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## Methodology for Modeling Combined Heat & Power for EAp2/c1 in LEED 2009

*Pertains to all Design & Construction 2009 Rating Systems*

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### 1. Background

Combined heat and power (CHP) captures the heat that would otherwise be rejected in traditional fossil fuel generation of electrical power so that the total efficiency of these integrated systems is much greater than from central station power plants and separate thermal systems. CHP systems also produce lower emissions compared to traditional fossil fuel generation. Other benefits include reduction in peak demand, releasing of electrical system capacity, and reduction in overall electrical system transmission and distribution losses.

The treatment of CHP under the ASHRAE 90.1 – 2004 Performance Rating Method (PRM, Appendix G) comes under the purview of G2.4 Energy Rates. This document provides supplemental guidance to G2.4 for modeling the CHP system. The document only applies to on-site systems, and applies to all Design & Construction projects that have CHP systems installed on-site. District Energy Systems are addressed under the “*Treatment of District or Campus Thermal Energy in LEED v2 and LEED 2009*” document.

### 2. CHP Cases & Calculation of Performance

**Table 1: Summary of CHP Cases. CHP cases can be categorized as follows:**

Case	Ownership of CHP vs. Project	CHP Location	Electricity	Recovered Thermal
1	Same	Inside Project Site Boundaries	All in project and/or sold to grid	All in project
2	Different (3 <sup>rd</sup> party)	Inside Project Site Boundaries	All in project and/or sold to grid	All in project

#### Case 1 – Same Ownership, CHP inside project site boundaries

In accordance with the PRM, the parameters of the calculation of the CHP performance are as follows:

- The Baseline Building heating and cooling plant utilizes the backup energy source(s) of the Design, or electricity if no backup source is present or specified.
- When all electricity and thermal outputs (heating or cooling) of the CHP are used within the Design Building, the electricity produced is considered “free”, as is the produced thermal energy. The input fuel for the CHP and any additional purchased energy is charged to the Design Building.
- In some cases some electricity generated by the CHP is sold to the grid or an external customer. Thermal and electrical outputs of the CHP used within the Design Building are treated as above. All electricity sold externally is a



“process”, and both the Design and Baseline Buildings are charged with the input fuel associated with the generation of that electricity. (The sold electricity is irrelevant to the calculations other than for the purpose of determining the associated fuel input.) The thermal output generated from the process and used by the Design is considered “free”.

#### Considerations for Simulation/Calculation:

The PRM requires hourly calculation of the CHP performance, either directly through simulation of the system or manual post-processing of the hourly simulation results. This captures hourly effects of load coincidence and electrical demand reduction, and any declining block or time-of-day utility rate structures. The general approach is to determine the net Design Building hourly energy use after the CHP contribution(s) and then apply the prevailing conventional utility rates. However, it may be possible to conduct the calculation on a net annual basis if hourly load, demand, and/or utility rate relationships are insignificant.

#### Case 2 – Different Ownership, CHP inside the building

The rates charged to a building by a CHP developer or operator for electricity and thermal outputs typically include factors for capital recovery, maintenance, and other non-energy costs. Since these types of costs are not included in the PRM calculation for other energy efficiency equipment and measures within the Design, they are also excluded for the CHP calculation regardless of the ownership of the system. Essentially the CHP system in Case 2 is treated the same as Case 1, with the input fuel charged to the Design Building (at the prevailing utility rate as it applies to the Design Building) for all CHP outputs used within the building, and charged to both the Design and Baseline Buildings for “process” electricity sold externally (again at the prevailing rate). As with Case 1, the Design realizes the benefit of thermal outputs resulting from the “process” generation.