UNIVERSITY BLDG

- Administrative Heart of the University
- “Orientation” point for entry to the University Campus
- Offices, Conference, Auditorium
- Estimated 120,000 Sq. Ft.
AL GHUIR UNIVERSITY

INTRO  STRATEGY  BUILDING  CALCULATIONS
ARCHITECTURAL STRATEGY

- Cooling and ventilation provided with considerably less energy demands vs. traditional strategies
  - Ground Source Heat Pumps
  - Earth Tubes
  - Photovoltaic Arrays
- Submerge building’s program into ground
- Aesthetics both contextually appropriate and unique
UNIVERSITY BUILDING

- Ground Source Heat Pumps
- Pond centrally located
- Series of vertical piping used to cool water
- Earth tubes
- Continual piping spans below the structure to cool incoming air

INTRO  STRATEGY  BUILDING  CALCULATIONS
UNIVERSITY BUILDING

INTRO

STRATEGY

BUILDING

CALCULATIONS
UNIVERSITY BUILDING

INTRO
STRATEGY
BUILDING
CALCULATIONS
## Intro

**Strategy**

**Building**

**Calculations**

### Location

- **Building owner**: AGU
- **Program user**: Jin Lee
- **Company**: Group 3

### Calculations

**By**

- **Dataset name**: C:\CDS\TRACE700\PROJECTS\DUBAITRC
- **Calculation time**: 09:57 AM on 12/01/2003
- **TRACE® 700 version**: 4.0

**Location**

- **Latitude**: 26.0 deg
- **Longitude**: -56.0 deg
- **Time Zone**: -4
- **Elevation**: 50 ft
- **Barometric Pressure**: 29.9 in. Hg

**Air Density**: 0.0759 lb/cu ft

**Air Specific Heat**: 0.2444 Btu/lb•°F

**Density-Specific Heat Product**: 1.1132 Btu/h•cfm•°F

**Latent Heat Factor**: 4,900.3 Btu-min/h•cu ft

**Enthalpy Factor**: 4.5542 lb-min/hr•cu ft

**Summer Design Dry Bulb**: 113 °F

**Summer Design Wet Bulb**: 79 °F

**Winter Design Dry Bulb**: 41 °F

**Summer Clearness Number**: 0.90

**Winter Clearness Number**: 0.90

**Summer Ground Reflectance**: 0.20

**Winter Ground Reflectance**: 0.20

**Design Simulation Period**: January - December

**Cooling Load Methodology**: TETD-TA1

**Heating Load Methodology**: UATD
# System Checksums

By CCJM ENGINEERS

## System - 001

### COOLING COIL PEAK

- **Mo/yr**: 9/15
- **Outside Air**: OAD/DB/WH: 112 / 80 / 104

<table>
<thead>
<tr>
<th>Space</th>
<th>Sens. + Lat.</th>
<th>Plenum Sens.</th>
<th>Plenum Latent</th>
<th>Net Total</th>
<th>Percent Of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Envelope Loads</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Skylite Solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Skylite Cond</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Roof Cond</td>
<td>0</td>
<td>61,366</td>
<td>61,366</td>
<td>61,366</td>
<td>2.10</td>
</tr>
<tr>
<td>Glass Solar</td>
<td>286,000</td>
<td>0</td>
<td>286,000</td>
<td>286,000</td>
<td>9.85</td>
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<tr>
<td>Glass Cond</td>
<td>15,840</td>
<td>0</td>
<td>15,840</td>
<td>15,840</td>
<td>0.54</td>
</tr>
<tr>
<td>Wall Cond</td>
<td>24,554</td>
<td>6,608</td>
<td>31,162</td>
<td>31,162</td>
<td>1.07</td>
</tr>
<tr>
<td>Partition</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
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<tr>
<td>Exposed Floor</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Infiltration</td>
<td>483,521</td>
<td>16,54</td>
<td>499,989</td>
<td>499,989</td>
<td>15.84</td>
</tr>
<tr>
<td><strong>Sub Total ==&gt;&gt;</strong></td>
<td>811,915</td>
<td>67,975</td>
<td>879,890</td>
<td>879,890</td>
<td>30.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Space</th>
<th>Sens. + Lat.</th>
<th>Plenum Sens.</th>
<th>Plenum Latent</th>
<th>Net Total</th>
<th>Percent Of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Internal Loads</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lights</td>
<td>40,956</td>
<td>264,822</td>
<td>305,778</td>
<td>305,778</td>
<td>10.06</td>
</tr>
<tr>
<td>People</td>
<td>238,455</td>
<td>0</td>
<td>238,455</td>
<td>238,455</td>
<td>78.96</td>
</tr>
<tr>
<td>Misc</td>
<td>614,340</td>
<td>0</td>
<td>614,340</td>
<td>614,340</td>
<td>202.63</td>
</tr>
<tr>
<td><strong>Sub Total ==&gt;&gt;</strong></td>
<td>900,751</td>
<td>163,822</td>
<td>1,064,575</td>
<td>1,064,575</td>
<td>35.82</td>
</tr>
<tr>
<td>Ceiling Load</td>
<td>71,523</td>
<td>-71,523</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Outside Air</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Sup. Fan Heat</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Ret. Fan Heat</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Duct Heat Pkp</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>O/U/NDR Sizing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Terminal Bypass</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

