Documentation of the BEMCmpMgr (CEC Compliance Manager) DLL
For Analysis of Residential Buildings
SAC 11/7/2019 (v22) (recent changes in Red font)

The purpose of this document is to provide information needed to develop software interfaces to the CEC Compliance engine DLL(s). The primary library third party tools will interface with is BEMCmpMgr19r.dll for 2019 analysis. These DLLs manage the compliance analysis processing, including:

- Evaluation of compliance rules on user input building models (via BEMProc19r.dll for 2019),
- Simulation of the proposed and standard building models (via CSE.exe for all enduses, including DHW), and
- Generation of compliance reports (informal reports internal to compliance manager, certified reports via web-based report generator).

The analysis engine DLLs are now based solely on open source dependencies (primarily boost, Qt C++ & OpenSSL libraries), whereas the CBECC-Res UI still requires Microsoft (Windows) libraries.

There are only a handful of exports needed to perform compliance analysis and retrieve analysis results/reports. One performs the analysis (and potentially generates a report), another to generate a draft report from an existing analysis results file, three more enable the retrieval of data (inputs and/or results) from the building model following analysis, a couple more to retrieve error messages and the last is used to clean-up following exit.

Recommended sequence of events (assuming use of Visual Studio & C++) for a scenario where direct linking to the compliance manager DLLs is not required:

1. Load the pertinent DLLs via LoadLibrary() -->> "libeay32.dll" , "ssleay32.dll" , "Qt5Core.dll", "Qt5Xml.dll", "Qt5Gui.dll", "Qt5Network.dll", "Qt5WebKit.dll", "Qt5Widgets.dll", and then "BEMProc19r.dll" and "BEMCmpMgr19r.dll" (for 2019 analysis).
   This step MAY not be required if the third party application and these referenced DLLs are located in the same directory.

2. Call GetProcAddress() to retrieve function pointers to each DLL function you plan to call.

3. For each building model to be simulated:
   - Call `CMX_PerformAnalysis_CECRes()` to perform the compliance analysis. An Alternative here is to use `CMX_PerformAnalysisCB_CECRes()` if you wish to provide a callback function pointer enabling progress monitoring and mid-analysis abort within your application.
   - If the desired compliance report(s) are not generated via the Analysis call above, then call `CMX_GenerateReport_CEC()` (or `CMX_GenerateReport_Proxy_CEC()` to provide proxy server info) to generate a PDF compliance report based on the results contained in an XML file identified by the calling application.
   - Call `CMX_GetDataString()`, `CMX_GetDataInteger()`, &/or `CMX_GetDataFloat()` any number of times to retrieve building model inputs, calculated defaults or simulation results (anything stored in the building model).
   - Call `CMX_PopulateCSVResultSummary_CECRes()` to populate a character string with results of a

compliance analysis run.
- Call `CMX_GetRulesetErrorCount()` to retrieve the number of errors encountered during the analysis and `CMX_GetRulesetErrorMessage()` to retrieve individual error message character strings.
- Call `CMX_PopulateCSVHourlyResults_CECRes()` to export a CSV file containing hourly simulation results and TDV multipliers for a single analysis run (proposed vs. standard…).

4. Call `CMX_ExitBEMProcAndCmpMgrDLLs()` following all simulations to clean-up BEMProc & BEMCmpMgr data.

5. Unload the loaded DLLS (in reverse order) via FreeLibrary() -->> "BEMCmpMgr19r.dll" and "BEMProc19r.dll" (for 2019), then "Qt5Widgets.dll", "Qt5WebKit.dll", "Qt5Network.dll ", "Qt5Gui.dll", "Qt5Xml.dll", "Qt5Core.dll", "ssleay32.dll", and "libeay32.dll"
This step not required if the third party DLLs are not explicitly loaded in step 1.

Function Reference

The following are names and documentation pertaining to the compliance manager routines referenced above

```
int CMX_PerformAnalysis_CECRes(                  const char* pszBEMBasePathFile,
            const char* pszRulesetPathFile,      const char* pszCSEEXEPath,
            const char* pszCSEWeatherPath,       const char* pszDHWDLLPath,
            const char* pszDHWWeatherPath,       const char* pszProcessingPath,
            const char* pszModelPathFile,        const char* pszLogPathFile,
            const char* pszUIVersionString,      bool bLoadModelFile,
            const char* pszAnalysisOptionsCSV,
            char* pszErrorMessage,               int iErrorMsgLength,
            bool bDisplayProgress,               HWND hWnd,
            int iSecurityKeyIndex,               const char* pszSecurityKey );

      // typedef int  (__cdecl *PCMX_PerformAnalysis_CECRes)(  const char*,
      //                        const char*, const char*, const char*,
      //                        const char*, const char*, const char*,
      //                        const char*, const char*, const char*, bool,
      //                        const char*, char*, int, bool, HWND, int,
      //                        const char* );
      // _CMX_PerformAnalysis_CECRes
```

where:

- pszBEMBasePathFile is a null terminated string containing the path and filename of the data model definitions file. This should not be specified (pass in NULL) unless the run being performed uses a different data model as the one previously used to initialize the DLLs or perform a simulation.
- pszRulesetPathFile is a null terminated string containing the path and filename of the ruleset file used to process the building model and generate the CSE simulation inputs. This should be specified for each run when switching building models, as it re-initializes both the building model and ruleset data. In the CBECC-Res installer, this would be: ‘<Data directory>\Rulesets\CA Res 2019.bin’ (for 2019 analysis).
If a simulation is to be performed on a building model already loaded into memory, then you can specify NULL for this argument.

- pszCSEEXEPath is a null terminated string containing the path (including trailing '\') of the directory where the CSE executable (and ashwat.dll) reside. In the CBECC-Res installer, this would be: '<Program directory>\CSE\'.
- pszCSEWeatherPath is a null terminated string containing path (including trailing '\') of the directory where the CSE weather files reside. In the CBECC-Res installer, this would be: '<Program directory>\CSE\'.
  Weather files from this directory are copied into the processing directory immediately prior to simulation.
- pszDHWDLLPath (no longer used)
- pszDHWWeatherPath (no longer used)
- pszProcessingPath is a null terminated string containing the path (including trailing '\') of the directory where the simulation inputs and outputs will be written.
- pszModelPathFile is a null terminated string containing the path and filename of the building model input (.ribd or .ribd16 native format inputs or XML with extension .xml, .ribdx or .ribd16x) file. The file identified by this argument may or may not be loaded into memory during the simulation processing depending on a subsequent argument.
- pszLogPathFile is a null terminated string containing the path and filename of file to write processing messages to. If specified as NULL (which it typically is), then the log file will be equivalent to the pszModelPathFile specified in the previous argument, but with the file extension replaced with '.log'.
- pszUIVersionString is a null terminated string containing the name and version/ID of the application that is calling this function. This information is stored in the data model for later reporting in CSV results export and (potentially) final compliance reports.
- bLoadModelFile is a boolean indicating whether or not to read the building model (pszModelPathFile) into memory prior to simulation. This should be specified as 'true' (non-zero) unless the calling application has already loaded the building model into memory via a previous call.
- pszAnalysisOptionsCSV is a null terminated string containing a comma separated value (CSV) format for any/all of a number of the following analysis options:
  - FullComplianceAnalysis: boolean (0/1 – default 1): whether or not multiple runs are to be performed during the analysis. When performing a single simulation (w/ Proj:AnalysisType = "Research" or "Proposed Only"), then this flag should be set to 0 and a value of 1 (the default) when Proj:AnalysisType = "Proposed and Standard".
  - InitHourlyResults: booean (0/1 – default 1): whether or not to initialize all hourly results storage prior to performing the simulation. This argument should be 1 (the default) for any individual simulation runs or the first simulation of a multiple compliance simulation run sequence.
  - StoreBEMProcDetails: boolean (0/1 – default 0): whether or not to store detailed building energy model ('.ibd-detail') files during the course of the model defaulting and simulation. Typically set to 1 in testing/debugging phases and turned off (value of 0, the default) for distribution to users (to save time and file I/O).
  - Verbose: boolean (0/1 – default 0): whether or not to write messages to the log file for each rule evaluated on the model and identifying each step in the analysis sequence. Typically set to 1 in testing/debugging phases and turned off (value of 0, the default) for distribution to users (to save time and file I/O – can cause very large log files).
  - PerformRangeChecks: boolean (0/1 – default 1): whether or not to perform range checks on model inputs following the reading and initialization of the building model (pszModelPathFile).

This option should be set to 1 (the default) unless performing runs where violation of the range checks should not terminate the analysis.

- PerformSimulations: boolean (0/1 – default 1): whether or not to perform CSE & T-24 DHW simulations for each model defined for the analysis. This argument should be 1 (the default) except for testing/debugging scenarios where the contents of simulation inputs (and not the simulations results) and or building summary reports are the desired output.
- BypassCSE: boolean (0/1 – default 0): whether or not any/all CSE simulations should be bypassed during the course of performing the analysis. This is typically activated (set to 1) only when performing software testing/debugging.
- IgnoreFileReadErrors: boolean (0/1 – default 0): whether or not analysis should be aborted if errors are encountered while reading building model (project) data from input file.
- ComplianceReportPDF: boolean (0/1 – default 0): whether or not a PDF compliance report will be generated at the conclusion of the analysis, assuming no errors have occurred and no checks or simulation runs were bypassed. In the event a compliance PDF is generated, the file will be located in the project directory and named:
  <project file name> - CF1RPRF01E-BEES.pdf
- ComplianceReportXML: boolean (0/1 – default 0): whether or not a full (XML) compliance report will be generated at the conclusion of the analysis, assuming no errors have occurred and no checks or simulation runs were bypassed. Full XML compliance reports include all analysis inputs and results as well as an imbedded PDF report. In the event a XML compliance report is generated, the file will be located in the project directory and named:
  <project file name> - CF1RPRF01E-BEES.xml
- Silent: boolean (0/1 – default 0): whether or not dialog boxes are permitted to be presented during the analysis. One example is a dialog indicating that a file needing to be written during/following the analysis cannot be written to, prompting the user to close the file in another application it is opened in so that the file can be re-written. A value of '1' will prevent user prompts and issues such as files unable to be written may cause the analysis to be aborted.
- ExportHourlyResults_p: boolean (0/1 – default 0): whether or not CSV files of hourly simulation results (& TDV multipliers) are exported for the run specified by the character(s) trailing the '_' in the option name string. The CSV file(s) generated will be located in the same directory as the project/model input file, with "<ProjectFile> - <RunAbbrev> - HourlyResults.CSV".
  Valid trailing run abbreviation characters include:
  "_p": proposed model (of compliance analysis)
  "_s": standard model (of compliance analysis)
  "_dr": design rating model (of compliance EDR analysis)
  "_u": user-input model (when simulating in 'research' mode)
  "_p-N": the proposed North orientation run (when performing All Orientation compliance)
  "_p-E": the proposed East orientation run (when performing All Orientation compliance)
  "_p-S": the proposed South orientation run (when performing All Orientation compliance)
  "_p-W": the proposed West orientation run (when performing All Orientation compliance)
  "_pfx": the proposed flexibility run (when flexibility design features selected)
  "_pfx-N": the prop flexibility North orientation run (for All Orientation compliance)
  "_pfx-E": the prop flexibility East orientation run (for All Orientation compliance)
  "_pfx-S": the prop flexibility South orientation run (for All Orientation compliance)
  "_pfx-W": the prop flexibility West orientation run (for All Orientation compliance)

