

# Thermal Simulation of FSU's Off-Grid Zero Emission Building

J.C. Ordonez<sup>1,2</sup>, S. Yang<sup>1,2</sup>, C. Ordonez<sup>3</sup>, J.V.C. Vargas<sup>1,2</sup>, T. Solano<sup>1</sup>, M. Bublitz<sup>1</sup>, E. Collins<sup>3</sup>

Department of Mechanical Engineering

<sup>1</sup>Energy and Sustainability Center (ESC)

<sup>2</sup>Center for Advanced Power Systems (CAPS)

<sup>3</sup>Center for Intelligent Systems, Control, and Robotics (CISCOR)

Florida State University

FESC Workshop, Gainesville, FL

May 2014



**Solar PV Powered**



**Electrolysis  
H<sub>2</sub> Production**



**Hydrogen Appliances**



**Off-Grid Zero Emission Building (OGZEB)**



**Prototype Building for Developing and Testing Alternative Energy Technologies in Residential and Commercial Settings**

6.9 kW installed PV power (uses ~1.2kW)

**High Efficiency  
Lighting  
LEDs, Solar Skylights**

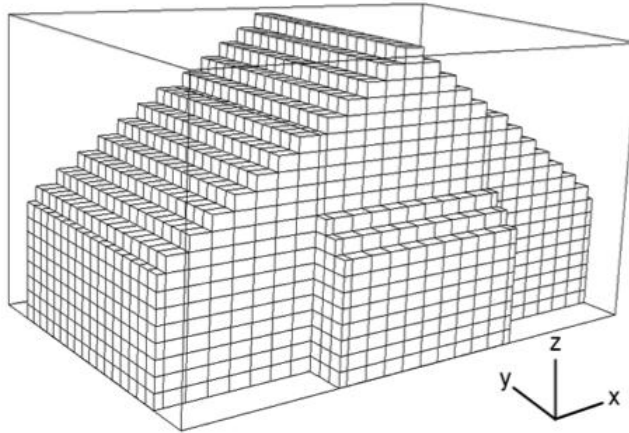


**Geothermal  
HVAC with Integrated solar  
loop thermal system**

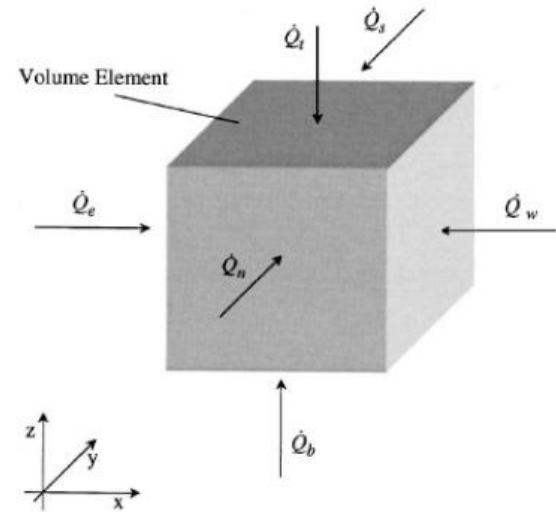




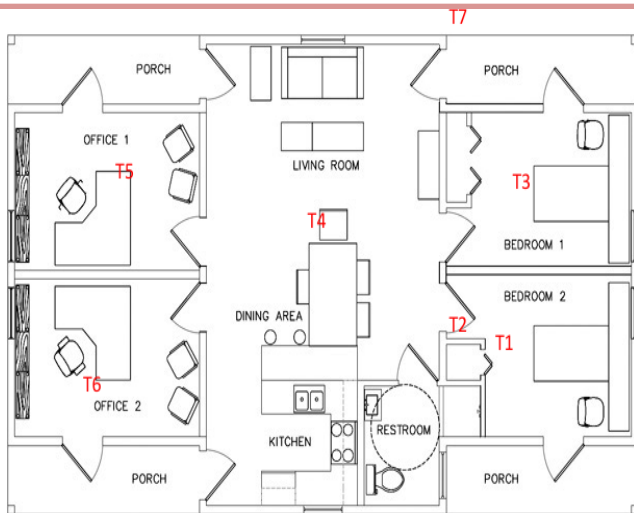
Ray Tracing Algorithm



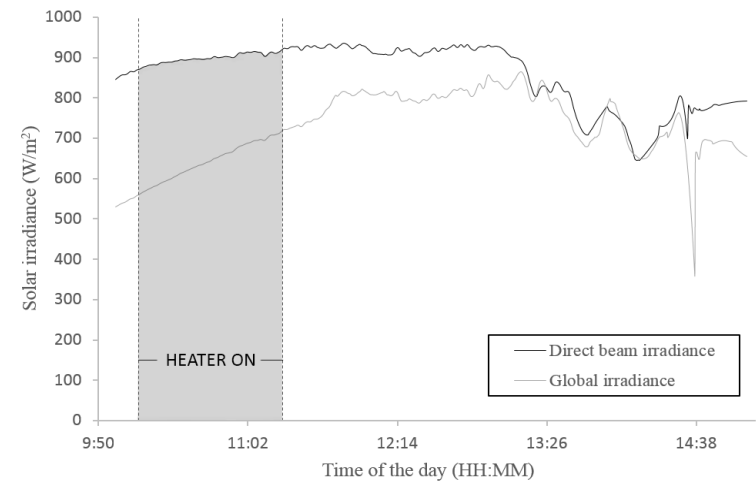
Discretization



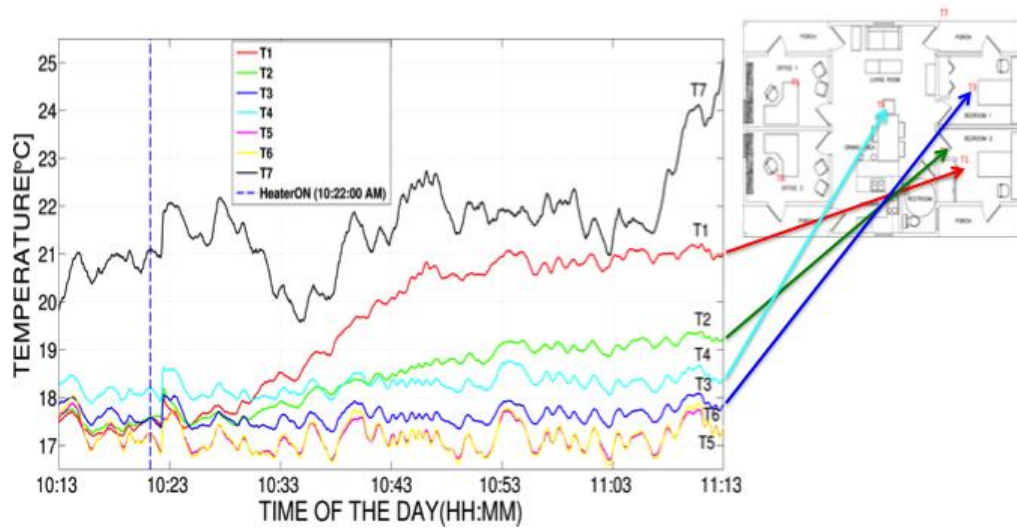
Energy Balance



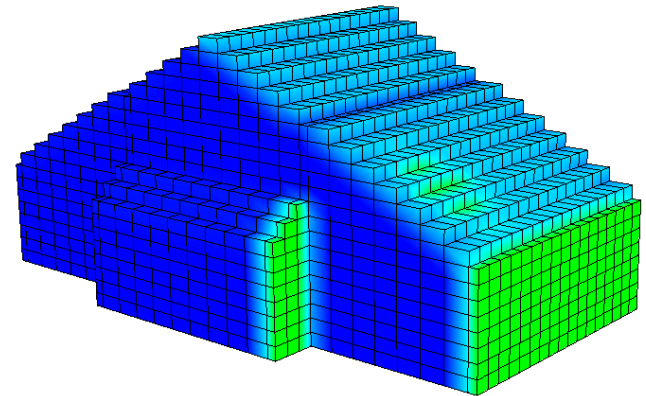
Experimental Setup



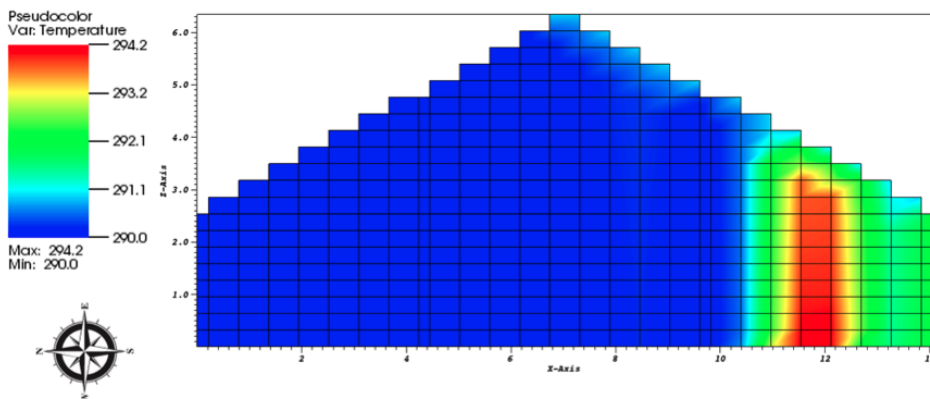
Solar Irradiance and Load



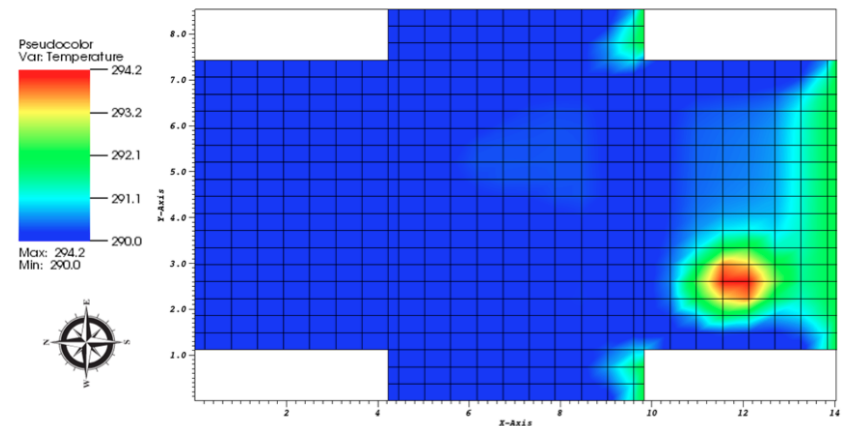
Thermistors readings



Temperature Field

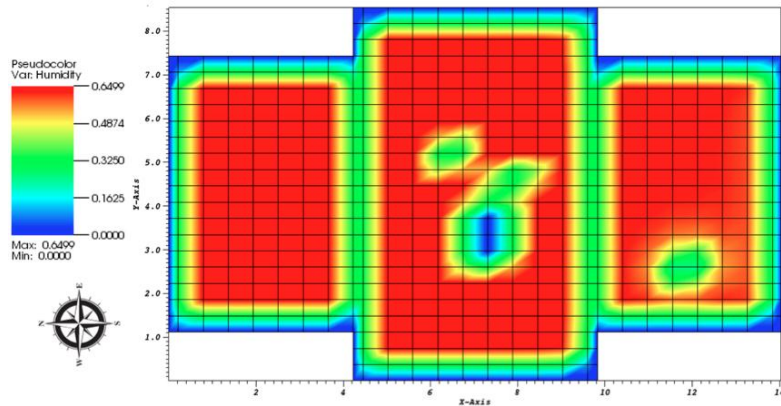


Temperature field at 2.56 m in y-direction, where the heater is placed

