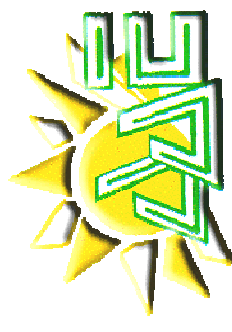


Puerto Rico Energy Conservation Code

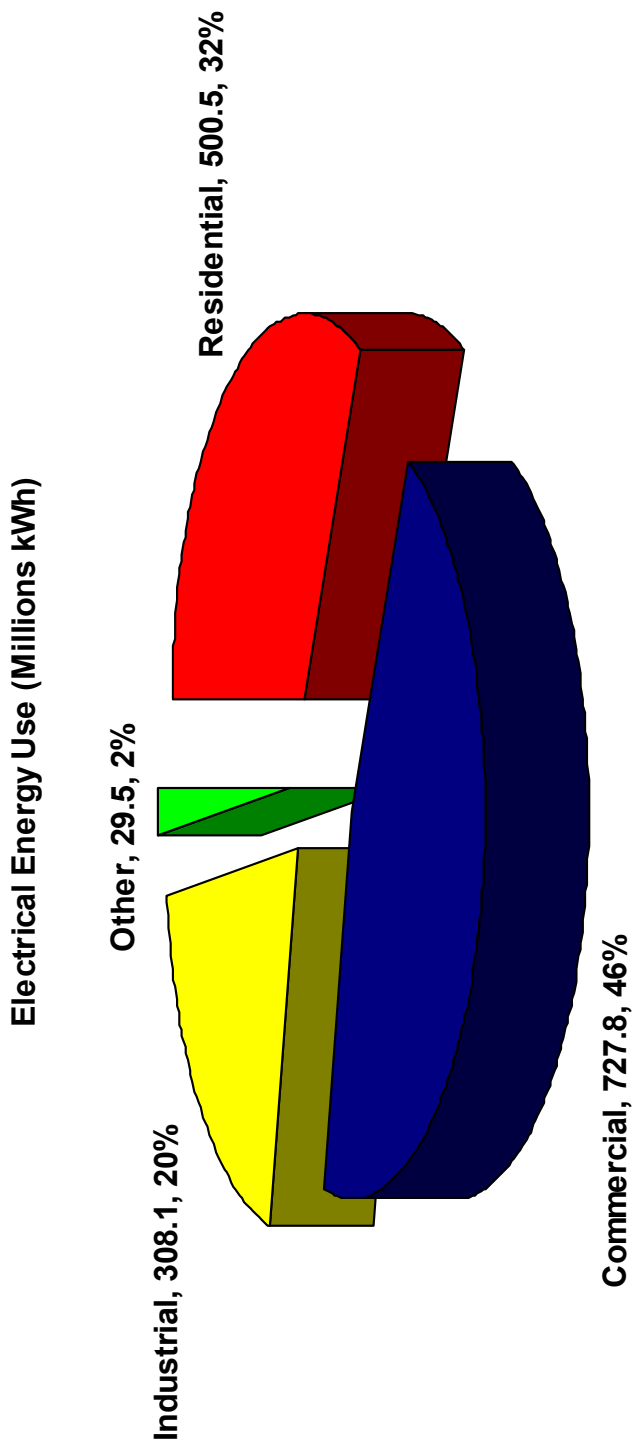
Ing. José R. Benítez
Energy Affairs Administration



Why should PR adopt an Energy Conservation Code?

- Currently PR does not have an updated Energy Conservation Code
- Residences and Commercial Buildings are big consumers of energy (78% of Electrical Energy Consumption in PR)
- Around 40% of all energy used in the US is consumed by buildings
- An energy conservation code will provide minimum requirements for energy efficiency and conservation
- It is also necessary as benchmark for green building certification

Puerto Rico Electrical Energy Use (March 2008)



Why should PR adopt an Energy Conservation Code?