- ProxyServerAddress: character string: The address (i.e. "site.site:port") of the proxy server to be used in accessing the report generator (via the internet).
- ProxyServerCredentials: character string: Username and password credentials (i.e. "username:password") needed to access the internet via the proxy server (only needed for report generation).
- ProxyServerType: character string: options include 'Http' (default), 'Socks5', 'HttpCaching' and 'FtpCaching'.
- BypassRuleLimits: boolean (>=0 – default 0): whether or not a variety of compliance analysis limits on property values and functionality are enforced during analysis. This option is used primarily by rule developers to test new/upcoming compliance analysis changes that are not allowed in a current, official compliance analysis run.
- BypassValidFileChecks: boolean (0/1 – default 0): whether or not valid file checks are performed during compliance analysis. These checks are not time consuming and should always pass for installations of CEC-certified software, but when performing analysis using interim program versions, then this option will prevent the logging of potentially numerous file hash check errors.
- LogWritingMode: integer (0-2 – default 2): the method used to write messages to project log files.
    0. log file flushed and closed following each write (slower, but ensures complete log file)
    1. log file populated in memory and only flushed/refreshed periodically (faster writing)
    2. causes use of method '1' if any detailed logging activated (when VerboseInputLogging, LogRuleEvaluation, or DebugRuleEvalCSV are specified), otherwise '0'
- SimSpeedOption: integer (-1 thru 1 – default -1): specifies what simulation speed option to use during analysis:
  -1: Whatever is specified in the project file (or will default to 0-Compliance)
  0: Compliance – simulation settings that ensure accurate compliance results
  1: Quick – settings that cause faster simulations w/ slightly less accurate results
- EnableRptGenStatusChecks: boolean (0/1 – default 1): whether or not to confirm that the report generator website is accessible prior to initiating report generation. Enabling this check can help to minimize processing time in cases where the report generator is not currently available. In those cases, the processing can be held up for several seconds, much longer than it takes to check the site's availability. This feature can be disabled by passing a '0' here if this report gen checking feature causes problems on certain systems/networks.
- AllowAnalysisAbort: boolean (0/1 – default 1): whether or not the analysis abort button (in the analysis progress dialog) will be activated and allowed to cause the analysis to be terminated when pressed. Setting this value to '0' can help to prevent inadvertent 'abort' actions when performing batches of multiple runs.
- StoreResultsToModelInput: boolean (0/1 – default 0): whether or not to store results of the analysis back to the original project input file. This is how CBECC-Res facilitates display of analysis results after the calculations and later re-loading the project. No changes are made to the original model inputs that are used to calculate building compliance.
- SimReportDetailsOption; integer (0-2 – default 1): what post processing is performed on CSE simulation 'report' file output: 0 for no CSE report processing, 1 to echo only user-specified output reports and 2 to echo entire CSE report file. When > 0, a file is generated (in the project

file directory) by the name “<project filename> - CSE Reports.txt” that lists the specified CSE report data for each simulation performed during analysis.

  - SimErrorDetailsOption; boolean (0/1 – default 1): whether or not to post process CSE simulation errors for easier access by users or vendor tools. When > 0, a file is generated (in the project file directory) by the name “<project filename> - CSE Errors.txt” that lists the specified CSE report data for each simulation performed during analysis.

  Multiple analysis options can be concatenated into the pszAnalysisOptionsCSV string, for instance, if you wanted to perform a run with the Verbose & BypassCSE flags activated (and all other defaults used), then this function argument would include the string “Verbose,1, BypassCSE,1,”. Searches for options in this string argument are case insensitive and if a single flag is repeated multiple times, the value associated with its first occurrence will drive the analysis.

- pszErrorMessage is a pointer to a character string that can be populated by this function to describe error(s) encountered during the analysis. Pass in a value of 0/NULL if no return of error messaging is desired.
- iErrorMsgLength is an integer describing the number of characters present in the error message character string (previous argument). Pass in a value of 0 if no return of error messaging is desired.
- bDisplayProgress is a boolean indicating whether or not to display the analysis progress dialog as the processing is executed.
- hWnd is a HANDLE to a MS Windows application window. This hWnd is used in the call that initiates the CSE executable to identify the owner of the simulation process, but can be specified as NULL if not available.
- iSecurityKeyIndex is an integer value assigned to each certified software vendor that is used to identify which of a predefined number of security keys integrated into the compliance ruleset should be used to generate permit (secure) compliance reports immediately following the analysis.
  Contact the CEC and/or compliance engine software contractor for this index prior to submitting software to the CEC for certification.
- pszSecurityKey is a null terminated string containing a subset of a private security key which is used by the compliance engine to generate permit (secure) compliance reports immediately following the analysis.
  Contact the CEC and/or compliance engine software contractor for this character string prior to submitting software to the CEC for certification.

Return value is 0 if simulation successful and > 0 if errors occurred (listed below).

Call this routine once for each individual simulation to be performed.

All path/filename arguments can be either complete or relative to the path in which the calling executable resides.

Error return value mapping:
```
#define  BEMAnal_CECRes_EXEPathInvalid        1   //  pszCSEEXEPath doesn't exist
#define  BEMAnal_CECRes_WthrPathInvalid       2   //  pszCSEWeatherPath doesn't exist
#define  BEMAnal_CECRes_unused                3   //
#define  BEMAnal_CECRes_MissingFiles          4   //  One or more missing files (CSE, ASHWAT or
                                                       T24*(DHW/ASM32/TDV/UNZIP/WTHR) DLLs)
#define  BEMAnal_CECRes_BEMBaseNotFound       5   //  pszBEMBasePathFile doesn't exist
#define  BEMAnal_CECRes_RulesetNotFound       6   //  pszRulesetPathFile doesn't exist
```

```
#define  BEMAnal_CECRes_BEMProcInitError      7   //  Error initializing BEMProc (database & rules
                                                       processor module)
#define  BEMAnal_CECRes_RulesetInitError      8   //  Error initializing compliance ruleset
#define  BEMAnal_CECRes_InvalidLogFile        9   //  Invalid project log file name (too long)
#define  BEMAnal_CECRes_LogFileWriteError    10   //  Error writing to project log file
#define  BEMAnal_CECRes_ModelFileNotFound    11   //  Building model input/project file not found
#define  BEMAnal_CECRes_ModelInitError       12   //  Error reading/initializing model input/project file
#define  BEMAnal_CECRes_EvalPropInpError     13   //  Error evaluating ProposedInput rules
#define  BEMAnal_CECRes_GetSimWthrError      14   //  Error retrieving CSE weather file name (from
                                                       Proj:WeatherFileName)
#define  BEMAnal_CECRes_SimWthrNotFound      15   //  Energy (CSE) simulation weather file not found
#define  BEMAnal_CECRes_GetDHWWthrError      16   //  Error retrieving DHW weather file name (from
                                                       Proj:DHWWthrFileName)
#define  BEMAnal_CECRes_DHWWthrNotFound      17   //  DHW simulation weather file not found
#define  BEMAnal_CECRes_GetReqdDataError     18   //  Error retrieving required data: Proj:RunID and/or
                                                       Proj:RunAbbrev
#define  BEMAnal_CECRes_ProcPathTooLong      19   //  Analysis processing path too long
#define  BEMAnal_CECRes_EvalPropInp3Error    20   //  Error evaluating ProposedInput rules
#define  BEMAnal_CECRes_EvalPostPropError    21   //  Error evaluating PostProposedInput rules
#define  BEMAnal_CECRes_EvalStdConvError     22   //  Error evaluating BudgetConversion rules
#define  BEMAnal_CECRes_EvalSimPrepError     23   //  Error evaluating CSE_SimulationPrep rules
#define  BEMAnal_CECRes_ProcDirError         24   //  Unable to create or access analysis processing
                                                       directory
#define  BEMAnal_CECRes_SimOutWriteError     25   //  Unable to open/delete/write simulation output file
                                                       (.csv or .rep)
#define  BEMAnal_CECRes_SimWthrWriteError    26   //  Unable to open/delete/write simulation weather file
#define  BEMAnal_CECRes_SimWthrCopyError     27   //  Error copying simulation weather file to processing
                                                       directory
#define  BEMAnal_CECRes_SimInputOpenError    28   //  Unable to open/delete/write simulation input (.cse)
                                                       file
#define  BEMAnal_CECRes_SimInputWriteError   29   //  Error writing simulation input (.cse) file
#define  BEMAnal_CECRes_CSESimError          30   //  CSE simulation not successful - error code returned
#define  BEMAnal_CECRes_DHWSimError          31   //  DHW simulation not successful
#define  BEMAnal_CECRes_ErrorLoadingCSE      32   //  Error encountered loading CSE DLL(s)
#define  BEMAnal_CECRes_EvalCodeChkError     33   //  Error evaluating ProposedModelCodeCheck rules
#define  BEMAnal_CECRes_EvalSimChkError      34   //  Error evaluating ProposedModelSimulationCheck rules
#define  BEMAnal_CECRes_EvalCodeAddError     35   //  Error evaluating ProposedModelCodeAdditions rules
#define  BEMAnal_CECRes_UserAbortedAnalysis  36   //  User aborted analysis via progress dialog 'Cancel'
                                                       button
#define  BEMAnal_CECRes_EvalPropInp2Error    37   //  Error evaluating ProposedInput rules
#define  BEMAnal_CECRes_RangeOrOtherError    38   //  Error performing range and/or error checks on
                                                       building model
#define  BEMAnal_CECRes_EvalSimCleanupError  39   //  Error evaluating CSE_SimulationCleanUp rules
#define  BEMAnal_CECRes_AbortViaCallback     40   //  Analysis aborted based on return from analysis
                                                       progress callback function
#define  BEMAnal_CECRes_EvalProcResultsError 41   //  Error evaluating ProcessResults rules
#define  BEMAnal_CECRes_EvalPropCompError    42   //  Error evaluating ProposedCompliance rules
#define  BEMAnal_CECRes_ModelReadError       43   //  Error(s) encountered reading building model
                                                       (project) file
#define  BEMAnal_CECRes_RuleProcAbort        44   //  Error(s) encountered evaluating rules required
                                                       analysis to abort
#define  BEMAnal_CECRes_BadResultsObjTypes   45   //  Invalid results object types encountered when
                                                       copying results between models
#define  BEMAnal_CECRes_ResultsCopyError     46   //  Error copying results objects from a previous model
#define  BEMAnal_CECRes_SetupWthrHashError   47   //  Error setting up check of weather file hash
#define  BEMAnal_CECRes_DuplicateObjNames    48   //  Input model contains one or more objects with the
                                                       same name
#define  BEMAnal_CECRes_MissingZnCSEIncFile  49   //  Missing Zone CSE include file
#define  BEMAnal_CECRes_EvalAnalPrepError    50   //  Error evaluating OneTimeAnalysisPrep rules
#define  BEMAnal_CECRes_BadResultsObjTypesU  51   //  Invalid results object types encountered when
                                                       copying final results to user model
#define  BEMAnal_CECRes_ResultsCopyErrorU    52   //  Error copying results objects from the final run
                                                       into the user model
#define  BEMAnal_CECRes_CSEIncFIleWriteError 53   //  Unable to open/delete/write CSE include file
#define  BEMAnal_CECRes_CSEIncFileCopyError  54   //  Error copying CSE include file to processing
                                                       directory
#define  BEMAnal_CECRes_DHWUseCSEIncMissing  55   //  DHW Use/Load Profile CSE include file missing
#define  BEMAnal_CECRes_DHWUseCSEIncCopyErr  56   //  Error copying DHW Use/Load Profile CSE include file
                                                       into processing directory
#define  BEMAnal_CECRes_DHWUseHashError      57   //  Error setting up check of DHW use/profile file hash
#define  BEMAnal_CECRes_CSEBattCtrlSetupErr  58   //  Error setting up CSE battery control data
```

```
#define  BEMAnal_CECRes_CSEOpenGLError       59  //  Error initializing OpenGL (required for CSE shading
                                                      simulation)
#define  BEMAnal_CECRes_TDVFileWriteError    60  //  Error writing CSV file w/ TDV data (required for
                                                      CSE simulation)
#define  BEMAnal_CECRes_EvalSetupPMFError    61  //  Error evaluating SetupRun_ProposedMixedFuel rules
#define  BEMAnal_CECRes_EvalSetupPFlxError   62  //  Error evaluating SetupRun_ProposedFlexibility rules
#define  BEMAnal_CECRes_SimModelInitError    63  //  Error initializing analysis model
#define  BEMAnal_CECRes_AnalResWriteError    64  //  Unable to overwrite analysis results XML file
#define  BEMAnal_CECRes_EvalPrelimRunError   65  //  Error evaluating ApplyPrelimRunResults rules
#define  BEMAnal_CECRes_CF1RXMLWriteError    66  //  Unable to overwrite CF1RPRF01E report XML file
#define  BEMAnal_CECRes_CF1RXMLPropError     67  //  Error evaluating CF1RPRF01E Proposed model rules
#define  BEMAnal_CECRes_CF1RXMLFinalError    68  //  Error evaluating CF1RPRF01E final/results rules
#define  BEMAnal_CECRes_CF1RXMLCompIDError   69  //  Main CF1RPRF01E object type invalid
#define  BEMAnal_CECRes_HPWHSizingError      70  //  Error in sizing HPWH system(s) using CSE
// ^^^^ Errors listed above result in invalid results ^^^^ ||
   vvvv Errors listed below should still allow users to VIEW analysis results vvvv
#define  BEMAnal_CECRes_ModelRptError        200 // (was 40)  Error generating model report
#define  BEMAnal_CECRes_CompRptWriteError    201 // (was 45)  Unable to write compliance report file
                                                      (.pdf or .xml)
#define  BEMAnal_CECRes_CompRptGenError      202 // (was 46)  Error(s) encountered generating compliance
                                                      report file (.pdf or .xml)
#define  BEMAnal_CECRes_EvalChkFileHashError 203 // (was 48)  Error evaluating CheckFileHash rules
#define  BEMAnal_CECRes_WthrHashChkFail      204 // (was 49)  Weather file hash failed consistency check
#define  BEMAnal_CECRes_InputSaveFailed      205 // Attempt to save project inputs (including results)
                                                      following analysis failed
#define  BEMAnal_CECRes_DHWUseHashChkFail    206 // DHW use/profile file hash failed consistency check
#define  BEMAnal_CECRes_RptGenErrorReturned  207 // Report generator found errors in analysis inputs
                                                      and/or results
#define  BEMAnal_CECRes_RptGenPDFExtract     208 // Error extracting PDF report from full XML report
                                                      file
```

