Energy Impact Statement

Project Name: **Example Building** OFPC Project No.: **12345**

Building Description and Assumptions:

The design professional shall provide a brief narrative describing various building related items and assumptions used to complete the Energy Impact Statement. Among these are the following:

Building Gross Floor Area
Building Hours of Operation (breakdown for various key areas as required)
Utilities Required
Mechanical Systems Description
    Chilled Water Design Entering and Leaving Temperatures
    Assumed Design Residual Pressure for the Domestic Cold Water System
Electrical System Description

Example Building Data:
General:
- Central Campus building with mix of offices and classrooms. Some small labs.

Building Gross Floor Area:
- 40,000 GSF (4 Stories @ 10,000 GSF each)

Building Hours of Operation (breakdown for various key areas as required):
- 7 a.m. - 6 p.m. and as further defined in the attached calculations and computer simulation input schedules.

Utilities Required:
- High pressure steam from central system.
- Domestic cold water from central system.
- Natural gas from campus distribution system.
- Electricity from central system.
- Chilled Water from central system.
- Fire protection (high pressure) water from central FWDS system in Speedway.
- Laboratory water for humidification from central system.
- Sanitary sewer to existing main in Speedway.
- Storm sewer to existing main in Speedway.

Mechanical Systems Description:
- Two air handling units located in the basement mechanical room.
- VAV boxes with hot water reheat coils.
- Hot water perimeter heating via steam/hot water heat exchanger.
- High pressure steam for autoclaves.
- 39 F Entering Chilled Water Temperature, 56 F Leaving Chilled Water Temperature.
- Assumed Design residual pressure for the Domestic Cold Water System is 30 psi.

Electrical System Description
- Electrical feed will come from Central Campus feeder 21-2.
- No emergency generation is required.

Energy Impact Statement

Project Name: **Example Building** OFPC Project No.: **P1000XXX-03-001**

Building Energy Summary:	**Schematic Phase**	**Design Development Phase**	**Construction Document Phase**
Project Affected Gross Area, (GSF)	40,000 *(See Exhibit A, 1.1)*	40,000 *(See Exhibit B, 1.1)*	40,000 *(See Exhibit C)*
Annual Building Energy Consumption All Energy Input Converted to BTU, (MBTU/year)	14,518 *(See Exhibit A, 1.2)*	12,781 *(See Exhibit B, 1.2)*	12,781 *(See Exhibit C)*
Annual Building Energy Consumption per GSF, (BTU/year/GSF)	363,000 *(See Exhibit A, 1.3)*	319,500 *(See Exhibit B, 1.3)*	319,500 *(See Exhibit C)*

Electrical:

Maximum Demand, (kW)	480 *(See Exhibit A, 2.1)*	474 *(See Exhibit B, 2.1)*	474 *(See Exhibit C)*
Annual Consumption, (kWH/year):	800,000 *(See Exhibit A, 2.2)*	*786,545* *(See Exhibit B, 2.2)*	786,545 *(See Exhibit C)*
Lighting	*Not Required*	346,080 *(See Exhibit B, 2.3)*	346,080 *(See Exhibit C)*
Miscellaneous Power	*Not Required*	212,367 *(See Exhibit B, 2.4)*	212,367 *(See Exhibit C)*
HVAC Equipment	Not Required	228,098 *(See Exhibit B, 2.5)*	228,098 *(See Exhibit C)*

165 PSI Steam:

Peak Load, (lbs/hr):			
Summer	400 *(See Exhibit A, 3.1)*	250 *(See Exhibit B, 3.1)*	250 *(See Exhibit C)*
Winter	400 *(See Exhibit A, 3.2)*	250 *(See Exhibit B, 3.2)*	250 *(See Exhibit C)*
Annual Consumption, (Lb/yr)	200 *(See Exhibit A, 3.3)*	125 *(See Exhibit B, 3.3)*	125 *(See Exhibit C)*

Energy Impact Statement

Project Name: **Example Building** OFPC Project No.: **P1000XXX-03-001**

Chilled Water:	**Schematic Phase**	**Design Development Phase**	**Construction Document Phase**
Peak Load, (tons/hour):			
Summer	320 *(See Exhibit A, 4.1)*	304 *(See Exhibit B, 4.1)*	304 *(See Exhibit C)*
Winter	100 *(See Exhibit A, 4.2)*	82 *(See Exhibit B, 4.2)*	82 *(See Exhibit C)*
Annual Consumption, (ton-hours/year)	320,000 *(See Exhibit A, 4.3)*	297,856 *(See Exhibit B, 4.3)*	297,856 *(See Exhibit C)*