- PR is highly dependent on foreign oil for electric energy production (73%)
- The construction and design of energy efficient buildings will reduce PR electrical energy consumption thus reducing our strong dependence on foreign oil
- Our dependence on foreign oil is affecting our economy, security and environment
- The cost of oil has increased dramatically and is expected to continue rising for the foreseeable future
- Energy Policy Act 1992 and the current Puerto Rico Energy Public Policy requires the island to adopt a code

[Benefits of an Energy Code]

- Adopting a code will help owners and operators of residential and commercial buildings or units reduce their energy bills
- Reducing energy use represents savings for taxpayers
- Reducing energy use represents less money leaving the island
- It is cheaper to increase energy efficiency than to increase energy use.
- Less public funds and power plant constructions will be needed to meet electrical energy demand
- Energy efficiency reduces environmental pollution and reduces carbon emissions which contributes to mitigating Global Warming

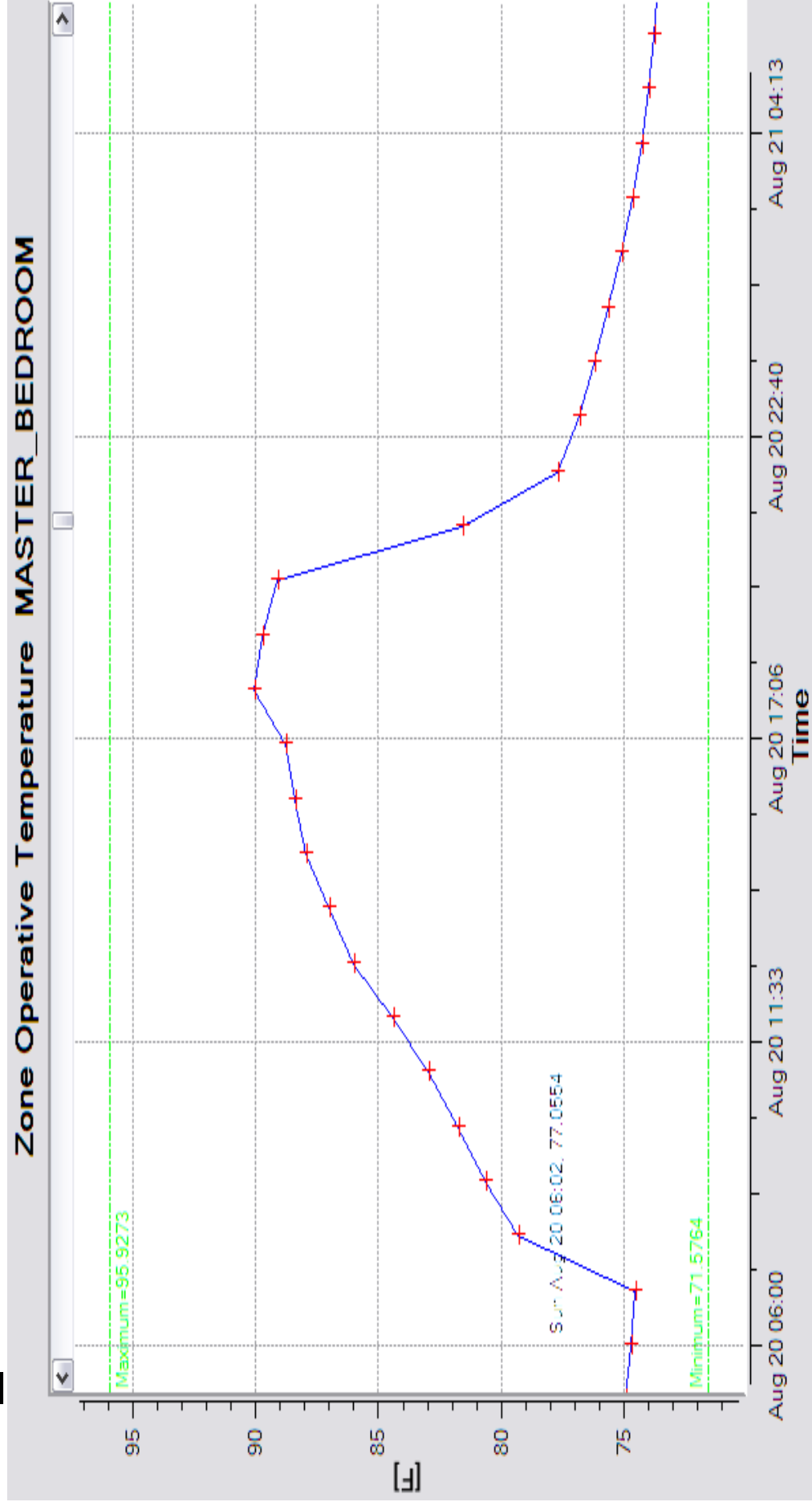
Proposed Puerto Rico Energy Code (Residential)

- Mass roofs will require R-15 insulation, all other type of roofs R-19.
- If high reflectance roof used R-13 insulation.
- Windows will require overhangs or tinted glass (SHGC=0.61).
- Solar water heaters mandatory for single dwelling residential units.
- Cooling load calculation method L x W x 80 prohibited.

