EXAMPLE OF AN ENERGY ANALYSIS PLAN

GENERAL INFORMATION

Project Overview

The Weeksville Heritage Center Education Building will be a 24,000 ft^2 education building with workshop space, exhibit spaces and offices. The proposed 2-story building will be located at 1698 Bergen St., Brooklyn, NY. The estimated construction cost is $14 million.

Project Team

Architect: Caples Jefferson Architects
MEP Engineer: Joseph R. Loring & Associates
Energy Analysis: Viridian Energy and Atmosphere

Energy Goals and Requirements

Local Law 86-2005 requires that all new construction, addition, and substantial renovation projects in occupancy group F-3 with a construction cost of greater than $12 million and less than $30 million demonstrate a minimum annual energy cost savings of 20% (or a minimum of up to 25% if additional energy efficiency measures can be identified for which the simple payback is less than seven years). Percent reductions are to be determined according to the methodology described in LEED-NC 2.1, which references ASHRAE 90.1-1999, or the New York State energy conservation code, whichever is more stringent, as the base case.

[Note that the baseline of ASHRAE 90.1-1999 for LL86 energy cost reduction requirements is only appropriate for projects over $12M that apply to the New York City Department of Buildings (DOB) prior to the State's expected adoption of the ASHRAE 90.1- 2004 standard in December, 2007. In accordance with the LEED NC 2.1 methodology cited in the LL86 Rules, projects that apply to the DOB after the December date must use the more stringent local code baseline of ASHRAE 90.1 2004.]

Local Law 86-2005 also requires that all new building projects in occupancy group F-3 with a construction cost of $2 million or greater be designed and constructed in accordance with the LEED NC 2.2 Green Building Rating System to achieve a LEED Silver or higher rating. To comply with this requirement, the project will be pursuing LEED-NC 2.2 Credits under Energy and Atmosphere (EA) Credit 1 and compliance with Prerequisite 2 through the "Whole Building Energy Simulation" path of LEED-NC 2.2 EA Credit 1. This credit references Appendix G of ASHRAE 90.1-2004 as the base case.

SCHEMATIC DESIGN

Task 1A: Design Case Model

Energy simulation models will be created using the computer program DOE-2.1E.

The simulation model will first be developed based upon Schematic Design narratives, plans and specifications for the design selected by DDC at the Pre-Art Commission Meeting.

Other modeling assumptions regarding operating and lighting schedules, interior equipment/process loads, utility rates, etc. are based on information gathered from the facility/agency and are listed in Appendix A.

The building model created from this information, representing the current building design, will be the Design Case Model.

Task 1B: Base Case LEED 2.1 Model

A Base Case LEED 2.1 Model will be created. Consistent with the requirements of LEED-NC 2.1 EA Credit 1, the LEED 2.1 Base Case Model will be developed by modifying the Design Case Model to comply with the requirements stipulated in the Energy Cost Budget Method described in Section 11 of ASHRAE/IESNA Standard 90.1-1999, and modifications as permitted or required in the LEED rating system.

The regulated load portion of the annual energy cost calculated by the Design Case Model will be compared to the regulated load portion of the annual energy cost calculated by the Base Case LEED 2.1 Model to determine the difference in energy cost. The percentage difference will determine compliance with the energy cost reduction requirements of Local Law 86-2005.

Task 1C: Base Case LEED 2.2 Model

A Base Case LEED 2.2 Model will be created. Consistent with the requirements of LEED-NC 2.2 EA Credit 1, the LEED 2.2 Base Case Model will be developed by modifying the Design Case Model to comply with the requirements stipulated in the Building Performance Rating Method in Appendix G of ASHRAE/IESNA Standard 90.1-2004, and modifications as permitted or required in the LEED rating system.

The total annual energy cost calculated by the Design Case Model will be compared to the annual energy cost calculated by the Base Case LEED 2.2 Model to determine the difference in energy cost. The percentage difference will determine how many LEED-NC 2.2 EAc1 credits the building qualifies for.

Task 1D: Investigate Alternates for HVAC Central Plant and Distribution Systems

Three alternate HVAC systems will be evaluated and compared for the proposed design.

The following HVAC systems will be evaluated:

1. Split DX Gas-Fired Heating System
   Roof-mounted condensers, fan coil units with DX cooling coils located within building. Fin-tube radiation heating; gas-fired modular boilers provide hot water.

2. Chilled Water System
   Central air-cooled chiller, fan coil units with chilled water cooling coils located within building. Fin-tube radiation heating; gas-fired modular boilers provide hot water.

3. Open Loop Geothermal System
   Open loop geothermal wells, water source heat pumps (in place of fan coil units) located within building. Reduced fin-tube radiation (heat pumps provide some heat); fewer gas-fired modular boilers provide hot water.