| **Grand Total ==>>** | 1,784,191 | 124,064 | 2,223,008 | 1,449,557 | 100.00 |

### CLG SPACE PEAK

- **Mo/yr**: 9/16
- **OAD**: 111

<table>
<thead>
<tr>
<th>Space</th>
<th>Sens. + Lat.</th>
<th>Plenum Sens.</th>
<th>Plenum Latent</th>
<th>Net Total</th>
<th>Percent Of Total</th>
</tr>
</thead>
</table>

### HEATING COIL PEAK

- **Mo/yr**: 13/1
- **OAD**: 41

<table>
<thead>
<tr>
<th>Space</th>
<th>Sens. + Lat.</th>
<th>Plenum Sens.</th>
<th>Plenum Latent</th>
<th>Net Total</th>
<th>Percent Of Total</th>
</tr>
</thead>
</table>

### TEMPERATURES

- **Cig**: 55.0
- **Htg**: 95.0
- **Plenum**: 76.0
- **Return**: 76.0
- **Ret/QA**: 82.7
- **Fn MtrTD**: 0.2
- **Fn BltTD**: 0.4
- **Fn Frit**: 1.3

### AIRFLOWS

<table>
<thead>
<tr>
<th>Space</th>
<th>Sens. + Lat.</th>
<th>Plenum Sens.</th>
<th>Plenum Latent</th>
<th>Net Total</th>
<th>Percent Of Total</th>
</tr>
</thead>
</table>

### ENGINEERING CKS

<table>
<thead>
<tr>
<th>Space</th>
<th>Sens. + Lat.</th>
<th>Plenum Sens.</th>
<th>Plenum Latent</th>
<th>Net Total</th>
<th>Percent Of Total</th>
</tr>
</thead>
</table>

### COOLING COIL SELECTION

<table>
<thead>
<tr>
<th>Total Capacity</th>
<th>Sens Cap. MBh</th>
<th>Coil Airf cfm</th>
<th>Enter DB/WH/HR</th>
<th>Leave DB/WH/HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Clg</td>
<td>292.7</td>
<td>3,511.8</td>
<td>2,730.9</td>
<td>65,003</td>
</tr>
<tr>
<td>Aux Clg</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Opt Vent</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Total**: 292.7 | 3,511.8

### AREAS

**Floor** | 120,000 | **Part** | 0 | **ExFlr** | 0 | **Roof** | 40,000 | 0 | **Wall** | 28,800 | 7,200 | 25

### HEATING COIL SELECTION

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Coil Airf</th>
<th>Ent</th>
<th>Lvg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Htg</td>
<td>1,045.0</td>
<td>19,501</td>
<td>46.9</td>
</tr>
<tr>
<td>Aux Htg</td>
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<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Preheat</td>
<td>-147.4</td>
<td>10,090</td>
<td>41.0</td>
</tr>
<tr>
<td>Reheat</td>
<td>-458.9</td>
<td>19,501</td>
<td>45.0</td>
</tr>
<tr>
<td>Humidif</td>
<td>-485.2</td>
<td>16,900</td>
<td>11.8</td>
</tr>
<tr>
<td>Total</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>