Some errors in building model inputs that are checked and reported prior to performing analysis include:

Checks on any model simulated by the compliance manager (independent of compliance analysis):

- At least one Zone object must exist in the model
- When interior walls or floors specify a Garage zone as being on the Outside of the surface, then “Has Attached Garage” (Proj:HasGarage=1 / Project dialog, Building tab) must be selected.
- Each Zone and Garage must have at least 6 surfaces associated with it, including direct wall/floor/ceiling children and w/f/c children of other Zones that specify the Zone as being Outside that surface.
- Of the surfaces associated with each Zone and Garage, no single surface can have a larger area than ½ the sum of all associated surface areas.

```
int CMX_PerformAnalysisCB_CECRes(               const char* pszBEMBasePathFile,
            const char* pszRulesetPathFile,     const char* pszCSEEXEPath,
            const char* pszCSEWeatherPath,      const char* pszDHWDLLPath,
            const char* pszDHWWeatherPath,      const char* pszProcessingPath,
            const char* pszModelPathFile,       const char* pszLogPathFile,
            const char* pszUIVersionString,     bool bLoadModelFile,
            const char* pszAnalysisOptionsCSV,
            char* pszErrorMessage,              int iErrorMsgLength,
            bool bDisplayProgress,              int iSecurityKeyIndex,
            const char* pszSecurityKey,
            PAnalysisProgressCallbackFunc pAnalProgCallbackFunc );

      // typedef int  (__cdecl *PCMX_PerformAnalysisCB_CECRes)(  const char*,
      //                       const char*, const char*, const char*,
```

```
//                        const char*, const char*, const char*,
//                        const char*, const char*, const char*, bool,
//                        const char*, char*, int, bool, int, const char*,
//                        PAnalysisProgressCallbackFunc );
// _CMX_PerformAnalysisCB_CECRes
```

This is an alternative compliance analysis routine as the one listed above (CMX_PerformAnalysis_CECRes). The function arguments are identical to the above routine with the exception of the final one, replacing HWND* with a pointer to a callback function. The return value is also the same as above.

This callback function referenced by the final function argument is called each time the analysis progress is checked/reported, enabling calling applications to monitor analysis progress and abort analysis prior to completion without using the analysis progress dialog available in the compliance engine.

where:

- (refer to the previous routine for information on all arguments prior to pAnalProgCallbackFunc)
- pAnalProgCallbackFunc is a pointer to a callback function declared as:
  ```
  long (CALLBACK* PAnalysisProgressCallbackFunc)(    long lAnalProgType,
                                                     long lData   )
  ```
  where:
    lAnalProgType is either 0 (processing message) or 1 (percent progress reported), and
    lData is either percent progress (0-100 when lAnalProgType = 1) or unused/nothing
  A return value of 0 from the callback function will cause analysis to continue and a return value > 0 will cause the analysis to be aborted.

```
int CMX_CheckSiteAccess( const char* pszSite,   const char* pszCACertPath,
                  const char* pszProxyAddress,  const char* pszProxyCredentials,
                  char* pszErrorMessage,        int iErrorMessageLength,
                  bool bVerbose,                const char* pszProxyType,
                  const char* pszNetComLibrary  );

    // typedef int (__cdecl *PCMX_ CheckSiteAccess(  const char*,
    //                 const char*,  const char*,  const char*,  char*,  int,
    //                 bool,  const char*,  const char*  );
    // _CMX_ CheckSiteAccess
```

This function enables the calling application to determine whether or not the CEC Report Generator website is accessible and available to process compliance reports.

where:

- pszSite is a null terminated string containing the URL of the website to check for access. This site is stored in ruleset source for each program release as Proj:RptGenCheckURL. For release 2016.1.0 and 2013 ver 3d the site is: "https://t24docs.com/RGServiceStatus/RGServiceStatus.svc/IsResServiceActive"
- pszCACertPath (no longer used).
- pszProxyAddress is a null terminated string containing the address (i.e. “site.site:port”) of the proxy server to be used in accessing the report generator (via the internet). If no proxy server is present, then pass 0 (NULL) for this argument.

- pszProxyCredentials is a null terminated string containing the username and password credentials (i.e. "username:password") needed to access the internet via the proxy server. If no proxy server is present or no credentials are required to negotiate the proxy server, then pass 0 (NULL) for this argument.
- pszErrorMessage is a pointer to a character string that can be populated by this function to describe error(s) encountered during execution. Pass in a value of 0 (NULL) if no return of error messaging is desired.
- iErrorMessageLength is an integer describing the number of (single-byte) characters present in the error message character string (previous argument). Pass in a value of 0 if no return of error messaging is desired.
- bVerbose is a Boolean indicating whether or not to write messages to the current project log file indicating each step of the site access execution. This argument should be set to 'true' only if analysis has just been executed on a model or a model has been loaded into memory using some other means.
- pszProxyServerType is a null terminated string describing the type of proxy server needing to be negotiated to access the internet. Options include 'Http' (default), 'Socks5', 'HttpCaching' and 'FtpCaching'.). If no proxy server is present, then pass 0 (NULL) for this argument.
- pszNetComLibrary (no longer used – pass '0' (NULL) for only option of QT)

Return values from this routine include:

```
  -1    website accessed but report generator is offline
  -2    website accessed using supplied proxy server settings, but report generator is offline
  -3    website accessed using proxy server settings retrieved from system, but report generator is
        offline
 -11    website accessed and report generator is available
 -12    website accessed using supplied proxy server settings and report generator is available
 -13    website accessed using proxy server settings retrieved from system and report generator is
        available
 100    pszSite contained BEMBase Object:Property, but error retrieving URL using that obj:prop name

And errors related to the QT network library:
   1    Invalid storage path for webpage download
   2    Error encountered downloading webpage (typically error negotiating w/ local proxy server)
   3    Unable to write file downloaded from website (file locked by another application)
   7    Unable to connect either directly or via proxy server settings retrieved from the operating
        system
   8    Unable to connect via supplied proxy server settings
   9    Error initializing temporary file path to copy site status to internal buffer
  10    Error initializing temporary file to copy site status to
```

```
int CMX_GenerateReport_CEC( const char* pszXMLResultsPathFile,
                  const char* pszCACertPath,    const char* pszReportName,
                  const char* pszAuthToken1,    const char* pszAuthToken2,
                  const char* pszSignature,     const char* pszPublicKey,
                  const char* pszDebugBool,     bool bVerbose,   bool bSilent,
                  bool bSchemaBasedRptGen );

     // typedef int (__cdecl *PCMX_GenerateReport_CEC(  const char*,
     //                  const char*, const char*, const char*, const char*,
     //                  const char*, const char*, const char*, bool, bool, bool );
     // _CMX_GenerateReport_CEC
```

where:

- pszXMLResultsPathFile is a null terminated string containing the path and filename of the analysis results XML file. This is typically: <Project file directory>\<project file name> - AnalysisResults.xml
- pszCACertPath (no longer used)
- pszReportName is a null terminated string containing the name of the report to be generated. Valid report names currently include:
  - "CF1R_NCB_PRF19": 2019 CF-1R Cert. of Compliance when Proj:RunScope = "Newly Constructed"
  - "CF1R_ALT_PRF19": 2019 CF-1R Cert. of Comp. when Proj:RunScope = "Addition and/or Alteration"

  No CAHP reports available in 2019 releases: Reports added in version 2016-3b (685) supporting the CAHP-SF / CAHP-MF / CMFNH programs:
  (note: appropriate CAHP inputs must have been provided prior to performing analysis)
  - "CAHPSFSO": CAHP single family program, single orientation analysis
  - "CAHPSFMO": CAHP single family program, all orientation analysis
  - "CAHPMFSO": CAHP multifamily program, single orientation analysis
  - "CAHPMFMO": CAHP multifamily program, all orientation analysis
  - "CMFNHSO": PG&E CMFNH program, single orientation analysis
  - "CMFNHMO": PG&E CMFNH program, all orientation analysis
- pszAuthToken1 is a null terminated string that, combined with AuthToken2, identifies the calling application. When called from CBECC-Res this argument is "CBECC-Res" and when called from other certified software this argument should be specified based on instructions from the CEC and/or CEC contractor supplying vendor-specific software distributables.
- pszAuthToken2 is a null terminated string that, combined with AuthToken1, identifies the calling application. When called from CBECC-Res 2013 version 4 (*) this argument is "4", from CBECC-Res 2016.1.0 this argument is "1" **(new version # here)** and when called from other certified software this argument should be specified based on instructions from the CEC and/or CEC contractor supplying vendor-specific software distributables.
- pszSignature is a null terminated string containing the base-64 ASCII-encoded signature used to sign request data. Signature processing is not yet implemented, so for the time being the string "none" should be supplied for this argument.
- pszPublicKey is a null terminated string containing the base-64 ASCII-encoded public key used to sign request data. Signature processing is not yet implemented, so for the time being the string "none" should be supplied for this argument.
- pszDebugBool is a null terminated string containing either the word "true" or "false". Passing "true" (the current default) causes the report generator to activate debugging features.
- bVerbose is a boolean flag (not in the form of a character string) indicating whether verbose information should be written to the project processing log file.
- bSilent is a boolean flag (not in the form of a character string) indicating whether or not dialog boxes are permitted to be presented during the report generation. One example is a dialog indicating that the file needing to be written to contain the compliance report cannot be written to, prompting the user to close the file in another application it is opened in or change the file permissions so that the file can be re-written. A value of '1' will prevent user prompts and issues such as files unable to be written may cause the report generation to be aborted.
- bSchemaBasedRptGen is a boolean flag (not in the form of a character string) indicating whether or not the report is generated from analysis results XML data governed by a schema (such as CF1RPRF01E.xml).

