|  |
| --- |
| **Energy Modeling Form****(Finalisation of Building Design)** |
| Green Mark DepartmentBuilding & Construction Authority52 Jurong Gatewayl Road #11-01Singapore 608550  | INSTRUCTIONS:1. Please refer to the Explanatory Notes attached before completing the form.
2. Use a separate set of forms for each building.
3. \*Delete accordingly
 |
|  Project Ref. No.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | - |  |  |  |  |  | - |  |  |  |  | - | B | P |  |  |

Description of Building / Building Works:

|  |
| --- |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| \*Lot / Plot  |  | \*TS / MK  |  |

Address / Road:

|  |
| --- |
|  |

   |
| (1) As the Qualified Persons responsible for the design of M&E services for the above mentioned project, we declare that:1. the energy modeling conducted for the project is in accordance with the requirements of BCA’s Framework for Energy Modeling and
2. based on the results of the energy modeling, the Proposed Model is expected to achieve a saving of **\_\_\_\_%** in annual energy consumption compared to the Reference Model.
 |
| (2) We attach the following documentations to support the above declaration:1. Summary of Space and ETTV of the Building Envelope (Form EM-1.1)
2. Comparison of Reference Model versus Proposed Model (Form EM-1.2)
3. Summary of Energy by End Use including Efficiency Indicators for both models (Form EM-1.3)
4. Summary printouts of energy modeling software
 |
| (1) Name & Signature of Energy Modeler | (2) Name & Signature of Qualified Person (Mechanical PE) |
| Name, Address, Email and Tel of M&E Consultancy Firm for the project | (3) Name & Signature of Qualified Person (Electrical PE)  |

**FORM EM-1.1: Summary of Space and ETTV of the Building Envelope**

|  |
| --- |
| **(A) Space Summary** |
| Building Use | Air-Conditioned Area (m2) | Non Air-Conditioned Area (m2) | Total Area (m2) |
| 1. Office
 |  |  |  |
| 1. Retail
 |  |  |  |
| 1. F&B areas
 |  |  |  |
| 1. M&E Areas
 |  |  |  |
| 1. Storage
 |  |  |  |
| 1. Carpark
 |  |  |  |
| 1. Atrium
 |  |  |  |
| 1. Corridors
 |  |  |  |
| 1. Lobbies
 |  |  |  |
| 1. Staircases
 |  |  |  |
| 1. Toilets
 |  |  |  |
| 1. Others
 |  |  |  |
| ***Total***  |  |  |  |
| **Note: The building use floor areas for both the Reference and Proposed Models must be the same.** |

|  |
| --- |
| **(B) Building Envelope Summary – ETTV** |
| Orientation of Façade  | Gross Area of External Walls and Windows (m2) | Reference ModelETTV (W/m2) | Proposed Model ETTV (W/m2) |
| North |  |  |  |
| East |  |  |  |
| South |  |  |  |
| West |  |  |  |
| **Average ETTV of the Building Envelope (W/m2)** |  |  |  |

**Section EM-1.2: Comparison of Reference Model versus Proposed Model**

| **BUILDING ELEMENT** | **REFERENCE MODEL** | **PROPOSED MODEL** |
| --- | --- | --- |
| **BUILDING ENVELOPE**  |
| Wall Construction  |  |  |
| Opaque Doors |  |  |
| Windows  |  |  |
| Floor  |  |  |
| Roof |  |  |
| Skylight  |  |  |
| Window to Wall Ratio (WWR) |  |  |
| Others |  |  |
| **ELECTRICAL SYSTEMS**  |
| Lighting Power Density (W/m2) |  |  |
| Lighting Occupant Sensor Controls  |  |  |
| Lighting Daylighting Controls  |  |  |
| Receptacle Power (W/m2) |  |  |
| Lifts & Escalators  |  |  |
| Others |  |  |
| **Note: The Receptacle Loads for both the Reference and Proposed Models must be the same.** |
| **RENEWABLE ENERGY SYSTEMS**  |
| Photovoltaics  |  |  |
| **Note: The stipulated energy savings required in attaining the Green Mark GoldPlus and Platinum rating to be based on the savings derived from energy efficiency measures and improvements over its reference model as listed above.** |
| **SCHEDULES**  |
| Occupancy, Lighting & Equipment  |  |  |
| HVAC  |  |  |
| **Note: The Occupancy Rates and Operating Schedules for both the Reference and Proposed Models must be the same.** |
| **MECHANICAL & PLUMBING SYSTEMS**  |
| HVAC System Type |  |  |
| AHU Fan Properties  |  |  |
| PAU Fan Properties |  |  |
| FCU Fan Properties |  |  |
| Boiler Efficiency  |  |  |
| Central Plant Efficiency (kW/ton)  |  |  |
| Air Distribution Efficiency (kW/ton) |  |  |
| **Note: Central plant efficiencies and capacities for chillers and cooling towers should be listed whenever the central plant is included as part of the energy model.** |
| HVAC Circulation Loop Properties  |  |  |
| Domestic Water System |  |  |
| Mechanical Ventilation Fans |  |  |
| **OTHERS**  |
|  |  |  |