Domestic Cold Water:

Peak Cold Water Demand, (GPM)	200 *(See Exhibit A, 5.1)*	200 *(See Exhibit B, 5.1)*	200 *(See Exhibit C)*
Peak Sanitary Demand, (GPM)	231 *(See Exhibit A, 5.2)*	231 *(See Exhibit B, 5.2)*	231 *(See Exhibit C)*
Annual Consumption (million gallons/year):	9.53 *(See Exhibit A, 5.3)*	9.53 *(See Exhibit B, 5.3)*	9.53 *(See Exhibit C)*
Sanitary Sewer	*Not Required*	11.53 *(See Exhibit B, 5.4)*	11.53 *(See Exhibit C)*

Domestic Hot Water:

Peak Demand, (GPM)	75 *(See Exhibit A, 6.1)*	75 *(See Exhibit B, 6.1)*	75 *(See Exhibit C)*
Annual Consumption, (million gallons/year)	3.01 *(See Exhibit A, 6.2)*	3.01 *(See Exhibit B, 6.2)*	3.01 *(See Exhibit C)*

Natural Gas:

Peak Demand, (CCF/hour)	5 *(See Exhibit A, 7.1)*	4 *(See Exhibit B, 7.1)*	4 *(See Exhibit C)*
Annual Consumption, (CCF/year)	2,500 *(See Exhibit A, 7.2)*	2,000 *(See Exhibit B, 7.2)*	2,000 *(See Exhibit C)*

Storm Drainage System:

Design Storm Peak Volume, (GPM)	286 *(See Exhibit A, 8.1)*	302 *(See Exhibit B, 8.1)*	302 *(See Exhibit C)*

Exhibit A
Energy Impact Statement – Sample
Schematic Design Phase Calculations

In accordance with the Design Phase Deliverables; at the Schematic Design Phase, the design professional will have completed the following items which contribute to the development of the Energy Impact Statement:

- ***Reviewed energy code requirements.***
- ***Typical building elevations with window placement.***
- ***Roof layout.***
- ***Typical floor plans with identified area uses and resulting area square footage.***
- ***Identified all needed HVAC systems with one-line flow diagrams.***
- ***Conceptual plumbing and piping layout.***
- ***Electric one-line diagrams based on conceptual electric requirements.***

Item No.	Building Energy Summary	Descriptions & Calculations
1.1	Project Affected Gross Area, (GSF)	40,000 Sq. Ft. per Schematic Design Phase Space Programming.
1.2	Annual Building Energy Consumption, (MBTU/year)	All Energy Input Converted to MBTU/year Electric=2,730.4 MBTU/year [See Item 2.2] Chilled Water = 3,840 MBTU/year [See Item 4.3] 165 PSI Steam=236.4 MBTU/year [See Item 3.3] Natural Gas=250.0 MBTU/year [See Item 7.2] Total All Sources=14,519 MBTU/year
1.3	Annual Building Energy Consumption per Sq. Ft., (BTU/year/GSF)	14,519 MBTU/year/40,000 SF=363,000 Btu/year/SF

Item No.	Electrical	Descriptions & Calculations
2.1	Maximum Demand, (kW)	Assume: Lighting @ 2 Watts/SF Misc. Electric @ 5 Watts/SF HVAC @ 5 Watts/SF Results in 480 kW Peak Summer Load
2.2	Annual Consumption, (MWH/year)	Assume Annual consumption @ 20 kWH/year per SF. 20 kWH/year per SF X 40,000 SF=800,000 kWH/year.
2.3	Lighting	*Breakout value not required for this item in Schematic Phase.*
2.4	Miscellaneous Power	*Breakout value not required for this item in Schematic Phase.*
2.5	HVAC Equipment	*Breakout value not required for this item in Schematic Phase.*

Item No.	165 PSI Steam	Description & Calculations
3.1	Summer Peak Load, (lbs/hr)	Four Autoclaves: Assume 4 X 100 lbs/hour of 165 PSI steam required=400 lbs/hour.
3.2	Winter Peak Load, (lbs/hr)	Same as Summer Peak Load = 400 lb/hr.
3.3	Annual Consumption, (Lb/yr)	Four Autoclaves: Assume 4 X 100 lbs/hour of 165 PSI steam required/ 1000 lbs/hour per Lb/hr X 2 cycles/day X 250 days/yr = 200 Lb/year