For the time being, the report file written will be located in the same directory as the analysis results XML file and will be named: “<analysis results filename>-BEES.PDF” (or .XML, depending on the … argument).

Reports produced via this API function will always include a watermark (such as “Not useable for compliance”) indicating that the report is not valid compliance documentation (since there is no guarantee that the results XML file contains current analysis inputs and results). In order to generate a more formal certificate of compliance (such as one watermarked “This Certificate of Compliance is not registered”), you must generate the report via the CMX_PerformAnalysis_CECRes() API function, either by including “ComplianceReportPDF,1,” in the pszAnalysisOptionsCSV argument or by analyzing a model where Proj:ComplianceReportPDF = 1.
For more information about compliance report watermarks, refer to the FAQs listed in the CBECC-Res Quick Start Guide.

Return values from this routine include:

```
 0    Success – no errors
 1    XML file not found
 2    CACert file not found
 3    Error opening and/or reading the analysis results XML file
 4    Error allocating memory for XML file storage
 5    User chose not to overwrite output report file
 6    Error opening report output file
 7    Error reading analysis results XML file
 8    Error reading analysis results XML file
 9    Error initializing CURL (curl_easy_init() returned NULL)
10    Report generation processing error in send request
11    Report generation processing error in result retrieval
12    No Report Name specified
13    Missing or invalid PDF Only boolean string (must be 'true' or 'false' (case insensitive))
14    Missing or invalid report generation debug boolean string (must be 'true' or 'false' (case
      insensitive))
15    Missing or invalid AuthToken1 string
16    Missing or invalid AuthToken2 string
17    Missing or invalid Signature string
18    Missing or invalid PublicKey string
19    Error opening output file following report generation
20    Error reading data from output file following report generation
21    PDF report contains XML data - likely error messages from web server
22    XML Path not specified
23    CACert path not specified
24    CACertPath not a valid or found directory
25    Error converting results file signature to hexadecimal
26    Report generator found errors in analysis inputs and/or results
```

```
int CMX_GenerateReport_Proxy_CEC( const char* pszXMLResultsPathFile,
                      const char* pszCACertPath,    const char* pszReportName,
                      const char* pszAuthToken1,    const char* pszAuthToken2,
                      const char* pszSignature,     const char* pszPublicKey,
                      const char* pszProxyAddress,  const char* pszProxyCredentials,
                      const char* pszDebugBool,     bool bVerbose,   bool bSilent,
                      const char* pszCompRptID,     const char* pszRptGenServer,
                      const char* pszRptGenApp,     const char* pszRptGenService,
                      const char* pszSecKeyRLName,  const char* pszOutputPathFile,
                      const char* pszProxyType      const char* pszNetComLibrary,
                      bool bSchemaBasedRptGen );

      // typedef int (__cdecl *PCMX_GenerateReport_Proxy_CEC(  const char*,
      //                const char*,  const char*,  const char*,  const char*,
      //                const char*,  const char*,  const char*,  const char*,
      //                const char *,  bool,  bool,
```

```
//                  const char*, const char*, const char*, const char*,
//                  const char*, const char*, const char*, const char*, bool );
// _CMX_GenerateReport_Proxy_CEC
```

where:

- <arguments 1-7 and 10-12 same as those documented above for CMX_GenerateReport_CEC()>
- pszProxyAddress is a null terminated string containing the address (i.e. "site.site:port") of the proxy server to be used in accessing the report generator (via the internet).
- pszProxyCredentials is a null terminated string containing the username and password credentials (i.e. "username:password") needed to access the internet via the proxy server (only needed for report generation).
- pszCompRptID is a null terminated string containing report generator URL ID (default is "BEES")
- pszRptGetServer is a null terminated string containing the report generator server name (default is "cf6r.com")
- pszRptGenApp is a null terminated string containing the report generator server application name (default is "ReportGeneratorRes")
- pszRptGenService is a null terminated string containing the report generator service name (default is "ReportingService.svc")
- pszSecKeyRLName (unused)
- pszOutputPathFile is a null terminated string containing the name of the output report file (defaulting to "<project file>-<report name>.pdf")
- pszProxyType is a null terminated string describing the type of proxy server, options include 'Http' (default), 'Socks5', 'HttpCaching' and 'FtpCaching'.
- pszNetComLibrary is a null terminated string – no longer used (pass 0 (NULL))
- bSchemaBasedRptGen is a boolean flag (not in the form of a character string) indicating whether or not the report is generated from analysis results XML data governed by a schema (such as CF1RPRF01E.xml).

Allows for report generation where proxy server credentials are required to access the report generator website. All other information and return values are consistent with the CMX_GenerateReport_CEC() function described above.

```
int CMX_ExportCSVHourlyResults_CECRes(
        const char* pszHourlyResultsPathFile,     const char* pszModelPathFile,
        const char* pszModelName,
        char* pszErrorMessage,                    int iErrorMsgLength,
        bool bSilent,                             int iBEMProcIdx );

    // typedef int  (__cdecl *PCMX_ExportCSVHourlyResults_CECRes)(  const char*,
    //                         const char*, const char*, char*, int, bool, int );
    // _CMX_ExportCSVHourlyResults_CECRes
```

where:

- pszHourlyResultsPathFile is a null terminated string containing the path and filename of the CSV file you wish to be written by this routine.
- pszModelPathFile is a null terminated string containing the path and filename of the building model input file for which the results are being exported.
- pszModelName is a null terminated string containing one of the following:
  - for Research Mode analysis, the only option is "User"
  - for single-orientation compliance analysis, the options are "Proposed" and "Standard"
  - for all-orientation compliance analysis, the options are "Proposed-N", "Proposed-E", "Proposed-S", "Proposed-W" and "Standard"
- pszErrorMessage is a pointer to a character string that can be populated by this function to describe error(s) encountered during CSV export process. Pass in a value of 0/NULL if no return of error messaging is desired.
- iErrorMsgLength is an integer describing the number of characters present in the error message character string (previous argument). Pass in a value of 0 if no return of error messaging is desired.
- bSilent is a boolean indicating whether or not to prompt the user when issues arise as, such as the CSV file being open in a separate application and must be closed in order to refresh/overwrite the file.
- iBEMProcIdx is used to identify the building model transform to pull results from. For residential compliance analysis (using procedural rulesets), always pass in a -1 for this argument.

Return value is 0 if CSV export is successful and > 0 if errors occurred (listed below).

Call this routine once immediately following execution of the analysis for each individual simulation for which results are to be exported.

All path/filename arguments should be complete, not relative to the path of the calling executable or building model file.

Error return value mapping:
  1 : Error retrieving Proj:AnalysisType, AllOrientations, CondFloorArea, ClimateZone and/or NatGasAvailable
  2 : Unable to open and/or write hourly CSV results file
  3 : Error encountered opening hourly CSV results file
  4: Error encountered opening hourly CSV results file

```
int CMX_GetDataString(  char* sReturnStr, int iRetStrLen, const char* pszCompParam,
                        const char* pszCompName,  BOOL bAddCommas,
                        int iPrecision,  const char* pszDefault );

      // typedef int  (__cdecl *PCMX_GetDataString)(  char*, int, const char*,
      //                                  const char*, BOOL, int, const char* );
      // _CMX_GetDataString
```

where:

- sReturnStr is a character string buffer to be populated with data from the building model.
- iRetStrLen is the number of characters allocated in the sReturnStr buffer. The returned string will be null-terminated, so the maximum number of characters written to sReturnStr will be (iRetStrLen-1).

- pszCompParam is a null-terminated string identifying the model object and property to return a string representation of. This argument can reference properties of any type in the data model (float, integer, object reference, enumeration or string). The object name and property name are separated by a colon, so this argument would contain 'Proj: CondFloorArea' to return a string-representation of the CondFloorArea property of the Proj (Project) object.
- pszCompName is a null terminated string containing the name of the object for which the object/property is to be returned. If there is only a single object of this type in the project (as is the case for Proj, EUseSummary and some other object types), then this argument can/should be set to NULL. If this argument is NULL for objects where multiple are present in the building model, then the property data for the "currently active" object of that type will be returned (not advised).
- bAddCommas is a BOOLean indicating whether or not commas (or related Windows Locale-based numeric separators) are to be included in the returned string. This argument is only referenced when returning string representations of integer or float object properties.
- iPrecision is an integer indicating the decimal precision to be used when populating the return string of float properties. Ignored for non-float properties.
- pszDefault is a null-terminated string containing the desired return string in the event the Object:Property being retrieved is not defined in the building model.

Return value is 0 if data retrieval is successful and > 0 if errors occurred.
<error return value info to be supplied at a later date>

Call this routine each time string data is to be retrieved from the building model.

```
int CMX_GetDataInteger( long* pReturnInt,  const char* pszCompParam,
                        const char* pszCompName,  long lDefault );

      // typedef int  (__cdecl *PCMX_GetDataInteger)( long*,  const char*,
      //                                              const char*, long  );
      // _CMX_GetDataInteger
```

where:

- pReturnInt is a pointer to a (32-bit) integer to be populated with data from the building model.
- pszCompParam is a null-terminated string identifying the model object and property to return the value of. This argument can only reference properties of integer or enumeration types in the data model. The object name and property name are separated by a colon in this string argument.
- pszCompName is a null terminated string containing the name of the object for which the object/property is to be returned. If there is only a single object of this type in the project (as is the case for Proj, EUseSummary and some other object types), then this argument can/should be set to NULL. If this argument is NULL for objects where multiple are present in the building model, then the property data for the "currently active" object of that type will be returned (not advised).
- lDefault is a 32-bit integer value which will be returned (via the pReturnInt argument) in the event the Object:Property being retrieved is not defined in the building model.

Return value is 0 if data retrieval is successful and > 0 if errors occurred.
<error return value info to be supplied at a later date>

Call this routine each time integer data is to be retrieved from the building model.

```
int CMX_GetDataFloat(   float* pReturnFlt,  const char* pszCompParam,
                        const char* pszCompName,  float fDefault );

      // typedef int  (__cdecl *PCMX_GetDataFloat)(   float*, const char*,
      //                                              const char*, float );
      // _CMX_GetDataFloat
```

where:

- pReturnFlt is a pointer to a (32-bit) float to be populated with data from the building model.
- pszCompParam is a null-terminated string identifying the model object and property to return the value of. This argument can reference properties of float, integer, enumeration or object reference types in the data model (returning a float value for an object reference property returns a 1-based index of the referenced object (among all objects of that type)). The object name and property name are separated by a colon in this string argument.
- pszCompName is a null terminated string containing the name of the object for which the object/property is to be returned. If there is only a single object of this type in the project (as is the case for Proj, EUseSummary and some other object types), then this argument can/should be set to NULL. If this argument is NULL for objects where multiple are present in the building model, then the property data for the "currently active" object of that type will be returned (not advised).
- fDefault is a 32-bit float value which will be returned (via the pReturnFlt argument) in the event the Object:Property being retrieved is not defined in the building model.