Task 1E: Cost estimates and cost-benefit analysis for Alternate HVAC Options
Simple payback will be calculated for the Alternate HVAC options. The first cost data for each HVAC option will be based on design cost estimates. The purpose of this cost analysis is to inform the HVAC system selection and should be reviewed by the Design Consultant team, the DDC A&E Engineering and Sustainable Design Units, and the Client Agency.

Task 1F: Energy Modeling Report (Deliverable)
After completing tasks 1A-1E, a report will be written describing the DOE-2 modeling results. The report will summarize the energy and economic analysis for each Alternate HVAC system. Results will include additional first costs, annual energy cost savings, simple payback, and possible LEED credits. Report including system selection is to be included with the SD submission.

DESIGN DEVELOPMENT

Task 2a: Update Energy Models during Design Development (DD)
During the DD phase, the simulation models will be revised to incorporate design decisions that affect the energy efficiency of the building. Such changes may include details and specifications of glass or opaque walls, refinements of lighting design, or greater detail in the HVAC design. The Base and Design Case Models will be modified to reflect these changes.

Task 2b: Analyze Energy Efficiency Measures
A series of energy efficiency measures (EEMs) will be evaluated to determine the energy cost savings, incremental first cost, and simple payback for each. The incremental cost of each measure will be based on latest construction cost estimates. The EEMs are expected to include, but may not be limited to the following:

1. Lower SHGC for Windows
2. Lower U-factor for Windows
3. Additional wall insulation
4. Additional roof insulation
5. High efficiency lighting
6. Lighting controls, including daylight dimming controls
7. Variable speed pumps and fans
8. Premium efficiency motors
9. Heat/cool recovery
10. Outside air modulation using CO2 sensors
11. Temperature controls

Energy cost savings will be determined relative to the Design Case by deleting each measure, one at a time, from the Design Case Model. Based on the estimated energy cost savings and the first cost data for each EEM, the simple payback will be calculated.

The percent savings of the regulated load portion of the Design Case, including selected EEMs, compared to the Base Case LEED-NC 2.1 Model will be determined as per the ASHRAE 90.1-1999, Section 11 calculation methodology, and used to determine compliance with Local Law 86-2005 energy cost reduction requirements.

The percent savings of the Design Case, including selected EEMs, compared to the Base Case LEED-NC 2.2 Model will be determined as per the ASHRAE 90.1-2004, Appendix G calculation methodology, and used to determine the number of LEED-NC 2.2 EAc1 credits earned.

Task 2c: DD Energy Analysis Report (Deliverable)
The energy analysis report will be updated to include the energy and economic analysis for each EEM. Results will include additional first cost, energy cost savings, simple payback, and LEED credits. Report to be included with the DD submission.

75% CONSTRUCTION DOCUMENTS

Task 3a: Update Energy Analyses at 75% Construction Documents (CD)
The Design Case model will be revised to include the EEMs selected by DDC and any design changes between DD and 75% CD that affect the energy efficiency of the building.

As necessary, the ASHRAE simulation will be updated to reflect any design changes based on the 75% CD. The number of LEED points available will be calculated, and compliance with the Local Law 86-2005 energy cost reduction requirements will be confirmed.

Task 3b: 75% CD Energy Analysis Report (Deliverable)
The energy analysis report will be revised to include any changes resulting from the 75% CD analysis. Report to be included with the 75% CD submission.

100% CONSTRUCTION DOCUMENTS

Task 4a: Update Energy Analyses at 100% Construction Documents (CD)
The Design and Base Case Models will be revised as needed to reflect the approved 100% CD documents, the final LEED credits will be calculated, and compliance with the Local Law 86-2005 energy cost reduction requirements will be confirmed.

Task 4b: 100% CD Energy Analysis Report (Deliverable)
The energy analysis report will be revised to include the final energy analysis and LEED credits, and include all necessary documentation required for a LEED rating. Report to be included with the final compliance submission, and to serve as basis for filing with the USGBC.

LOCAL LAW 86 REPORTING REQUIREMENTS

Task 5a: Report Compliance with Local Law 86
The following will be reported at the end of Design to DDC AE based on the 100% CD Energy Analysis and the NYC Local Law 86 of 2005 Reporting Worksheet Instructions:

1. Energy providers and rate structures for each applicable energy source
2. Electric use (kWh/yr) for both Base Cases, and for the Design Case with and without non-regulated energy loads.
3. Sum of monthly peak demand for electricity (kW/yr) for both Base Cases, and for the Design Case with and without non-regulated energy loads.
4. Gas use (MBtu/yr) for both Base Cases, and for the Design Case with and without non-regulated energy loads.

Appendix A: Baseline Modeling Assumptions

Architectural Details:
The building is a 24,000 ft^2 education building with workshop space, exhibit spaces and offices. The proposed 2-story building will be located in Brooklyn, NY. The most recent plans and specifications will be used.

Siting:
There are no obstructions nearby that significantly shade the proposed building.