Item No.	Chilled Water	Description & Calculations
4.1	Summer Peak Load, (tons/hr)	Cooling load assumed to be 125 SF/ton @ 40,000 SF = 320 tons/hr.
4.2	Winter Peak Load, (tons/hr)	Assume winter peak load for computer server rooms and miscellaneous year-round cooling needs at 100 tons.
4.3	Annual Consumption, (ton-hrs/yr)	Using Equivalent Full Load Hours Method: 320 tons peak load X 1000 hours equivalent full load operation [from ASHRAE 1984 Fundamentals, pg 28.5] =320,000 ton-hrs/year. Using Cooling Degree Day Method: (320 tons peak load/92 ºF – 72 ºF) X 687 Cooling Degree Days [from ASHRAE 1984 Fundamentals, pg 28.6] X 24 =219,840 ton-hrs/year. Conclusion: Use 320,000 ton-hrs/year.

Item No.	Domestic Cold Water	Descriptions & Calculations
5.1	Peak Demand, (GPM)	Based on a review of the International Building Code, 2000 and International Plumbing Code, 2000 to determine maximum building occupancy levels and resulting minimum number of plumbing facilities, as well as a review of similar building types on campus, it was determined that the domestic cold water peak demand be based on 750 fixture units. From Table E102 of the International Plumbing Code, 2000, the resulting domestic cold water peak demand is 177 GPM. Total DCW Peak Demand = 177 GPM.
5.2	Peak Sanitary Demand, (GPM)	Peak Sanitary Demand= Domestic Cold Water Demand [Item 5.1] + Domestic Hot Water Demand [Item 6.1] = 177 +75 = 252 GPM.
5.3	Annual Consumption, (gallons/year):	Occupied DCW: 177 GPM X 25 % Diversity X 2,000 hours/year =5.31 million gallons/year. Unoccupied DCW: 177 GPM X 2.5% Diversity X 6,760 hours/year =1.80 million gallons/year. Total=5.31 + 1.80 = 7.11 million gallons/year.
5.4	Sanitary Sewer	*Breakout value not required for this item in Schematic Phase.*

Item No.	Domestic Hot Water	Descriptions & Calculations
6.1	Peak Demand, (GPM)	Based on a review of the International Building Code, 2000 and International Plumbing Code, 2000 to determine maximum building occupancy levels and resulting minimum number of plumbing facilities, as well as a review of similar building types on campus, it was determined that the domestic hot water peak demand be based on 250 fixture units. From Table E102 of the International Plumbing Code, 2000, the resulting domestic hot water peak demand is 75 GPM.
6.2	Annual Consumption (million gallons/year):	Occupied: 75 GPM X 25% Diversity X 2,000 hours/year =2.25 million gallons/year. Unoccupied: 75 GPM X 2.5% Diversity X 6,760 hours/years =0.76 million gallons/year. Total = 2.25 + 0.76 = 3.01 million gallons/year.

Item No.	Natural Gas	Descriptions & Calculations
7.1	Peak Demand, (CCF/hour)	Two Gas Fired Unit Heaters in Loading Dock: Assume 2 X 250,000 BTU/hr = 500,000 BTU/hr/100,000 BTU/CCF = 5 CCF/hour.
7.2	Annual Consumption, (CCF/year):	Two Gas Fired Unit Heaters in Loading Dock: Assume 2 X 250,000 BTU/hr X 2000 hours/year operation x 25% diversity/100,000 BTU/CCF = 2,500 CCF/year.

Item No.	Storm Drainage System	Descriptions & Calculations
8.1	Design Peak Storm Volume, (GPM)	From 2000 International Plumbing Code, Section 1106: Assume roof area of 10,000 SF@ 2.75 inches/hr (100 year rainfall) = 286 GPM.

Exhibit B
Energy Impact Statement—Sample
Design Development Phase Calculations

In accordance with the Design Phase Deliverables; at the Design Development Phase, the design professional will have completed the following items (in addition to those completed during the Schematic Design Phase) which contribute to the further refinement of the Energy Impact Statement:

- ***All building elevations with window placement and wall sections.***
- ***Roof and drainage plan.***
- ***All floor plans with identified area uses and resulting area square footage.***
- ***Design criteria for each mechanical system.***
- ***Equipment schedules for major mechanical items.***
- ***Overall building airflow diagram.***
- ***Conceptual control diagrams for all mechanical and plumbing systems.***
- ***Preliminary calculations for HVAC systems.***
- ***Design criteria for each plumbing system, including set points, etc.***
- ***One-line diagrams for all plumbing systems.***
- ***Plumbing and piping plans.***
- ***Typical lighting plans.***
- ***Lighting fixture schedule.***
- ***Review of lighting energy code requirements.***
- ***Normal power riser diagram.***
- ***Power panel schedules.***
- ***Electric load estimates.***