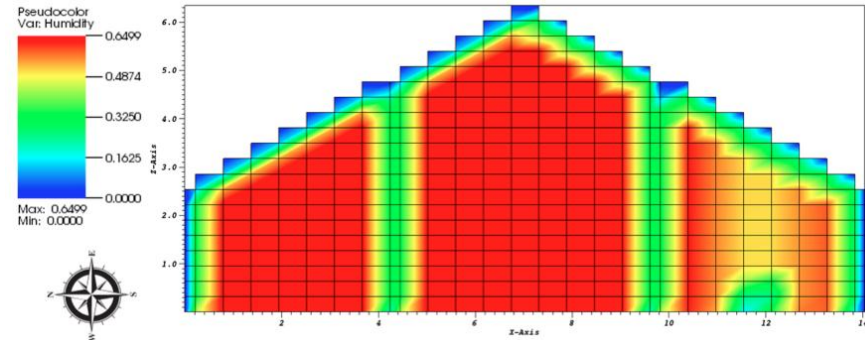


Temperature field at 1.2 m above ground





Relative humidity field at 1.2 m above ground



Relative humidity fields at 2.56 m in y-direction, where the heater is placed

## Conclusions:

A volume element based thermal simulation tool for an off-grid house was developed in order to compute the house temperature and humidity fields.

The model will be used to develop control strategies for energy conservation.

## More information:

- <http://esc.fsu.edu>
- J.C. Ordonez, S. Yang, C. Ordonez, J.V.C. Vargas, T. Solano, M. Bublitz, E. Collins, "Thermal Simulation of an Off-Grid Zero Emission Building," ASME 2014 8<sup>th</sup> International Conference on Energy and Sustainability Conference, June 30<sup>th</sup>- July 2<sup>nd</sup>, 2014, Boston, MA.