Annexure: A

Questionnaire
Subject: Questionnaire Survey for Ph.D Research.

Dear sir/madam,

Mr. Tej Singh Chouhan is a Ph.D Research Scholar in the Department of Mechanical Engineering at JJT University, Jhunjhunu, Rajasthan. He is conducting a questionnaire survey under my supervision and guidance as part of his Ph.D program for research entitled “Assessment of Building Energy Performance for Energy Efficiency Measures in Selected Commercial Buildings of India”. I ensure that your identity shall be kept confidential along with the building identity and your response in questionnaire will be used only for research outcomes. An important step towards achieving research objective is to collect information like design documents, specifications, working drawings, photos, etc. about commercial buildings under design phase or proposed commercial buildings like yours. And seek technical information from the members of facility design team. The outcome of the research will be useful for the assessment of building energy performance and to identify appropriate energy efficiency measures along with HVAC and lighting system operation techniques for energy conservation while maintaining thermal comfort and required lighting power density for commercial buildings of India. Your co-operation will be highly appreciated in this regard.

Please feel free to ask any additional information.

With regards

Dr. A. D. Sharma
Subject: Questionnaire Survey for Ph.D Research.

Dear sir/madam,

I am pursuing Ph.D in Mechanical Engineering from JJT University, Rajasthan. My research topic is “Assessment of Building Energy Performance for Energy Efficiency Measures in Selected Commercial Buildings of India”. The area of my study is being focused on commercial buildings of India.

I shall be grateful if you spare some valuable time to fill this questionnaire. I promise that your identity shall be kept confidential and your response in questionnaire will be used only for research outcomes. If required you can seek confirmation about the research work from my research guide:

Dr. Ashish Dutt Sharma, Research Supervisor, JJT University, Rajasthan.
Email ID: ads.edu@gmail.com

You are requested to complete this at your earliest convenience and send back.

With regards

Tej Singh Chouhan
Questionnaire

Section 1: General Information

<table>
<thead>
<tr>
<th>Project/Facility Name:</th>
<th>Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gross Floor Area</th>
<th>Maximum Occupancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft²</td>
<td>Persons</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conditioned Areas</th>
<th>Unconditioned Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>ft²</td>
<td>ft²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Floors</th>
<th>Floor to floor height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ft</td>
</tr>
</tbody>
</table>

Section 2: Building and its Components

A. Walls and Roof

1. Components of Wall System Assembly

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Thickness in mm</th>
<th>Component Name</th>
<th>Thickness in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

2. Wall Exterior Color

- ☐ Light
- ☐ Medium
- ☐ Dark

3. Components of Roof System

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Thickness in mm</th>
<th>Component Name</th>
<th>Thickness in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

4. Roof Exterior Color

- ☐ Light
- ☐ Medium
- ☐ Dark

B. Fenestration

1. Glass Type SGU or DGU

2. Glass U Value (Btu/hr.ft² °F)

3. Glass SHGC

4. Visible Light Transmittance (VLT)

5. Window Wall Ratio (WWR)

6. Fin (Yes/No)

- ☐ Yes
- ☐ No

7. Blinds (Yes/No)

- ☐ Yes
- ☐ No

8. Overhangs (Yes/No)

- ☐ Yes
- ☐ No
### C. Facility Operating Schedule

<table>
<thead>
<tr>
<th>Day Time/Seasons</th>
<th>Summer</th>
<th>Winter</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morning Start Time</strong></td>
<td>AM</td>
<td>AM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AM</td>
<td>AM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AM</td>
<td>AM</td>
<td></td>
</tr>
<tr>
<td><strong>Evening End Time</strong></td>
<td>PM</td>
<td>PM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM</td>
<td>PM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PM</td>
<td>PM</td>
<td></td>
</tr>
</tbody>
</table>

### Section 3: Building Systems

#### A. Lighting and Electrical System

1. Average Interior Lighting Power Density in Different Zones of the Building During Occupancy.
   - Office .......... W/ft² Retail .............. W/ft² Other ............ W/ft²

2. Exterior Lighting Load ........................................ kW

3. Car Parking Lighting Power Density ................ W/ft²

4. Car Parking Fan Load ........................................ kW

5. Equipment (Computer - Photocopy Machine - Printer etc.) Load Density in the Building in Different Zones During Occupancy.
   - Office .......... W/ft² Retail .............. W/ft² Other ............ W/ft²

6. Elevator Load .................................................. kW

7. Is there a Mechanism for Reducing Lighting Energy Consumption in the Presence of Daylight?  
   - Yes  [ ]  No  [ ]
   - If Yes Specify the Mechanism:
     - Dimming  [ ]  ON/OFF  [ ]  OFF and ON 50%  [ ]
     - Other specify ............................................................