Item No.	Building Energy Summary	Descriptions & Calculations
1.1	Project Affected Gross Area, (GSF)	40,000 GSF per Design Development Phase Space Programming.
1.2	Annual Building Energy Consumption, (MBTU/year)	All Energy Input Converted to MBTU/year Electric = 2,684 MBTU/year [See Item 2.2] Chilled Water = 3,574.2 MBTU/year [See Item 4.3] 165 PSI Steam = 148 MBTU/year [See Item 3.3] <u>Natural Gas = 200 MBTU/year [See Item 7.2]</u> Total All Sources = 12,781 MBTU/year
1.3	Annual Building Energy Consumption per GSF, (BTU/year/GSF)	12,781 MBTU/year/40,000 GSF = 319,522 kBtu/year/GSF

Item No.	Electrical	Descriptions & Calculations
2.1	Maximum Demand, (kW)	Data from Design Development Phase lighting and power panel schedules was input into a computer simulation program. See Table B.1, "Billing Details – Electric" for maximum electric demand. The maximum electric demand of 474 kW occurs in June.
2.2	Annual Consumption, (MWH/year)	Data from Design Development Phase lighting and power panel schedules was input into a computer simulation program. See Table B.1, "Billing Details—Electric" for annual electric consumption. The annual electric consumption for all components is 786,545 kWH.
2.3	Lighting	For electrical consumption by component, see Table B.2, "Energy Budget by System Component". This table shows electrical energy as kBTUs. The estimated annual electrical consumption for lighting is listed under "Site Energy" as 1,181,170 kBTU per year. This converts to 346,080 kWH per year.
2.4	Miscellaneous Power	For electrical consumption by component, see Table B.2, "Energy Budget by System Component". This table shows electrical energy as kBTUs. The estimated annual electrical consumption for miscellaneous power is listed under "Site Energy" as 724,809. This converts to 212,367 kWH per year.
2.5	HVAC Equipment	For electrical consumption by component, see Table B.2, "Energy Budget by System Component". This table shows electrical energy as KBTUs. The estimated annual electrical consumption for HVAC is listed under "Site Energy" as the sum of the air system fans, pumps and cooling towers, or 536,896 + 53,690 + 187,913 = 778,499. This sum converts to 228,098 kWH per year.

Item No.	165 PSI Steam	Description & Calculations
3.1	Summer Peak Load, (lbs/hr)	During the Design Development Phase two autoclaves were eliminated. From the equipment schedules, the two remaining autoclaves require 125 lbs/hour. 2 X 125 lbs/hour of 165 PSI steam required = 250 lbs/hour.
3.2	Winter Peak Load, (lbs/hr)	Same as Summer Peak Load = 250 lbs/hr.
3.3	Annual Consumption, (Lb/yr)	Assume 2 X 125 lbs/hour of 165 PSI steam required / 1000 lbs/hour per Lb/hr X 2 cycles/day X 250 days/yr = 125 Lb/year

Item No.	Chilled Water	Description & Calculations
4.1	Summer Peak Load, (tons/hr)	Data from Design Development Phase was input into a computer simulation program to determine the estimated peak chilled water demand. See Table B.3, "Hourly Simulation – Summer Chiller Plant" for details. The peak summer chilled water demand of 3,648 MBH or 304 tons occurs at 4:00 pm on July 22.
4.2	Winter Peak Load, (tons/hr)	Data from Design Development Phase was input into a computer simulation program to determine the estimated peak chilled water demand. See Table B.4, "Hourly Simulation – Winter Chiller Plant" for details. The peak winter chilled water demand of 984 MBH or 82 tons occurs at 2:00 pm on April 28.
4.3	Annual Consumption, (ton-hrs/yr)	Data from Design Development Phase was input into a computer simulation program to determine the annual chilled water consumption. See Table B.2, "Energy Budget by System Component" for details. The estimated annual chilled water consumption is listed under "Site Energy" as 3,574,272 kBTU. This converts to 297,856 ton-hours per year. Note: winter cooling load is handled by winterized cooling towers via free cooling system.