**Total**: -1,657.6

---

**Project Name**: IPRO - AGU
**Dataset Name**: C-JCDs/TRACE700/PROJECTS/DUBAI/TRC
### System Checksums

**By CCJM ENGINEERS**

**System - 001**

**COOLING COIL PEAK**
- Peaked at Time: Mth/Day: 9/15
- OADB/WB/HR: 112 / 80 / 104

<table>
<thead>
<tr>
<th>Envelope Loads</th>
<th>Space Sens. + Lat.</th>
<th>Plenum Sensible</th>
<th>Plenum Latent</th>
<th>Net Total</th>
<th>Percent Of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skylite Solar</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Skylite Cond</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Roof Cond</td>
<td>96,000</td>
<td>61,403</td>
<td>0</td>
<td>111,403</td>
<td>3.30</td>
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<tr>
<td>Glass Solar</td>
<td>5,280</td>
<td>5,280</td>
<td>0</td>
<td>5,280</td>
<td>0.20</td>
</tr>
<tr>
<td>Wall Cond</td>
<td>8,185</td>
<td>8,185</td>
<td>0</td>
<td>8,185</td>
<td>0.27</td>
</tr>
<tr>
<td>Partition</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Exposed Floor</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Infiltration</td>
<td>480,170</td>
<td>480,170</td>
<td>0</td>
<td>480,170</td>
<td>17.97</td>
</tr>
<tr>
<td><strong>Sub Total =&gt;</strong></td>
<td><strong>589,634</strong></td>
<td><strong>63,807</strong></td>
<td><strong>0</strong></td>
<td><strong>653,422</strong></td>
<td><strong>24.45</strong></td>
</tr>
</tbody>
</table>

**Internal Loads**
- Lights: 40,956, 163,824
- People: 245,456
- Misc: 614,340
- **Sub Total =>**: 900,751, 163,824
- Ceiling Load: 70,759
- Outside Air: 0
- Sup. Fan Heat: 0
- Ret. Fan Heat: 0
- Duct Heat Pkup: 0
- OV/UNDR Sizing: 0
- Exhaust Heat: -35,030
- Terminal Bypass: 0

**Grand Total =>**: 1,561,144, 121,643

- Total Capacity: 2,671,629
- Gross Total: 1,240,471
- **Net Total**: 503,471

---

**HEATING COIL PEAK**
- Mth/Day: 13/1
- OADB: 41

<table>
<thead>
<tr>
<th>Space Sensible</th>
<th>Percent Of Total</th>
<th>Space Peak Sensible</th>
<th>Space Peak Percent Of Total</th>
<th>Total</th>
<th>Coil Peak Tot Sensible</th>
<th>Percent Of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>88,000</td>
<td>7.16</td>
<td>4,620</td>
<td>0.48</td>
<td>0</td>
<td>-4,620</td>
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</tr>
<tr>
<td>9,271</td>
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<tr>
<td>257,153</td>
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<td>0</td>
<td>0.00</td>
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<tr>
<td>651,224</td>
<td>29.12</td>
<td>-191,782</td>
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<td>0</td>
<td>0.00</td>
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<tr>
<td>428,306</td>
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<td>-327,893</td>
<td>-327,893</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
</tr>
</tbody>
</table>

---

**TEMPERATURES**

- **SADB**: 55.0
- **Htg**: 95.0
- **Plenum**: 76.9, 67.2
- **Return**: 76.9, 67.2
- **Ret/OA**: 83.7, 52.1
- **Fm Mtr/Do**: 0.2, 0.0
- **Fm Bld/Do**: 0.4, 0.0
- **Fm Fric**: 1.3, 0.0

---

**AIRFLOWS**

- **Vent**: Cooling: 10,909, Heating: 10,909
- **Infil**: Cooling: 6,000, Heating: 6,000
- **Supply**: Cooling: 55,835, Heating: 16,751
- **Min/Min**: Cooling: 16,751, Heating: 16,751
- **Return**: Cooling: 81,835, Heating: 81,835
- **Exhaust**: Cooling: 16,909, Heating: 16,909
- **Rm Exh**: 0, 0
- **Auxil**: 0, 0

---

**ENGINEERING CKS**

- **% OA**: Cooling: 19.9, Heating: 16.1
- **cfm/Htr**: Cooling: 47.0, Heating: 0.47
- **cfm/ktn**: Cooling: 210.87, Heating: 50.0
- **ft/ton**: Cooling: 455.20, Heating: 26.48
- **Bthl/ft²**: Cooling: -12.58, Heating: 545

---

**COOLING COIL SELECTION**

- **Total Capacity**: 264.8
- **Sens Cap**: 3,177.4
- **Cool Airf**: 2,405.9
- **F**: 55,635
- **G**: 63.7
- **T**: 64.1
- **D**: 58.6
- **LBG**: 53.1
- **G**: 43.3
- **Btu/h**: 26.0

**AREAS**

- **Grand Total**: 1,561,144
- **Gross Total**: 1,240,471
- **Net Total**: 503,471

---

**HEATING COIL SELECTION**

- **Total Capacity**: 264.8
- **Sens Cap**: 3,177.4
- **Cool Airf**: 2,405.9
- **F**: 55,635
- **G**: 63.7
- **T**: 64.1
- **D**: 58.6
- **LBG**: 53.1
- **G**: 43.3
- **Btu/h**: 26.0

---

Project Name: IPRO - AGU
Dataset Name: C:\DSS\TRACE700\PROJECTS\DUBAI02TRC.TR.C
ENERGY CALCULATIONS

- Conclusions