8. Interior Lighting Schedule ......................................

9. Exterior Lighting Schedule ......................................

10. Equipment Schedule .............................................


B. HVAC System

1. Type of HVAC System

2. Operation of the HVAC System

<table>
<thead>
<tr>
<th>Day Time/Seasons</th>
<th>Summer</th>
<th>Winter</th>
<th>Other (if any)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning Start Time</td>
<td>...... AM</td>
<td>...... AM</td>
<td>...... AM</td>
</tr>
<tr>
<td>Evening End Time</td>
<td>...... PM</td>
<td>...... PM</td>
<td>...... PM</td>
</tr>
</tbody>
</table>

3. Thermostat Management for all year round

<table>
<thead>
<tr>
<th>Set point (Temp. °C)</th>
<th>Unoccupied Periods (Temp. °C)</th>
</tr>
</thead>
</table>

4. Number of Air Handling Units (AHU)

5. Supply Fan Type

- □ Const. High Efficiency 2 in
- □ Vane 4 in. Med. Efficiency
- □ Vane 6 in. Med. Efficiency
- □ VSD 6 in. High Efficiency
- □ Other

6. Rated Fan Flow in cfm

7. Fan Control During Operation

- □ Constant Volume
- □ Inlet Vanes
- □ Cycle with Load
- □ Variable Speed
- □ Other

8. Cooling Coil Types

- □ DX Low Efficiency
- □ DX Medium Efficiency
- □ DX High Efficiency
- □ Water Coils
- □ Others

9. Supply Temperature

<table>
<thead>
<tr>
<th>Sensible Capacity</th>
<th>TR</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Total Coil Capacity</th>
<th>TR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coil Bypass Factor</td>
<td></td>
</tr>
</tbody>
</table>

10. Maximum Allowed RH of Supply Air

| % |

11. Heating Coil Types

- □ Furnace Low
- □ Furnace High
- □ Heat Pump Low
- □ Heat Pump High
- □ Coils
- □ Other

12. Zone Entering Supply Air Temperature

| °C |

13. Sources of Heating

- □ Electric Resistance
- □ Hot Water from Plant
- □ Electric Heat Pump
- □ Other
If Heating is Supplied from Heat Pump

14. Heat Pump Type
   - Electric
   - High Efficiency
   - Medium Efficiency
   - Electric Pumper
   - Other

15. Shut-Off Temperature for Heat Pump

16. Control of HP
   - On-Demand
   - Timed
   - Other

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C. Central Plant

1. Type of Chillers Used
   - Electric Chillers
   - Absorption Chillers

2. Number of Electric Chillers
   - None
   - One
   - Two
   - Three
   - Four

3. Capacity of Each Electric Chiller in TR

4. Chilled Water Supply Temperature

5. Entering Condenser Water Temperature

6. Chiller COP
   - Single Stage
   - Two Stage

7. Absorption Chiller Types
   - Single Stage
   - Two Stage

8. Number of Absorption Chillers
   - None
   - One
   - Two
   - Three
   - Four

9. Capacity of Each Absorption Chiller in TR

10. Electric Energy Usage in Absorption Chillers

11. Water Cooled Condenser Cooling Tower Types
   - High Efficiency Air Cooled
   - Open Low Efficiency
   - Open High Efficiency
   - Closed Medium Efficiency
   - Closed High Efficiency
   - Other

12. Cells in Cooling Tower
   - Yes
   - No
   - Number of Cells

13. Control of Cooling Tower
   - Min. Cell Needed
   - Max. Cells Available

14. Sizing of Cooling Tower (CT)
   - Design WB T
   - Approach Temp
   - Design Range

15. Temperature Control in CT
   - Fixed Temperature
   - Wet Bulb Reset

16. Capacity Control of CT
   - One-Speed Fan
   - Two Speed Fan
   - Variable Speed Fan
   - Fluid Bypass
   - Other
17. Type of Boilers used

☐ Gas Fired  ☐ Fuel Fired
☐ Electric  ☐ Other  ………………

18. Number of Boilers

☐ None  ☐ One  ☐ Two  ☐ Three  ☐ Four

19. Capacity of Each Boiler in MMBtu ………………………………………

20. Boiler Heat Input Ratio (HIR)………………………………………………

D. Ventilation System

1. Ventilation Rate in L/s/person …………………………………………………

2. Ventilation Schedule Management for all year round

<table>
<thead>
<tr>
<th>Occupied Periods (Percentage of Total Outdoor Air)</th>
<th>Unoccupied Periods (Percentage of Total Outdoor Air)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following documents are also essentially required for detailed energy modeling and simulation of the building. Please ensure the availability of these documents and kindly provide them with response of this questionnaire for complete details.

<table>
<thead>
<tr>
<th>Documents Required for Building Energy Modeling and Simulation</th>
<th>Provided</th>
<th>Under Process (Shall be Provided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. HVAC Equipment Schedules</td>
<td>☐ Yes</td>
<td>☐ No</td>
</tr>
<tr>
<td>2. HVAC Technical Specifications</td>
<td>☐ Yes</td>
<td>☐ No</td>
</tr>
<tr>
<td>3. HVAC Bill of Quantity (BOQ)</td>
<td>☐ Yes</td>
<td>☐ No</td>
</tr>
<tr>
<td>4. HVAC Floor Plans</td>
<td>☐ Yes</td>
<td>☐ No</td>
</tr>
<tr>
<td>5. Interior and Exterior Lighting Floor Plans</td>
<td>☐ Yes</td>
<td>☐ No</td>
</tr>
<tr>
<td>6. Architectural Floor Plan</td>
<td>☐ Yes</td>
<td>☐ No</td>
</tr>
<tr>
<td>7. Building Elevation and Sectional Drawings</td>
<td>☐ Yes</td>
<td>☐ No</td>
</tr>
</tbody>
</table>

For any additional comments

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