Return value is 0 if data retrieval is successful and > 0 if errors occurred.
<error return value info to be supplied at a later date>

Call this routine each time float data is to be retrieved from the building model.

```
int CMX_PopulateCSVResultSummary_CECRes(       char* pszResultsString,
                  int iResultsStringLength,  const char* pszRunOrientation,
                  int iResultsFormatVersion, const char* pszProjectPathFileName );

      // typedef int  (__cdecl *PCMX_PopulateCSVResultSummary_CECRes)
      //                      (  char*, int, const char*, int, const char*  );
      // _CMX_PopulateCSVResultSummary_CECRes
```

where:

- pszResultsString is a pointer to a character string of length (iResultsStringLength) that is to be populated with a summary of the analysis just performed.
- iResultsStringLength is the length of the character string (first argument) to be populated (recommended length 3,200 characters).
- pszRunOrientation is a pointer to a null-terminated character string that can serve to specify which of potentially several runs the CSV string is to be populated with. This argument is not referenced for

Research Mode or single orientation compliance analysis runs and simply passing in NULL is recommended.
For all orientation analysis, passing in NULL here will cause the worst case (least efficient) orientation run to be used to populate the CSV string. To specify the orientation to use, pass in 'N', 'E', 'S', or 'W' (case insensitive).

- iResultsFormatVersion is an integer which identifies what gets populated to the results CSV string. Valid values include:
  1 results in the original column definitions (as shown in the diagram below)
  2 will cause the string to have a column of data containing PV Credit inserted @ column AO (beginning in version 1c (496), dated 11/20/13, of the compliance manager)
  3 includes ver 2 plus inserts starting @ column CO proposed and standard model electric demand by endues, total and compliance total
  4 includes ver 3 plus additional columns beginning DK including total & compliance total savings percents for demand and TDV and CAHP-SF/CAHP-MF/CMFNH results
  5 includes ver 4 with the ProjectPathFileName inserted as column 2 (B), design rating result inserted at column 7 (G) and additional columns DZ-HV including proposed and reference design rating model electric, natural gas, other fuel and TDV energy use and electric demand
  6 includes ver 5 with adjustment of PV credit and design rating PV results
  7 includes ver 6 plus design rating PV-only and rating of standard design model
  8 includes ver 7 with changes for proposed PV kWh & kW reporting (for 2019 analysis)
  9 includes ver 8 with addition of overall model TDV by fuel (Elec, NatGas, Other)
  10 includes ver 9 with removal of CEC DHW sim engine version ID, addition of climate zone and # of dwelling units inputs, re-organization of demand results (now split out by run) and addition of Battery enduse results
  11 includes ver 10 with replacement of 9 old CAHP results w/ 16 new 2017 results (cols DX-EM)
  12 includes ver 11 with 3 additional sets of columns: Proposed PV Scaling (3), Target EDR (2), and Minimum Req'd PV (2) (cols JC-JI)
  13 includes ver 12 with Proposed & Standard design carbon emissions (cols JJ-JO)
  14 (10/6/17) includes ver 13 with 2 new sets of colums: Proposed & Standard design carbon emissions
  15 (1/4/18) includes ver 14 with 4 GHC (grid harmonization credit) columns
  16 (1/12/18) includes ver 15 with 3 Standard Design PV results (kWh, TDV & kW) added
  17 (1/29/18) includes ver 16 with added 102 columns to report emissions by model, fuel and enduse
  18 (9/30/18) includes ver 17 with 10 new columns labeled 'Reference Design Rating Model TDV (before fuel multiplier adjustment)' @ col IF
  19 (10/1/18) includes ver 18 with new Ref DRtg TDV (before fuel mult adj) moved from col IF to JY
  20 (2/8/19) includes major overhaul of CSV format, eliminating many unused columns, improving on the organization and consolidating C02-reporting format (tic #1053)
  21 (6/20/19) includes ver 20 with added columns documenting EDR1 (source energy TDV) to facilitate 2022 code research

  -1 will cause the string to be populated with whatever data is consistent with the referenced version of the compliance manager (always the most recent results data)
- pszProjectPathFileName is a pointer to a null-terminated character string that can specify the full path and filename of the project file for which the analysis results were produced. If this data is not desired for inclusion in the result CSV string, then passing in NULL for this argument is recommended.

Return value is 0 if simulation successful and > 0 if errors occurred (listed below).

Error return value mapping:

1 : Error retrieving Proj:AnalysisType and/or Proj:CondFloorArea
2 : Error retrieving Proj:ResultSummary object
3 : Error retrieving Proj:ResultSummary object index
4 : Error retrieving EUseSummary:PassFail (compliance result)
5 : Error retrieving one or more Proj:RunResults results objects
6 : Error retrieving one or more Proj:RunResults results object indices
7: Error: Unexpected number of RunResults objects or error retrieving WorstOrientation index
8: Error: Unable to identify which run to return results for (based on pszRunOrientation argument)
9: Error: Unrecognized results format version argument (-1 => current, else 1-N)
10: Error retrieving Proj:ClimateZone and/or Proj:NumDwellingUnits (for format versions >= 10)

When loaded into Excel (and column titles added (see below)), this is what the results look like:
(note: see iResultsFormatVersion above for more info)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W
1					Number of	Conditioned									Proposed Model Site Electric Use								
2		Project		Climate	Dwelling	Area		Pass /	TDV Margi	EDR Efficie	EDR Total	EDR	EDR1 (source energy)		Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Self Util. Cr	PV	Battery	Flexibility	Ins Light
3	Run Date/Time	Path/File	Run Title	Zone	Units	(ft2)	Analysis Type	Fail	(kTDV/ft2-y	Margin	Margin	Total	Margin	Total	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)
4	11/19/2019 11:01	C:\Dev\svn-CEC\SF_	1 Story Example Rev 3	12	1	2100	Proposed and Standard	PASS	5.05	2.2	2.5	23			144.717	163.943	197.909	85.2288	0	-3138.69	124.614	0	505.557
5	11/19/2019 11:03	C:\Dev\svn-CEC\SF_	1 Story Example Rev 3	12	1	2850	Proposed and Standard	PASS	4.28	2.1	0.3	25.1			158.041	337.555	244.396	85.5164	0	-3138.69	123.24	0	643.293
6	11/19/2019 11:04	C:\Dev\svn-CEC\SF_	Duct Design	12	1	2100	Proposed and Standard	PASS	8.73	3.7	3.3	22.2			133.246	155.116	197.909	85.2288	0	-4152.3	0	0	505.557
7	11/19/2019 11:04	C:\Dev\svn-CEC\SF_	1 Story Example Rev 3	12	1	2100	Proposed and Standard	PASS	-4.19	1.5	2.4	22.8			150.498	230.591	196.418	85.2288	89.8945	-3923.37	42.9018	0	505.557
8	11/19/2019 11:05	C:\Dev\svn-CEC\SF_	1 Story Example Rev 3	12	1	2100	Proposed and Standard	PASS	-1.4	2.6	3.9	21.3			150.753	220.14	196.418	85.2288	84.3021	-3923.37	48.3955	0	505.557
9	11/19/2019 11:06	C:\Dev\svn-CEC\SF_	1 Story Example Rev 3	12	1	2100	Proposed and Standard	PASS	5.6	2.4	2.7	22.8			144.717	163.943	197.909	83.562	0	-3138.69	124.633	0	505.557
10	11/19/2019 11:07	C:\Dev\svn-CEC\SF_	1 Story Example Rev 3	12	1	2100	Proposed and Standard	PASS	4.57	1.9	0.6	24.9			112.487	391.014	197.909	85.2288	0	-3138.69	124.96	0	505.557

	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX
1						Proposed Model Site Fuel Use						Proposed Model TDV														Proposed Model Source	
2	Appl & Coo	Plug Lds	Exterior	TOTAL	Comp Total	Spc Heat	Wtr Heat	Flexibility	Appl & Coo	TOTAL	Comp Total	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Self Util. Cr	PV	Battery	Flexibility	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Comp Total	Spc Heat	Spc Cool
3	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(Therms)	(Therms)	(Therms)	(Therms)	(Therms)	(Therms)	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y
4	929.972	2025.88	119.621	1158.75	591.798	213.553	114.403	0	42.7925	370.748	327.956	24.06	11.31	2.61	12.05	0	-37.53	-10.6	0	7.37	16.88	27.51	1.64	55.3	50.03		
5	936.246	2025.88	159.489	1574.96	825.508	233.214	116.582	0	42.7925	392.588	349.796	19.36	14.79	2.38	9.03	0	-27.71	-7.55	0	6.91	12.49	20.27	1.61	51.58	45.56		
6	929.736	2025.88	119.621	-4.25E-05	571.5	196.626	114.403	0	42.7925	353.822	311.029	22.15	9.54	2.61	12.05	0	-46.41	0	0	7.37	16.87	27.51	1.64	53.33	46.35		
7	942.305	2025.88	119.621	465.529	752.631	222.084	114.403	0	42.7925	379.279	336.487	25.04	19.1	2.59	12.05	-7.6426	-45.94	-3.6474	0	7.37	17.06	27.51	1.64	55.13	51.1374		
8	937.243	2025.88	119.621	450.172	736.842	222.46	114.403	0	42.7925	379.656	336.863	25.08	16.27	2.59	12.05	-7.6426	-46.02	-4.3874	0	7.37	17	27.51	1.64	51.46	48.3474		
9	929.972	2025.88	119.621	1157.1	590.131	213.553	108.857	0	42.7925	365.203	322.411	24.06	11.31	2.61	11.5	0	-37.53	-10.6	0	7.37	16.88	27.51	1.64	54.75	49.48		
10	936.711	2025.88	119.621	1360.68	786.639	165.992	114.403	0	42.7925	323.188	280.395	18.79	21.96	2.61	12.05	0	-37.55	-9.61	0	7.37	16.97	27.51	1.64	61.74	55.41		

	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY
1	e Energy (EDR1)										Proposed Model Electric Demand														Standard Model Site Electric Use		
2	IAQ Vent	Wtr Heat	PV	Battery	Flexibility	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Self Util. Cr	PV	Battery	Flexibility	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Comp Total	Spc Heat	Spc Cool	IAQ Vent
3	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kWh)	(kWh)	(kWh)
4											0	0.274945	0.022599	0.014324	0	-0.05374	-0.69286	0	0.134212	0.141873	0.303644	0.020387	0.165387	0.311868	140.34	215.759	197.909
5											0	0.825347	0.027907	0.014382	0	-0.05374	-0.69806	0	0.170777	0.142238	0.303644	0.027182	0.759675	0.867637	160.91	464.987	244.396
6											0	0.215108	0.022599	0.014324	0	-0.0711	0	0	0.134212	0.141828	0.303644	0.020387	0.781006	0.252031	140.34	215.759	197.909
7											0	1.02678	0.022429	0.014324	-0.46431	-0.06718	-0.22159	0	0.134212	0.144722	0.303644	0.020387	0.913413	0.599216	137.691	217.313	196.418
8											0	0.619533	0.022429	0.014324	-0.51255	-0.06718	-0.29424	0	0.134212	0.144303	0.303644	0.020387	0.384873	0.143741	137.691	217.313	196.418
9											0	0.274945	0.022599	0.014142	0	-0.05374	-0.69274	0	0.134212	0.141873	0.303644	0.020387	0.165321	0.311686	140.34	215.759	197.909
10											0	1.02787	0.022599	0.014324	0	-0.05374	-0.63202	0	0.134212	0.142543	0.303644	0.020387	0.979816	1.06479	109.778	524.88	197.909

