus Logo and Name, Date of the report, customer's name, project name, and name/contact information of the energy modeling firm
- Timeline of project milestones and contacts.
- Summary of the energy savings measures, including key parameters used in energy modeling for the baseline model and "proposed building" model.
- The energy modeling software used.
- Energy usage / savings information (kW, kWh, and Therms)
- kW number should be out to two decimal places. kWh and Therms can be 0 decimals.
- Baseline energy use (without any efficiency improvements)
- Proposed energy use with efficiency improvements
- Energy savings (Baseline — Proposed)
- Energy cost savings, including % of cost saved over baseline.
- Estimated and actual incentive based on the tier system and Clearly show the percent of energy cost saved and tie this to the appropriate incentive tier
- Electric and natural gas utility rates and how these were determined - directly from applicable utility rate (specify which rate and the effective date) or from prior 12 months utility bills (if the new facility will be on same rate as an existing facility for the customer) are the preferred methods.
- As a follow-up to the report, provide clear direction on whether each measure/groups of measures was accepted by the customer or not.
- Provide clear direction on whether measures / groups of measures are additive (i.e., modeling run 1 = measure 1, modeling run 2 = measure 1 and measure 2, etc.) or mutually exclusive (modeling run 1 = HVAC system type 1, modeling run 2 = HVAC system type 2).

- For lighting measures, provide some guidance / explanation of how the lower lighting power density is achieved. Examples: keep lighting levels to minimum required for the space type, use high performance T8 components, choice of fixture type (direct/indirect fluorescent, high bay fluorescent), reduce number of lamps, reduce number of fixtures, etc.
- Separate from the report, provide detailed input / output for reports from the energy modeling software and a copy the actual modeling files for both the baseline and proposed versions of the energy model. This information should be kept separately from the report that is sent to the customer, and is needed for the Focus on Energy program evaluators.
- Any supporting information and documentation that sufficiently explains the project to the evaluators and program staff.

## **Attachment B**

### ACES New Construction Process Summary

1. For a new lead, request that a project team member submit a completed ACES NC application, providing valuable details about the project as well as contact information for the most important project team members.
2. Create a database entry and hard copy folder shortly within a week of receiving a completed application.
3. Start creating database Notes summarizing substantial communication with project team members (and enter them retroactively prior to the receipt of the application, back to the time of initial contact).
4. Within three weeks of receiving an application, issue a Preliminary Proposal, i.e., a broad set of potential energy efficiency measures, averaging four pages in length, that is tailored to the building type (e.g., low- vs. high-rise, and with or without underground parking).
5. Answer questions that project team members have about specific recommendations in the Preliminary Proposal and follow up with technical information regarding energy efficiency measures in which project team members express interest. Continue to create Notes documenting these dialogues.
6. Around the start of construction, begin to compile construction drawings, specs, and schedules necessary for energy modeling and other calculations of potential rewards.
7. While documents are being received, review their energy implications and enter details for measures on the project workbook's Summary tab (
8. After savings are calculated, enter the numbers on the Summary tab, which computes the associated reward.
9. After calculating savings for multiple measures, issue a quantified Proposal (typically a page long). Issue substitute Proposals or amendments as new or different information is provided by project team members.
10. Around the time construction is scheduled to finish, make a site visit to verify installed measures listed on the most recent Proposal(s).