This form will be accompanied by energy modeling report which includes the following:

1. Project Brief
2. Images of the model (if applicable)
3. Energy saving results
4. Performance of A/C systems (Cooling load vs time, A/C efficiency vs time)
5. Assumptions
6. Limitation of modeling and rectifications
7. Printscreen from the modeling
8. Summary of energy modeling results
9. Recommendations (if any)

**EM-1.3: Summary of Energy by End Use including Efficiency Indicators for both models**

|  |  |  |  |
| --- | --- | --- | --- |
| **End Use** | **Reference Model****Energy Consumption****(MWh)** | **Proposed Model****Energy Consumption****(MWh)** | **Energy Consumption Savings****(%)** |
| Lighting – (Air-Conditioned Space) |  |  |  |
| Lighting – (Non Air-Conditioned Space) |  |  |  |
| Chiller Plant |  |  |  |
| Chilled Water and Condenser Water Pumps |  |  |  |
| Cooling Towers |  |  |  |
| Air System Fans |  |  |  |
| Lifts |  |  |  |
| Escalators |  |  |  |
| External Landscape and Façade Lighting |  |  |  |
| Receptacle Loads |  |  |  |
| Domestic Water Systems |  |  |  |
| Others |  |  |  |
| **Total Building Energy Consumption** |  |  |  |
| **Note: The stipulated energy savings required in attaining the Green Mark GoldPlus and Platinum rating to be based on the savings derived from energy efficiency measures and improvements over its reference model as listed above.** |

**Renewable Energy Sources**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **End Use** | **Energy Produced****(kWh)** | **Reference Model Energy Consumption****(kWh)** | **Proposed Model Energy Consumption****(kWh)** | **Energy Consumption Savings****(%)** |
| Photovoltaics | - | - | - | - |
| Others | - |  |  |  |
| **Total Building Energy Consumption including Renewable Energy Sources** |  |  |  |

**Efficiency Indicators**

|  |  |  |
| --- | --- | --- |
| **Efficiency Indicators** | **Reference Model** | **Proposed Model** |
| **Energy Efficiency Index, EEI (kWh/m2/yr)** |  |  |
| **System Efficiency of Air-Conditioned Plant (ikW/kW)** |  |  |

**EXPLANATORY NOTES FOR APPENDIX C – SUBMISSION FORM FOR ENERGY MODELING**

To facilitate verification of the declared energy consumption, the submission forms shall be accompanied by the following:-

1. The detailed computation of the ETTV values for both the Reference and Proposed Model using APPENDICES 1 to 4 of “ETTV CALCULATON FORMAT IN RESPECT OF AN AIRCONDITIONED BUILDING”.
2. Certification of the simulation program is tested in accordance to the ASHRAE Standard 140.
3. The input data of the simulation program for both the Proposed and Reference Models shall include:
	* 1. Space input data for all zones comprising detail information on construction materials and their properties designed for each individual zone. For example, room area, walls, windows, doors, floors, partitions, sensible and latent loads (lightings, occupancy rates, receptacles loads, Outdoor ventilation rates, misc. loads etc).
		2. Schedules for each individual operating zone (eg. lighting, occupants, mechanical fans, AHUs, other mechanical and electrical equipment, etc.)
4. The output data of the simulation program for both the Proposed and Reference Models shall include:
	* 1. Monthly energy consumption by Mechanical and Electrical system components (eg. Air-Conditioned Systems, Lighting Systems, Receptacle Equipment, Lifts, Escalators, etc).
5. The EM-1 shall be signed by the Energy Modeler and the Qualified Persons (both Mechanical and Electrical Professional Engineers) for the project.