	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ
1									Standard Model Site Fuel Use					Standard Model TDV											Standard Model Source Energy (ED		
2	Wtr Heat	PV	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Comp Total	Spc Heat	Wtr Heat	Appl & Coo	TOTAL	Comp Total	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	PV	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Comp Total	Spc Heat	Spc Cool	IAQ Vent
3	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(Therms)	(Therms)	(Therms)	(Therms)	(Therms)	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y
4	85.2288	-4227.44	505.557	937.148	2025.88	119.621	0.000475	639.237	207.095	114.403	42.7925	364.29	321.498	23.4	17.02	2.61	12.05	-47.2	7.37	16.97	27.51	1.64	61.37	55.08			
5	85.5164	-4728.36	643.293	943.891	2025.88	159.489	-0.0002	955.809	237.448	116.582	42.7925	396.822	354.03	19.75	18.68	2.38	9.03	-38.83	6.91	12.57	20.27	1.61	52.37	49.84			
6	85.2288	-4227.44	505.557	937.148	2025.88	119.621	0.000475	639.237	207.095	114.403	42.7925	364.29	321.498	23.4	17.02	2.61	12.05	-47.2	7.37	16.97	27.51	1.64	61.37	55.08			
7	85.2288	-4227.66	505.557	939.952	2025.88	119.621	-0.00039	636.651	203.185	114.403	42.7925	360.381	317.588	22.96	16.99	2.59	12.05	-47.21	7.37	17.03	27.51	1.64	60.93	54.59			
8	85.2288	-4227.66	505.557	939.952	2025.88	119.621	-0.00039	636.651	203.185	114.403	42.7925	360.381	317.588	22.96	16.99	2.59	12.05	-47.21	7.37	17.03	27.51	1.64	60.93	54.59			
9	85.2288	-4227.44	505.557	937.148	2025.88	119.621	0.000475	639.237	207.095	114.403	42.7925	364.29	321.498	23.4	17.02	2.61	12.05	-47.2	7.37	16.97	27.51	1.64	61.37	55.08			
10	85.2288	-4512.47	505.557	943.614	2025.88	119.621	-0.00046	917.796	161.995	114.403	42.7925	319.191	276.398	18.4	26.92	2.61	12.05	-50.29	7.37	17.06	27.51	1.64	63.27	59.98			

	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA
1	)R1)							Standard Model Electric Demand											Software Versions				Savings Results				Proposed D
2	Wtr Heat	PV	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	PV	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Comp Total	Compliance		End User	Fuel	Total Dema	Compliance	Total TDV	Compliance	Spc Heat
3	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	Ruleset	CSE	Application	Type	(kW)	(kW)	(%)	(%)	(kWh)
4								0	0.696525	0.022599	0.014324	-0.07238	0.134212	0.143083	0.303644	0.020387	1.26239	0.733448	BEMCmpM	CSE19-860	CBECC-Res	Natural Ga	1.09701	0.42158	9.9	9.2	144.717
5								0	1.19528	0.027907	0.014382	-0.08096	0.170777	0.14334	0.303644	0.027182	1.80156	1.23757	BEMCmpM	CSE19-860	CBECC-Res	Natural Ga	1.04188	0.369934	1.5	8.6	158.041
6								0	0.696525	0.022599	0.014324	-0.07238	0.134212	0.143083	0.303644	0.020387	1.26239	0.733448	BEMCmpM	CSE19-860	CBECC-Res	Natural Ga	0.481386	0.481417	13.1	15.8	133.246
7								0	0.701838	0.022429	0.014324	-0.07239	0.134212	0.144495	0.303644	0.020387	1.26894	0.738591	BEMCmpM	CSE19-860	CBECC-Res	Natural Ga	0.355531	-0.32494	9.5	6.3	150.498
8								0	0.701838	0.022429	0.014324	-0.07239	0.134212	0.144495	0.303644	0.020387	1.26894	0.738591	BEMCmpM	CSE19-860	CBECC-Res	Natural Ga	0.884071	0.082305	15.5	11.4	150.753
9								0	0.696525	0.022599	0.014324	-0.07238	0.134212	0.143083	0.303644	0.020387	1.26239	0.733448	BEMCmpM	CSE19-860	CBECC-Res	Natural Ga	1.09707	0.421762	10.8	10.2	144.717
10								0	1.3459	0.022599	0.014324	-0.07726	0.134212	0.143477	0.303644	0.020387	1.90728	1.38282	BEMCmpM	CSE19-860	CBECC-Res	Natural Ga	0.92746	0.318027	2.4	7.6	112.487

	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB
1	esign Rating Model Site Electric Use												Proposed Design Rating Model Site Fuel Use					Proposed Design Rating Model TDV									
2	Spc Cool	IAQ Vent	Wtr Heat	Self Util. Cr	PV	Battery	Flexibility	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Wtr Heat	Flexibility	Appl & Coo	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Self Util. Cr	PV	Battery	Flexibility	Ins Light	Appl & Coo
3	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(Therms)	(Therms)	(kWh)	(Therms)	(Therms)	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y
4	163.943	197.909	85.2288	0	-3138.69	124.614	0	505.557	929.972	2025.88	119.621	1158.75	213.553	114.403	0	42.7925	370.748	24.06	11.31	2.61	12.05	0	-37.53	-10.6	0	7.37	16.88
5	337.555	244.396	85.5164	0	-3138.69	123.24	0	643.293	936.246	2025.88	159.489	1574.96	233.214	116.582	0	42.7925	392.588	19.36	14.79	2.38	9.03	0	-27.71	-7.55	0	6.91	12.49
6	155.116	197.909	85.2288	0	-4152.3	0	0	505.557	929.736	2025.88	119.621	-4.25E-05	196.626	114.403	0	42.7925	353.822	22.15	9.54	2.61	12.05	0	-46.41	0	0	7.37	16.87
7	230.591	196.418	85.2288	89.8945	-3923.37	42.9018	0	505.557	942.305	2025.88	119.621	465.529	222.084	114.403	0	42.7925	379.279	25.04	19.1	2.59	12.05	-7.6426	-45.94	-3.6474	0	7.37	17.06
8	220.14	196.418	85.2288	84.3021	-3923.37	48.3955	0	505.557	937.243	2025.88	119.621	450.172	222.46	114.403	0	42.7925	379.656	25.08	16.27	2.59	12.05	-7.6426	-46.02	-4.3874	0	7.37	17
9	163.943	197.909	83.562	0	-3138.69	124.633	0	505.557	929.972	2025.88	119.621	1157.1	213.553	108.857	0	42.7925	365.203	24.06	11.31	2.61	11.5	0	-37.53	-10.6	0	7.37	16.88
10	391.014	197.909	85.2288	0	-3138.69	124.96	0	505.557	936.711	2025.88	119.621	1360.68	165.992	114.403	0	42.7925	323.188	18.79	21.96	2.61	12.05	0	-37.55	-9.61	0	7.37	16.97

	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC
1				Proposed Design Rating Model Source Energy (EDR1)												Proposed Design Rating Model Electric Demand											
2	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	PV	Battery	Flexibility	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Self Util. Cr	PV	Battery	Flexibility	Ins Light	Appl & Coo	Plug Lds	Exterior
3	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kBtu/ft2-y	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)	(kW)
4	27.51	1.64	55.3													0	0.274945	0.022599	0.014324	0	-0.05374	-0.69286	0	0.134212	0.141873	0.303644	0.020387
5	20.27	1.61	51.58													0	0.825347	0.027907	0.014382	0	-0.05374	-0.69806	0	0.170777	0.142238	0.303644	0.027182
6	27.51	1.64	53.33													0	0.215108	0.022599	0.014324	0	-0.0711	0	0	0.134212	0.141828	0.303644	0.020387
7	27.51	1.64	55.13													0	1.02678	0.022429	0.014324	-0.46431	-0.06718	-0.22159	0	0.134212	0.144722	0.303644	0.020387
8	27.51	1.64	51.46													0	0.619533	0.022429	0.014324	-0.51255	-0.06718	-0.29424	0	0.134212	0.144303	0.303644	0.020387
9	27.51	1.64	54.75													0	0.274945	0.022599	0.014142	0	-0.05374	-0.69274	0	0.134212	0.141873	0.303644	0.020387
10	27.51	1.64	61.74													0	1.02787	0.022599	0.014324	0	-0.05374	-0.63202	0	0.134212	0.142543	0.303644	0.020387

	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD
1		Reference Design Rating Model Site Electric Use									Reference Design Rating Model Site Fuel Use				Reference Design Rating Model TDV (fuel multiplier adjusted)									Reference Design Rating Model TDV (before fu			
2	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Wtr Heat	Appl & Coo	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat
3	(kW)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(Therms)	(Therms)	(Therms)	(Therms)	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y
4	0.165387	467.072	1165.91	197.909	0	2135	930.001	2637.81	297.5	7831.2	388.697	167.457	65.4	621.554	48.9717	54.3	2.61	38.8293	31.93	23.2095	36.39	4.13	240.37	46.37	54.3	2.61	15.92
5	0.759675	486.323	1851.92	244.396	0	2735	930.001	3320.3	335	9902.94	404.717	169.916	65.4	640.033	37.5979	52.36	2.38	29.0244	30.14	17.0974	33.75	3.43	205.78	35.6	52.36	2.38	11.9
6	0.781006	467.072	1165.91	197.909	0	2135	930.001	2637.81	297.5	7831.2	388.697	167.457	65.4	621.554	48.9717	54.3	2.61	38.8293	31.93	23.2095	36.39	4.13	240.37	46.37	54.3	2.61	15.92
7	0.913413	462.01	1260.65	196.418	0	2135	930.001	2637.81	297.5	7919.39	384.485	167.457	65.4	617.342	48.4436	56.63	2.59	38.8293	31.93	23.2095	36.39	4.13	242.152	45.87	56.63	2.59	15.92
8	0.384873	462.01	1260.65	196.418	0	2135	930.001	2637.81	297.5	7919.39	384.485	167.457	65.4	617.342	48.4436	56.63	2.59	38.8293	31.93	23.2095	36.39	4.13	242.152	45.87	56.63	2.59	15.92
9	0.165321	467.072	1165.91	197.909	0	2135	930.001	2637.81	297.5	7831.2	388.697	167.457	65.4	621.554	48.9717	54.3	2.61	38.8293	31.93	23.2095	36.39	4.13	240.37	46.37	54.3	2.61	15.92
10	0.979816	396.997	1825.72	197.909	0	2135	930.001	2637.81	297.5	8420.94	330.38	167.457	65.4	563.238	41.7487	68.98	2.61	38.8293	31.93	23.2095	36.39	4.13	247.827	39.53	68.98	2.61	15.92

	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE
1	uel multiplier adjustment)					Reference Design Rating Model Source Energy (EDR1) (fuel multiplier adjusted)									Reference Design Rating Model Source Energy (EDR1) (before fuel multiplier adjustment)									Reference Design Rating Model Electric Demai			
2	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat
3	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kTDV/ft2-y	(kW)	(kW)	(kW)	(kW)
4	31.93	18.57	36.39	4.13	210.22																			0	2.45933	0.022599	0
5	30.14	13.68	33.75	3.43	183.24																			0	3.04109	0.027907	0
6	31.93	18.57	36.39	4.13	210.22																			0	2.45933	0.022599	0
7	31.93	18.57	36.39	4.13	212.03																			0	2.51185	0.022429	0
8	31.93	18.57	36.39	4.13	212.03																			0	2.51185	0.022429	0
9	31.93	18.57	36.39	4.13	210.22																			0	2.45933	0.022599	0
10	31.93	18.57	36.39	4.13	218.06																			0	2.965	0.022599	0