Item No.	Domestic Cold Water	Description & Calculations
5.1	Peak Demand, (GPM)	Based on a review of the International Building Code, 2000 and International Plumbing Code, 2000 to determine maximum building occupancy levels and resulting minimum number of plumbing facilities, as well as a review of similar building types on campus, it was determined that the domestic cold water peak demand be base on 750 fixture units. From Table E102 of the International Plumbing Code, 2000, the resulting domestic cold water peak demand is 177 GPM. Total DCW Peak Demand = 177 GPM.
5.2	Peak Sanitary Demand, (GPM)	Peak Sanitary Demand= Domestic Cold Water Demand [Item 5.1] + Domestic Hot Water Demand [Item 6.1] = 177+75 = 252 GPM.
5.3	Annual Consumption, (million gallons/year):	Occupied DCW: 177 GPM X 25% Diversity X 2,000 hours/year =5.31 million gallons/year. Unoccupied DCW: 177 GPM X 2.5% Diversity X 6,760 hours/year =1.80 million gallons/year. Total=5.31 + 1.80 = 7.11 million gallons/year.
5.4	Annual Sanitary Sewer, (million gallons/year)	Annual sanitary sewer volume is estimated as: The sum of the annual domestic cold water (DCW) consumption + annual domestic hot water (DHW) consumption. Occupied DCW = 5.31 million gallons/year. [Item 5.3] Unoccupied DCW = 1.80 million gallons/year. [Item 5.3] Occupied DHW = 2.25 million gallons/year. [Item 6.2] Unoccupied DHW=0.76 million gallons/year. [Item 6.2] Total = 5.31 + 1.80 + 2.25 + 0.76 = 10.12 million gallons/year.

Item No.	Domestic Hot Water	Description & Calculations
6.1	Peak Demand, (GPM)	Based on a review of the International Building Code, 2000 and International Plumbing Code, 2000 to determine maximum building occupancy levels and resulting minimum number of plumbing facilities, as well as a review of similar building types on campus, it was determined that the domestic hot water peak demand be based on 250 fixture units. From Table E102 of the International Plumbing Code, 2000, the resulting domestic hot water peak demand is 75 GPM.
6.2	Annual Consumption, (million gallons/year):	Occupied: 75 GPM X 25% Diversity X 2,000 hours/year = 2.25 million gallons/year. Unoccupied: 75 GPM X 2.5% Diversity X 6,760 hours/year = 0.76 million gallons/year. Total=2.25 + 0.76 = 3.01 million gallons/year.

Item No.	Natural Gas	Description & Calculations
7.1	Peak Demand, (CCF/hour)	Two Gas Fired Unit Heaters in Loading Dock: From the Design Development Phase mechanical equipment schedules, the two gas fired unit heaters were downsized two at 200,000 BTU/hr each. 2 X 200,000 BTU/hr = 400,000 BTU/hr/100,000 BTU/CCF = 4 CCF/hour.
7.2	Annual Consumption, (CCF/year):	Two Gas Fired Unit Heaters in Loading Dock: Assume 2 X 200,000 BTU/hr X 2000 hours/year operation x 25% diversity/100,000 BTU/CCF=2,000 CCF/year.

Item No.	Storm Drainage System	Description & Calculations
8.1	Design Peak Storm Volume, (GPM)	Roof area from Design Development Phase Roof Plan is 10,560 SF. From 2000 International Plumbing Code, Section 1106: 10,560 SF @ 2.75 inches/hr (100 year rainfall) = 302 GPM.

Exhibit C
Energy Impact Statement – Sample
Construction Document Phase Calculations

In accordance with the Design Phase Deliverables; at the Construction Document Phase, the design professional will have completed the following items (in addition to those completed during the Design Development Phase) which contribute to the further refinement of the Energy Impact Statement:

- ***Complete specification.***
- ***One-line diagrams for all mechanical systems.***
- ***Duct layout and air flow volumes for each space.***
- ***Detailed control drawings with sequences of operation.***
- ***All design calculations.***
- ***Lighting plans for all areas.***
- ***Electrical power load summary.***
- ***Electrical panel schedules.***

Because the majority of the information needed for accurate estimates in the Energy Impact Statement is available in the Design Development Phase, most projects will require very little modification of the Energy Impact Statement in moving to the Construction Document Phase. Also, there is no change in the methodology used to determine estimates in moving form the Design Development Phase to the Construction Document Phase.

For these reasons, it is assumed that (for this example) there is no change in the Energy Impact Statement. Estimates shown in the Design Development Phase column of the Energy Impact Statement are repeated in the Construction Document Phase column.

It is not unusual for projects to change significantly in moving from Design Development Phase to Construction Document Phase (usually due to budget constraints). In these cases there may be significant changes to the Energy Impact Statement which the design professional will be expected to document.