NET-ZERO EMERGING LEADER INTERNSHIP

GREEN HAMMER | MICHELLE MONTIEL
RESIDENTIAL PROJECTS, CLIMATE 4C

REPORTED PROJECTS DDx

PREDICTED EUI REDUCTION FROM AVERAGE EUI

GSF VALUES
Total = 111,083
Meeting Target = 83,913
% Meeting Target = 75.5%

85.2%
ENERGY MODELING RESEARCH

ENERGY MODELING INTEGRATION IN WORKFLOW

DDx INTEGRATION IN WORKFLOW
<table>
<thead>
<tr>
<th>Software</th>
<th>Company/Organization</th>
<th>Interface</th>
<th>Works for single family?</th>
<th>Consider for SD tool?</th>
<th>Consider for In-Depth tool?</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHPP</td>
<td>PHI</td>
<td>Sketchup through Plugin</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>WUFI Passive</td>
<td>PHIUS</td>
<td>Sketchup Model Import</td>
<td>Yes</td>
<td>Maybe</td>
<td>Yes</td>
</tr>
<tr>
<td>PlanIT Impact</td>
<td></td>
<td>Sketchup Model Import</td>
<td>Maybe</td>
<td>Yes</td>
<td>Maybe</td>
</tr>
<tr>
<td>Cove Tool</td>
<td></td>
<td>Revit/Sketchup/Rhino Plugin</td>
<td>Maybe</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Open Studio</td>
<td>DOE</td>
<td>Sketchup Plugin</td>
<td>Yes</td>
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<td>Yes</td>
</tr>
<tr>
<td>Sefaira</td>
<td>Trimble</td>
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</tr>
<tr>
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<td>Autodesk</td>
<td>Revit tool</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>BuildSim Hub</td>
<td></td>
<td>Accepts EnergyPlus Models and BIM exported files gbXML</td>
<td>No</td>
<td>Maybe</td>
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<tr>
<td>DesignBuilder</td>
<td></td>
<td>BIM, CAD</td>
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<tr>
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<td></td>
<td>3D Model Import</td>
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[1] https://www.buildingenergysoftwaretools.com/software-listing?keywords=&field_catagory_tid%5B%5D=201&field_platform_tid=All&field_price_tid=All&field_last_updated_value%5Bvalue%5D%5Byear%5D=2010&field_language_tid=All&keys=&building-type=&sort_by=field_rating_rating&sort_order=DESC&items_per_page=40

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ENERGY MODELING RESEARCH
ENERGY MODELING RESEARCH
ANNUAL HEAT DEMAND

Transmission losses: 34,309 kBtu/yr
Ventilation losses: 42,218 kBtu/yr
Total heat losses: 76,527 kBtu/yr

Solar heat gains: 22,757 kBtu/yr
Internal heat gains: 11,469 kBtu/yr
Total heat gains: 34,227 kBtu/yr

Utilization factor: 74.4%
Total useful heat losses: 25,471 kBtu/yr
Annual heat demand: 16,747 kBtu/yr
Specific annual heat demand: 10,306.7 kBtu/ft²yr

ANNUAL COOLING DEMAND

Solar heat gains: 31,497 kBtu/yr
Internal heat gains: 13,816 kBtu/yr
Total heat gains: 45,313 kBtu/yr

Transmission losses: 57,247 kBtu/yr
Ventilation losses: 34,620 kBtu/yr
Total heat losses: 91,867 kBtu/yr

Utilization factor: 42.5%
Total useful heat losses: 38,998 kBtu/yr
Cooling demand - sensible: 6,315 kBtu/yr
Cooling demand - latent: 6,324 kBtu/yr

Specific annual cooling demand: 3.9 kBtu/ft²yr
**PROS:**
- Easy interface
- Graphic display of data
- Connectivity with DDx
- Plug-in to SketchUp and Revit

**CONS:**
- Limitations in R-Value
- Inconsistent numbers from one interface to another
- Limitations in Mechanical Systems
- High fluctuations due to HVAC selection

**SEFAIRA**

**PROS:**
- Reliable data
- Plug-in to SketchUp
- Potential use for SD
- PHIUS connectivity
- More range for Mechanical Systems
- Assembly analysis

**CONS:**
- May require more data in early stages of design.
- Interface harder to navigate

**WUFI PASSIVE**

**ENERGY MODELING RESEARCH**
TOTAL ENERGY USE BY TYPE

HEATING/COOLING LOADS

ANNUAL HEAT DEMAND

<table>
<thead>
<tr>
<th>Type</th>
<th>Site Energy [kWh/yr]</th>
<th>Specific site energy [kWh/ft² yr]</th>
<th>Site Energy [kBtu/yr]</th>
<th>Specific Site Energy [kBtu/ft² yr]</th>
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</thead>
<tbody>
<tr>
<td>Space heating</td>
<td>1,572.2</td>
<td>1</td>
<td>12,672.8</td>
<td>3.3</td>
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<tr>
<td>Space cooling</td>
<td>409</td>
<td>0.3</td>
<td>3,513</td>
<td>0.9</td>
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<tr>
<td>Hot water</td>
<td>347.7</td>
<td>0.2</td>
<td>2,781.6</td>
<td>0.7</td>
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<tr>
<td>Auxiliary equipment</td>
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<td>0.3</td>
<td>3,532.8</td>
<td>0.9</td>
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<tr>
<td>Lighting</td>
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<td>0.9</td>
<td>11,610.6</td>
<td>3</td>
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<tr>
<td>Miscellaneous</td>
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<td>0.4</td>
<td>5,037.4</td>
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<tr>
<td>Renewable energy</td>
<td>2,073.8</td>
<td>1.3</td>
<td>16,591.2</td>
<td>4.4</td>
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<tr>
<td>Total</td>
<td>6,915.8</td>
<td>4.3</td>
<td>55,953.3</td>
<td>14.5</td>
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</tbody>
</table>

ANNUAL COOLING DEMAND

<table>
<thead>
<tr>
<th>Type</th>
<th>Site Energy [kWh/yr]</th>
<th>Specific site energy [kWh/ft² yr]</th>
<th>Site Energy [kBtu/yr]</th>
<th>Specific Site Energy [kBtu/ft² yr]</th>
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<tbody>
<tr>
<td>Transmission losses</td>
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<td>3.4</td>
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<tr>
<td>Total heat gains</td>
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<td>27,287</td>
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<td>Utilization factor</td>
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<td>1.9</td>
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<td>Annual heat demand</td>
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<td>14,497</td>
<td>1.1</td>
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<td>Specific annual heat demand</td>
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<td>1.1</td>
<td>8,905.4</td>
<td>0.7</td>
</tr>
</tbody>
</table>

ENERGY MODELING RESEARCH
UNIFIED DESIGN BUILD PROCESS

We believe a cohesive team produces the best results. Our team of individual experts works dynamically in a unified effort to engage our clients in creating healthy and inspiring buildings.

ENERGY MODELING WORKFLOW INTEGRATION
THANK YOU