	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF
1	nd					Energy Design Ratings						EDR1 (source energy)		Compliance Total TDV Results By Fuel (kTDV/ft2-yr)								Source Energy (EDR1) Compliance Results By Fuel (kBtu/ft2-yr)					
2	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Proposed	Proposed	Proposed	Standard	Standard	Standard	Proposed	Standard	Proposed Model		Standard Model		Proposed Design Ratin		Reference Design Ratir		Proposed Model		Standard Model		Proposed Design Ratin	
3	(kW)	(kW)	(kW)	(kW)	(kW)	Efficiency	PV+Batt+Fl	Total	Efficiency	PV+Batt+Fl	Total	Total	Total	Electric	Gas	Electric	Gas	Electric	Gas	Electric	Gas	Electric	Gas	Electric	Gas	Electric	Gas
4	0.623429	0.118043	0.431964	0.06293	3.7183	43	20	23	45.2	19.7	25.5			16.85	33.18	22.51	32.57	16.85	33.18	62.52	82.191						
5	0.798632	0.118043	0.543727	0.070862	4.60026	42.2	17.1	25.1	44.3	18.9	25.4			19.45	26.11	23.36	26.48	19.45	26.11	59.04	62.3223						
6	0.623429	0.118043	0.431964	0.06293	3.7183	41.5	19.3	22.2	45.2	19.7	25.5			14.94	31.41	22.51	32.57	14.94	31.41	62.52	82.191						
7	0.623429	0.118043	0.431964	0.06293	3.77065	43.2	20.4	22.8	44.7	19.5	25.2			17.0474	34.09	22.43	32.16	17.0474	34.09	64.77	81.7229						
8	0.623429	0.118043	0.431964	0.06293	3.77065	42.1	20.8	21.3	44.7	19.5	25.2			14.2174	34.13	22.43	32.16	14.2174	34.13	64.77	81.7229						
9	0.623429	0.118043	0.431964	0.06293	3.7183	42.8	20	22.8	45.2	19.7	25.5			16.83	32.65	22.51	32.57	16.83	32.65	62.52	82.191						
10	0.623429	0.118043	0.431964	0.06293	4.22396	43.9	19	24.9	45.8	20.3	25.5			27.11	28.3	32.04	27.94	27.11	28.3	76.36	75.808						

	JG	JH	JI	JJ	JK	JL	JM	JN	JO	JP	JQ	JR	JS	JT	JU	JV	JW	JX	JY	JZ	KA	KB	KC	KD	KE	KF	KG
1			Proposed PV Scaling			Target EDR		Standard Design PV		Proposed Design CO2 Emissions			Standard Design CO2 Emissions			Self Utilization Credit		Proposed Model Site Electric CO2 Emissions									
2	Reference Design Ratir		Max PV	PV Scale	Scaled PV		Target	Prop Mixec	Std Design	Self Consur	Grid Export	CO2 Generi	Self Consur	Grid Export	CO2 Generi	TDV Cap	Battery	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Self Util. Cr	PV	Battery	Flexibility	Ins Light	Appl & Coo
3	Electric	Gas	Ratio	Factor	Total kW	EDR	Status	Total kWh	PV kW	(metric ton	(metric ton	(metric ton	(metric ton	(metric ton	(metric ton	(kTDV/ft2-y	Ratio	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
4			1.6	1	2			4228.68	2.69376	0.51	0.07	2.24	0.25	0.4	2.16			29.2339	35.1538	39.4886	16.6741	0	-478.443	-98.9254	0	109.703	183.153
5			1.6	1	2			4729.75	3.01295	0.52	0.06	2.45	0.27	0.45	2.37			31.1941	77.4143	48.7641	16.7314	0	-478.443	-97.5172	0	139.591	184.361
6			1	0.881958	2.64587			4228.68	2.69376	0.25	0.38	2.09	0.25	0.4	2.16			26.8297	32.8545	39.4886	16.6741	0	-632.951	0	0	109.703	183.103
7			1.6	1	2.5			4228.9	2.6939	0.53	0.17	2.19	0.25	0.39	2.14	7.6426	0.676935	30.4202	58.9981	39.1911	16.6741	-70.3188	-598.054	-33.5594	0	109.703	185.411
8			1.6	1	2.5			4228.9	2.6939	0.54	0.16	2.18	0.25	0.39	2.14	7.6426	0.635295	30.4659	49.7185	39.1911	16.6741	-66.8326	-598.054	-38.3667	0	109.703	184.357
9			1.6	1	2			4228.68	2.69376	0.51	0.07	2.21	0.25	0.4	2.16			29.2339	35.1538	39.4886	16.3487	0	-478.443	-98.9406	0	109.703	183.153
10			1.6	1	2			4513.79	2.87538	0.51	0.07	2.04	0.26	0.43	1.95			22.9032	91.7531	39.4886	16.6741	0	-478.443	-98.2861	0	109.703	184.503

	KH	KI	KJ	KK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH
1				Proposed Model Site Fuel CO2 Emissions					Standard Model Site Electric CO2 Emissions										Standard Model Site Fuel CO2 Emissions				Reference Design Rating Model Site Electric CO2 Emission				
2	Plug Lds	Exterior	TOTAL	Spc Heat	Wtr Heat	Flexibility	Appl & Coo	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	PV	Ins Light	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Wtr Heat	Appl & Coo	TOTAL	Spc Heat	Spc Cool	IAQ Vent	Wtr Heat	Ins Light
3	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)
4	413.965	26.1987	276.202	1133.33	607.14	0	227.101	1967.57	28.3308	50.3617	39.4886	16.6741	-644.406	109.703	184.602	413.965	26.1987	224.918	1099.06	607.14	227.101	1933.3	97.295	282.659	39.4886	0	463.08
5	413.965	34.9302	370.991	1237.68	618.702	0	227.101	2083.48	31.6642	110.077	48.7641	16.7314	-720.763	139.591	185.894	413.965	34.9302	260.855	1260.15	618.702	227.101	2105.95	100.456	437.414	48.7641	0	593.22
6	413.965	26.1987	215.866	1043.5	607.14	0	227.101	1877.74	28.3308	50.3617	39.4886	16.6741	-644.406	109.703	184.602	413.965	26.1987	224.918	1099.06	607.14	227.101	1933.3	97.295	282.659	39.4886	0	463.08
7	413.965	26.1987	178.629	1178.61	607.14	0	227.101	2012.85	27.8419	50.7616	39.1911	16.6741	-644.439	109.703	184.911	413.965	26.1987	224.808	1078.31	607.14	227.101	1912.55	96.6672	303.39	39.1911	0	463.08
8	413.965	26.1987	167.021	1180.6	607.14	0	227.101	2014.84	27.8419	50.7616	39.1911	16.6741	-644.439	109.703	184.911	413.965	26.1987	224.808	1078.31	607.14	227.101	1912.55	96.6672	303.39	39.1911	0	463.08
9	413.965	26.1987	275.861	1133.33	577.71	0	227.101	1938.14	28.3308	50.3617	39.4886	16.6741	-644.406	109.703	184.602	413.965	26.1987	224.918	1099.06	607.14	227.101	1933.3	97.295	282.659	39.4886	0	463.08
10	413.965	26.1987	328.46	880.926	607.14	0	227.101	1715.17	22.3052	125.737	39.4886	16.6741	-687.853	109.703	185.877	413.965	26.1987	252.096	859.715	607.14	227.101	1693.96	82.9071	431.916	39.4886	0	463.08

	LI	LJ	LK	LL	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI
1	s				Reference Design Rating Model Site Fuel CO2				CAHP / CMFNH Results																		
2	Appl & Coo	Plug Lds	Exterior	TOTAL	Spc Heat	Wtr Heat	Appl & Coo	TOTAL	EDR Bonus	CAHP Delta	Cash Bonus	2019 Zone	2019 Zone	High Perfor	High Perfor	High Perfor	Whole Hou	Balanced IA	DOE Zero E	Drain Wate	Design Cha	ENERGYSta	CAHP Base	CAHP Total Incentive			
3	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(kg)	(int)	(int)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)	($)			
4	187.226	544.689	71.4714	1685.91	2062.83	888.701	347.08	3298.61																			
5	187.226	685.617	80.4804	2133.18	2147.85	901.747	347.08	3396.67																			
6	187.226	544.689	71.4714	1685.91	2062.83	888.701	347.08	3298.61																			
7	187.226	544.689	71.4714	1705.72	2040.47	888.701	347.08	3276.25																			
8	187.226	544.689	71.4714	1705.72	2040.47	888.701	347.08	3276.25																			
9	187.226	544.689	71.4714	1685.91	2062.83	888.701	347.08	3298.61																			
10	187.226	544.689	71.4714	1820.78	1753.34	888.701	347.08	2989.12																			

FormatVersion=11 (ver 2016.3.0) CSV formatted strings that serve as column titles for the results summary data:

```
,,,,Number of,Conditioned,,,,,Proposed Model Site Electric Use,,,,,,,,,,,,Proposed Model Site Natural Gas Use,,,,,,,,,,Proposed Model Site Other Fuel Use,,,,,,,,,,Proposed Model TDV,,,,,,,,,,,,,,Proposed Model Electric Demand,,,,,,,,,,,,,Standard Model Site Electric Use,,,,,,,,,,Standard Model Site Natural Gas Use,,,,,,,,,,Standard Model Site Other Fuel Use,,,,,,,,,,Standard Model TDV,,,,,,,,,,,Standard Model Electric Demand,,,,,,,,,,,Software Versions,,,Savings Results,,,,,CAHP / CMFNH Results,,,,,,,,,,,,,,,,,Proposed Design Rating Model Site Electric Use,,,,,,,,,,,,Proposed  Design Rating Model Site Natural Gas Use,,,,,,,,,,Proposed  Design Rating Model Site Other Fuel Use,,,,,,,,,,Proposed  Design Rating Model TDV,,,,,,,,,,,,Proposed Design Rating Model Electric Demand,,,,,,,,,,,,Reference Design Rating Model Site Electric Use,,,,,,,,,,Reference Design Rating Model Site Natural Gas Use,,,,,,,,,,Reference Design Rating Model Site Other Fuel Use,,,,,,,,,,Reference Design Rating Model TDV,,,,,,,,,,Reference Design Rating Model Electric Demand,,,,,,,,,,Energy Design Ratings,,,,,Compliance Total TDV Results By Fuel (kTDV/ft2-yr)

,Project,,Climate,Dwelling,Area,,Pass /,Compliance,Design,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc
```

```
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ
Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr
Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl &
Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Comp Total,Compliance,,End User,Total Demand,Compliance Demand,Total TDV,Compliance TDV,EDR Bonus
Points,CAHP Delta EDR,Cash Bonus Total,2019 Zone Ready Kicker,2019 Zone Kicker,High Performance Fenestration
Kicker,High Performance Attic Kicker,High Performance Wall Kicker,Whole House Fans Kicker,Balanced IAQ Kicker,DOE Zero
Energy Kicker,Drain Water Heat Recovery Kicker,Design Charrette Kicker,ENERGYStar Laundry Recycling Kicker,CAHP Base
Incentive,CAHP Total Incentive,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ
Vent,Other HVAC,Wtr Heat,PV Credit,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ
Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other
HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins
Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Proposed,Proposed,Standard,Standard,Standard,Proposed Model,,Standard Model,,Proposed Design Rating
Model,,Reference Design Rating Model

Run Date/Time,Path/File,Run Title,Zone,Units,(ft2),Analysis
Type,Fail,Margin,Rating,(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(Therms),(Therms),(Ther
ms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMB
tu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(k
Wh),(kWh),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MM
Btu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),Ruleset,CSE,Application,(kW),(kW),(%),(%),(int),(int),($),($
),($),($),($),($),($),($),($),($),($),($),($),($),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kW
h),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MMBtu),(M
MBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(
kWh),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MMBtu),
(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),Excl. PV+Batt,PV+Batt Only,Final EDR,Excl. PV,Min Reqd
PV,Electric,Gas,Electric,Gas,Electric,Gas,Electric,Gas
```

