Using HAP v4.4 for LEED® Energy and Atmosphere Credit 1 Analysis

Introduction

This document provides a high-level tutorial of recommended procedures for performing a LEED® NC-2.2 Energy and Atmosphere Credit 1 analysis using the Carrier Hourly Analysis Program (HAP) v4.4.

In version 4.4, HAP has been modified to streamline the steps needed to perform the EA Credit 1 analysis. As a result, the recommended procedure for performing the analysis is different than in HAP v4.3. To make your work efficient, it is important to recognize these differences before starting work with v4.4.

The new features in HAP v4.4 are flexible. As a result there are multiple ways to approach the EA Credit 1 analysis. The procedure described below is one common way to approach the problem. As you become more familiar with the new version of HAP, you'll likely develop your own approach that best suits your own work style and the needs of individual project applications.

The following is meant only as a high-level tutorial on the new procedure. Further, more detailed information on the features described below can be found in the program on-line help system, the program manual and via the HAP for LEED® training classes offered by Carrier.

LEED® EA Credit 1 Analysis with HAP v4.4

The LEED® EA Credit 1 analysis in HAP v4.4 involves a procedure with 4 major steps described below.

> **Key Concept:** One important change in HAP v4.4 is that data for all five buildings in the EA Credit 1 analysis (Proposed and four Baselines) should be stored in one HAP project. This is the most efficient approach now and is also necessary for generating the *LEED NC-2.2 EA Credit 1 Summary* report that tabulates energy and cost results from the five buildings.

Step 1. Define Proposed Building.

First define the Proposed building design:

a. Select design and simulation weather for the project.

b. Spaces can be created in a number of ways depending on the nature of the project and whether you are in preliminary or detailed design:

- By importing space definitions in gbXML format from a CAD or Building Information Modeling (BIM) tool.
- By generating spaces using the Building Wizard feature of the program. Note: If you anticipate using the wizard features to create both spaces and HVAC equipment, you should use the Full Wizard Session feature to run both wizards in tandem.
- By creating spaces via takeoffs from architectural drawings.

c. HVAC systems and plants can be created in different ways too:

- By generating HVAC equipment via the Equipment Wizard or Full Wizard Session features in HAP.
- By manually creating air systems and plants using features of the HAP detailed design user interface.

d. Create utility rates for electricity and fuel using the HAP detailed design user interface.

e. Finally, create the HAP "Building" which collects together all the systems, plants and utility rates for the Proposed design. Make sure to specify non-HVAC energy uses here if they exist for the project.

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Step 2. Create "Baseline - 0 Degree" Building.

Create a duplicate of the Proposed building and all of its spaces and HVAC equipment. This duplicate serves as the starting point for modifying data to create the minimally compliant baseline building.

a.   In the HAP main program window click on the Building node in the tree panel on the left.

b.   In the list panel on the right, right-click on the Proposed building and choose the "Duplicate Building (with Spaces and HVAC Eqpt)" option on the pop-up menu.

c.   In the window that appears specify that you are creating a baseline building. Then click OK.

HAP will produce a copy of the building and all the plants, air systems, spaces, chillers, cooling towers and boilers that are part of the building. Item names for all copies will have the prefix "[B000]" so you can easily identify the data.

Next, modify the [B000] copies of data according to ASHRAE Standard 90.1-2004 Appendix G rules. The most efficient way to perform this work varies with the application. Some useful tips follow:

- Typically it is useful to start by defining the prescriptive wall, roof, window and door assemblies needed for the Baseline building.
- Then use the Replace option on the Edit menu to perform global search and replace on the [B000] spaces. The Replace option can be used to rapidly change spaces characteristics for a large group of spaces all at one time.
- If the mandated baseline HVAC system is of the same type as used in the Proposed building, edit the air system, plant, chiller, tower and boiler data for the baseline to comply with ASHRAE 90.1-2004 Appendix G rules.
- If the mandated baseline HVAC system is a different type than used in the Proposed building, then it will typically be most efficient to delete the "[B000]" copies of systems, plants, chillers, towers and boilers and redefine the HVAC systems and equipment from scratch using the ASHRAE 90.10-2004 Appendix G rules.
- As a last step, you must edit the [B000] building to assign utility rates for electricity and fuel, and to define any non-HVAC energy use data for the building.

While defining HVAC systems and plants, you can make use of a number of useful features for:

- Autosizing cooling and heating equipment capacities as peak load plus a specified percentage (example: peak load + 15% for cooling equipment).
- Automatically calculating the air system fan power per the ASHRAE 90.1-2004 Appendix G fan equation in section G.3.1.2.9.
- Modeling VAV fan part-load performance per the part load fan curve in ASHRAE 90.1-2004 Appendix G table G.3.1.3.15.
- Defining DX equipment performance in terms of the minimum EER or COP and allowing the program to automatically determine the corresponding compressor input power.
- Specifying terminal fan power as W/CFM or W/L/s.
- Specifying water flow rates in terms of gpm/Ton, L/s/kW or delta-T rather than as gpm.
- Specifying water pump power in terms of W/gpm or W/L/s instead of pump head.

Step 3. Produce Remaining Three Baseline Buildings

Once the "Baseline - 0 Degree" building has been created, you can quickly generate the 90 deg, 180 deg and 270 deg Baseline buildings using the following steps:

a.   In the HAP main program window click on the Building node in the tree panel on the left.

b.   In the list panel on the right, right-click on the "Baseline 0 Degree" building and choose the "Perform LEED (90.1 PRM) Rotations" option on the pop-up menu.

c.   A window will appear explaining the function of this option. Simply click OK to perform the rotations.

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This option will create three copies of the "Baseline 0 Deg" building along with its plants, air systems, spaces, chillers, towers and boilers, as necessary. In the first copy all spaces will be rotated 90 degrees from original orientation. In the second copy spaces are rotated 180 degrees from original orientation. In the final copy spaces are rotated 270 degrees. The item names for the copied items use the prefixes [B090], [B180] and [B270] for the 90, 180 and 270 degree rotations respectively, so the data can be easily identified.

At this point you have five complete building definitions in your HAP project - the Proposed, Baseline 0 deg, Baseline 90 deg, Baseline 180 deg and Baseline 270 deg buildings.

Step 4. Produce the LEED® NC-2.2 EA Credit 1 Summary Report.

Finally, you're ready to produce the LEED® EA Credit 1 Summary report which tabulates energy consumption, demand and energy costs results for the five buildings. The report formats data in a way that matches the key tables in the LEED® NC-2.2 EA Credit 1 online submittal template to facilitate easy transfer of data into the on-line template. The report also provides supplemental information such as a reference table of credit points. To generate this report:

a. In the HAP main program window click on the Building node in the tree panel on the left.

b. In the list panel on the right, select the Proposed building and the four Baseline buildings. Then right-click on the group of selected buildings and choose the "Print/View Simulation Results" option in the pop-up menu.

c. In the Building Simulation Reports selection window click on the "LEED NC-2.2 Report" tab.

d. On this tab check the box for "Generate LEED NC-2.2 EA Credit 1 Summary Report"

e. On this tab also verify the assignments of building designations for Proposed and the four Baseline cases. HAP will default these selections if the buildings use standard prefixes such as [B000], [B090], [B180] and [B270]. If the buildings are named differently, you will need to make the assignments yourself by choosing items from the drop-down lists.

f. Finally click the "Preview" button. The program will automatically run energy analysis calculations for the five buildings and their systems and plants, and then display results on the summary report.