Number of Occupants by Space:

Space Type	**Number of People**
Offices, Woodshop and Food/Kitchen	5 people/1000 ft^2
Multipurpose Room	50 people/1000 ft^2
Exhibit	40 people/1000 ft^2
Workshops	25 people
Lobby, Corridor and Gift Shop	150 people

Occupancy Schedules:
Note: % values represent the percentage of maximum number of occupants assumed for the space (indicated in the preceding table) during the scheduled time period.

Offices and Food/Kitchen

Weekdays	Midnight - 9:00 am	0%
	9:00 am - 10:00 am	50%
	10:00 am - 12:00 pm	90%
	12:00 pm - 1:00 pm	70%
	1:00 pm - 5:00 pm	90%
	5:00 pm - 6:00 pm	50%
	6:00 pm - Midnight	0%
Weekends	All hours	0%

Exhibit

Weekdays	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	10%
	6:00 pm - Midnight	0%
Weekends	Midnight - 12:00 pm	0%
	12:00 pm - 5:00 pm	15%
	5:00 pm - Midnight	0%

Event day (Six times a year)

	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	10%
	6:00 pm - 7:00 pm	20%
	7:00 pm - 10:00 pm	100%
	10:00 pm - Midnight	0%

Multipurpose Room

Monday, Tuesday and Friday		
	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	50%
	6:00 pm - Midnight	0%
Wednesday	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	100%
	6:00 pm - Midnight	0%
Thursday	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	50%
	6:00 pm - 7:00 pm	10%
	7:00 pm - 10:00 pm	100%
	10:00 pm - Midnight	0%
Weekends	All hours	0%

Workshops

Monday, Tuesday, Thursday and Friday		
	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	50%
	6:00 pm - Midnight	0%
Wednesday	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	100%
	6:00 pm - Midnight	0%
Weekends	Midnight - 12:00 pm	0%
	12:00 pm - 2:00 pm	50%
	2:00 pm - Midnight	0%

Lobby, Corridor and Gift Shop

	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	10%
	6:00 pm - Midnight	0%
Wednesday	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	10%
	6:00 pm - Midnight	0%
Thursday	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	10%
	6:00 pm - 7:00 pm	20%
	7:00 pm - 10:00 pm	50%
	10:00 pm - Midnight	0%
Weekends	Midnight - 12:00 pm	0%
	12:00 pm - 5:00 pm	10%
	5:00 pm - Midnight	0%
Event day (Six times a year)		
	Midnight - 9:00 am	0%
	9:00 am - 6:00 pm	10%
	6:00 pm - 7:00 pm	20%
	7:00 pm - 10:00 pm	50%
	10:00 pm - Midnight	0%

Project Specific Process Loads:

Space Type	**Load**	
Office	1.25 W/ft^2	
Multipurpose and Exhibit Rooms	0.25 W/ft^2	
Workshop	0.5 W/ft^2	
Lobby and Corridor	0.1 W/ft^2	
Food/kitchen	Microwave	1500 W
	Refrigerator (20 cu.ft.)	1000 W
	Coffee Brewer (12 cup/2 burner)	1600 W
Gift Shop	1.0 W/ft^2	

Equipment/Process Schedules:
Equipment schedules are based on occupancy schedules; 100% during occupied hours and 10% during unoccupied hours. Though occupancy varies throughout the day, equipment will remain 100% ON during occupied hours.

Lighting Schedules:
The lighting schedules are based on occupancy schedules; 100% during occupied hours and 5% during unoccupied hours. Though occupancy may vary throughout the day, lighting will remain 100% ON during occupied hours.

Temperature Schedules:
Heating temperature is set for 70 deg. F during the hours of operation with a 10 deg. F setback (setpoint: 60 deg. F) during unoccupied hours. The exhibit space with be heated to 70 deg. F for all hours.

Cooling temperature is set for 78 deg. F during the hours of operations with a 7 deg. F setback (setpoint: 85 deg. F) during unoccupied hours. The exhibit space with be cooled to 78 deg. F for all hours.

HVAC System On/Off Schedules:
Heating and cooling use are assumed to follow occupancy patterns. Heating or cooling is assumed to be available all year. The schedules reflect temperatures that are assumed to be average for each area.

Utility Rates and Structure:
Note: Rates and utilities below must be confirmed in writing by the OSD/DDC.

Electricity
NYPA – Conventional (applies to this project since project peak electric load is <1500 kW)

Electricity Use (kWh):	$0.0523/kWh
Peak Demand (kW):	$21.82/kW

Natural Gas
KeySpan

Firm:	$1.48/therm
Temperature Controlled Interruptible:	$1.21/therm

NYC Weather Data
National Renewable Energy laboratory (NREL) TMY2 tapes will be used. For detailed information refer to http://rredc.nrel.gov/solar/old_data/nsrdb/tmy2/State.html.