FormatVersion=13 (ver 2016.3.0 SP2) CSV formatted column titles for results summary data:

```
,,,,Number of,Conditioned,,,,,Proposed Model Site Electric Use,,,,,,,,,,,,Proposed Model Site Natural Gas
Use,,,,,,,,,,Proposed Model Site Other Fuel Use,,,,,,,,,,Proposed Model TDV,,,,,,,,,,,,,Proposed Model Electric
Demand,,,,,,,,,,,,,Standard Model Site Electric Use,,,,,,,,,,Standard Model Site Natural Gas Use,,,,,,,,,,Standard
Model Site Other Fuel Use,,,,,,,,,,Standard Model TDV,,,,,,,,,,,Standard Model Electric Demand,,,,,,,,,,,Software
Versions,,,Savings Results,,,,CAHP / CMFNH Results,,,,,,,,,,,,,,,,Proposed Design Rating Model Site Electric
Use,,,,,,,,,,,,Proposed  Design Rating Model Site Natural Gas Use,,,,,,,,,,Proposed  Design Rating Model Site Other
Fuel Use,,,,,,,,,,Proposed  Design Rating Model TDV,,,,,,,,,,,,Proposed Design Rating Model Electric
Demand,,,,,,,,,,,,Reference Design Rating Model Site Electric Use,,,,,,,,,,Reference Design Rating Model Site Natural
Gas Use,,,,,,,,,,Reference Design Rating Model Site Other Fuel Use,,,,,,,,,,Reference Design Rating Model
TDV,,,,,,,,,,Reference Design Rating Model Electric Demand,,,,,,,,,,Energy Design Ratings,,,,,Compliance Total TDV
Results By Fuel (kTDV/ft2-yr),,,,,,,,Proposed PV Scaling,,,Target EDR,,Minimum Req'd PV,,Proposed Design CO2
Emissions,,,Standard Design CO2 Emissions,,

,Project,,Climate,Dwelling,Area,,Pass /,Compliance,Design,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins
Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ
Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr
Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl &
Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Comp Total,Compliance,,End User,Total Demand,Compliance Demand,Total TDV,Compliance TDV,EDR Bonus
Points,CAHP Delta EDR,Cash Bonus Total,2019 Zone Ready Kicker,2019 Zone Kicker,High Performance Fenestration
Kicker,High Performance Attic Kicker,High Performance Wall Kicker,Whole House Fans Kicker,Balanced IAQ Kicker,DOE Zero
Energy Kicker,Drain Water Heat Recovery Kicker,Design Charrette Kicker,ENERGYStar Laundry Recycling Kicker,CAHP Base
Incentive,CAHP Total Incentive,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ
Vent,Other HVAC,Wtr Heat,PV Credit,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ
Vent,Other HVAC,Wtr Heat,PV,Battery,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other
HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins
Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc
```

```
Heat,Spc Cool,IAQ Vent,Other HVAC,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Proposed,Proposed,Standard,Standard,Standard,Proposed Model,,Standard Model,,Proposed Design Rating
Model,,Reference Design Rating Model,,Max PV,PV Scale,Scaled PV,,Target,Prop Mixed Fuel,Min Req'd,Self Consumed
Solar,Grid Exported Solar,CO2 Generated,Self Consumed Solar,Grid Exported Solar,CO2 Generated

Run Date/Time,Path/File,Run Title,Zone,Units,(ft2),Analysis
Type,Fail,Margin,Rating,(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(Therms),(Therms),(Ther
ms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMB
tu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(k
Wh),(kWh),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MM
Btu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),Ruleset,CSE,Application,(kW),(kW),(%),(%),(int),(int),($),($
),($),($),($),($),($),($),($),($),($),($),($),($),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kW
h),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MMBtu),(M
MBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(
kWh),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(MMBtu),(MMBtu),(MMBtu),
(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(MMBtu),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),Excl. PV+Batt,PV+Batt Only,Final EDR,Excl. PV,Min Reqd
PV,Electric,Gas,Electric,Gas,Electric,Gas,Electric,Gas,Ratio,Factor,Total kW,EDR,Status,Total kWh,PV kW,(metric
ton/yr),(metric ton/yr),(metric ton/yr),(metric ton/yr),(metric ton/yr),(metric ton/yr)
```

FormatVersion=21 (ver 2019.1.1) CSV formatted column titles for results summary data:

```
,,,,Number of,Conditioned,,,,,,,,,Proposed Model Site Electric Use,,,,,,,,,,,,,,Proposed Model Site Fuel
Use,,,,,,Proposed Model TDV,,,,,,,,,,,,,,Proposed Model Source Energy (EDR1),,,,,,,,,,,,Proposed Model Electric
Demand,,,,,,,,,,,,,,Standard Model Site Electric Use,,,,,,,,,,,Standard Model Site Fuel Use,,,,,Standard Model
TDV,,,,,,,,,,,Standard Model Source Energy (EDR1),,,,,,,,,,,Standard Model Electric Demand,,,,,,,,,,,Software
Versions,,,,Savings Results,,,,,Proposed Design Rating Model Site Electric Use,,,,,,,,,,,,,,Proposed Design Rating Model
Site Fuel Use,,,,,Proposed Design Rating Model TDV,,,,,,,,,,,,,,Proposed Design Rating Model Source Energy
(EDR1),,,,,,,,,,,,,Proposed Design Rating Model Electric Demand,,,,,,,,,,,,,,Reference Design Rating Model Site Electric
Use,,,,,,,,,Reference Design Rating Model Site Fuel Use,,,,,Reference Design Rating Model TDV (fuel multiplier
adjusted),,,,,,,,,Reference Design Rating Model TDV (before fuel multiplier adjustment),,,,,,,,,Reference Design Rating
Model Source Energy (EDR1) (fuel multiplier adjusted),,,,,,,,,Reference Design Rating Model Source Energy (EDR1)
(before fuel multiplier adjustment),,,,,,,,,Reference Design Rating Model Electric Demand,,,,,,,,,Energy Design
Ratings,,,,,,EDR1 (source energy),,Compliance Total TDV Results By Fuel (kTDV/ft2-yr),,,,,,,,Source Energy (EDR1)
Compliance Results By Fuel (kBtu/ft2-yr),,,,,,,,Proposed PV Scaling,,,Target EDR,,Standard Design PV,,Proposed Design
CO2 Emissions,,,Standard Design CO2 Emissions,,,Self Utilization Credit,,Proposed Model Site Electric CO2
Emissions,,,,,,,,,,,,,Proposed Model Site Fuel CO2 Emissions,,,,,,Standard Model Site Electric CO2
Emissions,,,,,,,,,,,Standard Model Site Fuel CO2 Emissions,,,,,Reference Design Rating Model Site Electric CO2
Emissions,,,,,,,,,Reference Design Rating Model Site Fuel CO2 Emissions,,,,,CAHP / CMFNH Results,,,,,,,,,,,,,,,

,Project,,Climate,Dwelling,Area,,Pass /,TDV Margin,EDR Efficiency,EDR Total,EDR,EDR1 (source energy),,Spc Heat,Spc
Cool,IAQ Vent,Wtr Heat,Self Util. Credit,PV,Battery,Flexibility,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp
Total,Spc Heat,Wtr Heat,Flexibility,Appl & Cook,TOTAL,Comp Total,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Self Util.
Credit,PV,Battery,Flexibility,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc Heat,Spc Cool,IAQ Vent,Wtr
Heat,PV,Battery,Flexibility,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Self
Util. Credit,PV,Battery,Flexibility,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc Heat,Spc Cool,IAQ
Vent,Wtr Heat,PV,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc Heat,Wtr Heat,Appl & Cook,TOTAL,Comp
Total,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,PV,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Spc Heat,Spc
Cool,IAQ Vent,Wtr Heat,PV,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,PV,Ins
Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Comp Total,Compliance,,End User,Fuel,Total Demand,Compliance Demand,Total
TDV,Compliance TDV,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Self Util. Credit,PV,Battery,Flexibility,Ins Light,Appl &
Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Wtr Heat,Flexibility,Appl & Cook,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Self
Util. Credit,PV,Battery,Flexibility,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr
Heat,PV,Battery,Flexibility,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Self
Util. Credit,PV,Battery,Flexibility,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr
Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Wtr Heat,Appl & Cook,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr
Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Ins Light,Appl & Cook,Plug
Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc
Cool,IAQ Vent,Wtr Heat,Ins Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Ins Light,Appl
& Cook,Plug Lds,Exterior,TOTAL,Proposed,Proposed,Proposed,Standard,Standard,Standard,Proposed,Standard,Proposed
Model,,Standard Model,,Proposed Design Rating Model,,Reference Design Rating Model,,Proposed Model,,Standard
Model,,Proposed Design Rating Model,,Reference Design Rating Model,,Max PV,PV Scale,Scaled PV,,Target,Prop Mixed
Fuel,Std Design,Self Consumed Solar,Grid Exported Solar,CO2 Generated,Self Consumed Solar,Grid Exported Solar,CO2
Generated,TDV Cap,Battery,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Self Util. Credit,PV,Battery,Flexibility,Ins Light,Appl &
Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Wtr Heat,Flexibility,Appl & Cook,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,PV,Ins
Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Wtr Heat,Appl & Cook,TOTAL,Spc Heat,Spc Cool,IAQ Vent,Wtr Heat,Ins
Light,Appl & Cook,Plug Lds,Exterior,TOTAL,Spc Heat,Wtr Heat,Appl & Cook,TOTAL,EDR Bonus Points,CAHP Delta EDR,Cash
Bonus Total,2019 Zone Ready Kicker,2019 Zone Kicker,High Performance Fenestration Kicker,High Performance Attic
Kicker,High Performance Wall Kicker,Whole House Fans Kicker,Balanced IAQ Kicker,DOE Zero Energy Kicker,Drain Water Heat
Recovery Kicker,Design Charrette Kicker,ENERGYStar Laundry Recycling Kicker,CAHP Base Incentive,CAHP Total Incentive
```

```
Run Date/Time,Path/File,Run Title,Zone,Units,(ft2),Analysis Type,Fail,(kTDV/ft2-
yr),Margin,Margin,Total,Margin,Total,(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh
),(Therms),(Therms),(Therms),(Therms),(Therms),(Therms),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-
yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kW
h),(kWh),(kWh),(kWh),(Therms),(Therms),(Therms),(Therms),(Therms),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kBtu/ft2-
yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-
yr),(kBtu/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),Ruleset,CSE,Application,Type,(kW),(kW),(%),(%),(kWh),(kWh),(
kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(Therms),(Therms),(kWh),(Therms),(Therms),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-
yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-yr),(kBtu/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(kWh),(k
Wh),(Therms),(Therms),(Therms),(Therms),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-yr),(kTDV/ft2-
yr),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),(kW),Efficiency,PV+Batt+Flex Only,Total,Efficiency,PV+Batt+Flex
Only,Total,Total,Total,Electric,Gas,Electric,Gas,Electric,Gas,Electric,Gas,Electric,Gas,Electric,Gas,Electric,Gas,Elect
ric,Gas,Ratio,Factor,Total kW,EDR,Status,Total kWh,PV kW,(metric ton/yr),(metric ton/yr),(metric ton/yr),(metric
ton/yr),(metric ton/yr),(metric ton/yr),(kTDV/ft2-
yr),Ratio,(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg)
,(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(kg),(in
t),(int),($),($),($),($),($),($),($),($),($),($),($),($),($),($)
```

```
int CMX_XXX(      <type> argument, …  );

      // typedef int  (__cdecl *PCMX_XXX)(   <type>, … );
      // _CMX_XXX
```

where:

- pXXX is a xxx.

```
int CMX_XXX(      <type> argument, …  );

      // typedef int  (__cdecl *PCMX_XXX)(   <type>, … );
      // _CMX_XXX
```

where:

- pXXX is a xxx.

```
void CMX_ExitBEMProcAndCmpMgrDLLs();

      // typedef void (__cdecl *PCMX_ExitBEMProcAndCmpMgrDLLs)();
      // _CMX_ExitBEMProcAndCmpMgrDLLs
```

Call this routine only once (following all simulations) immediately prior to unloading the DLLs.