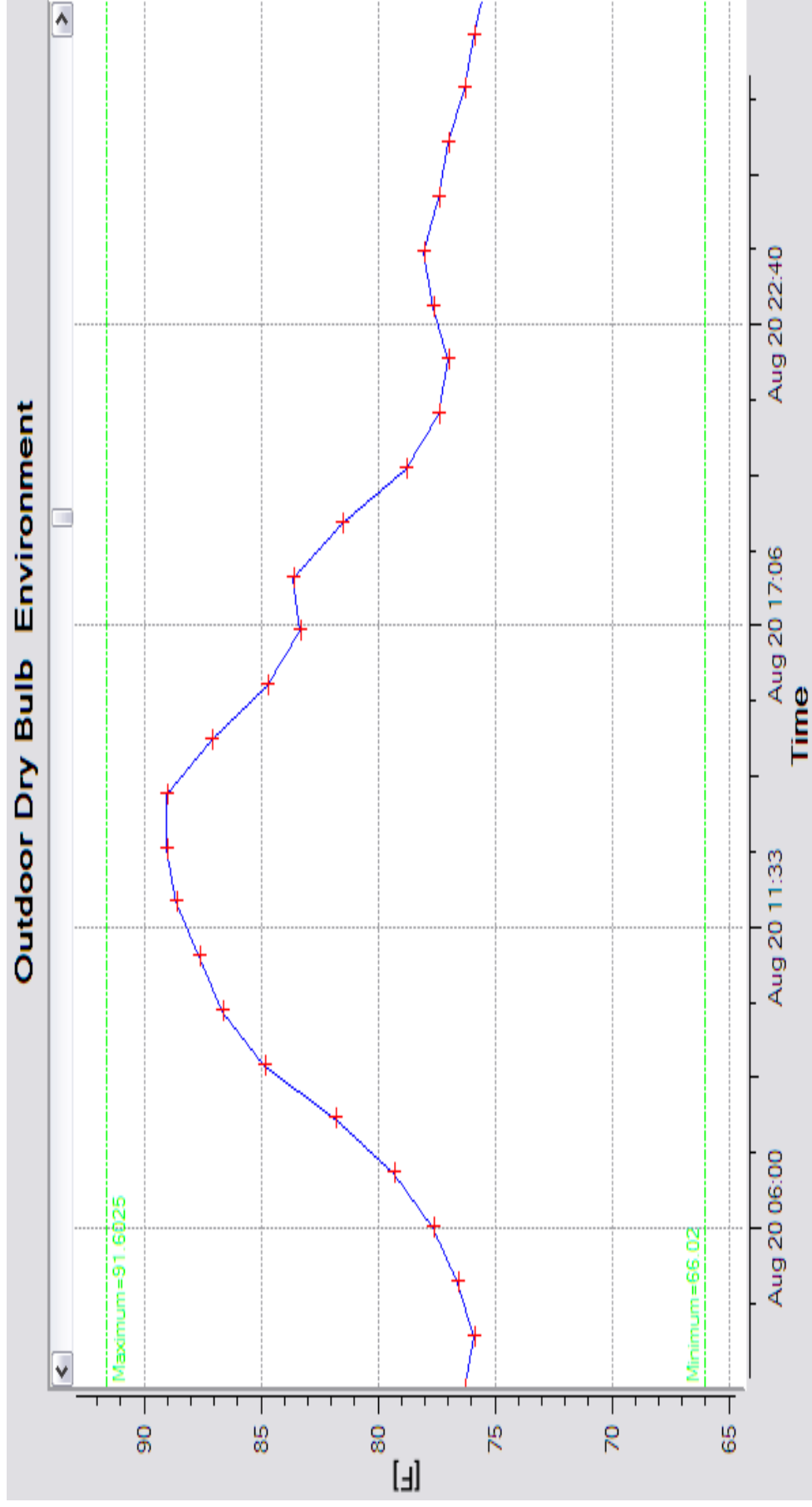
Economic Impact on Residential

- Roof slab inside temperature reduction of approximately 12 F
- Electric water heater 28% of electric energy consumption
- Solar water heater + roof insulation (R-15) = 7 years simple payback in energy costs.

Room Temperature (No Insulation)



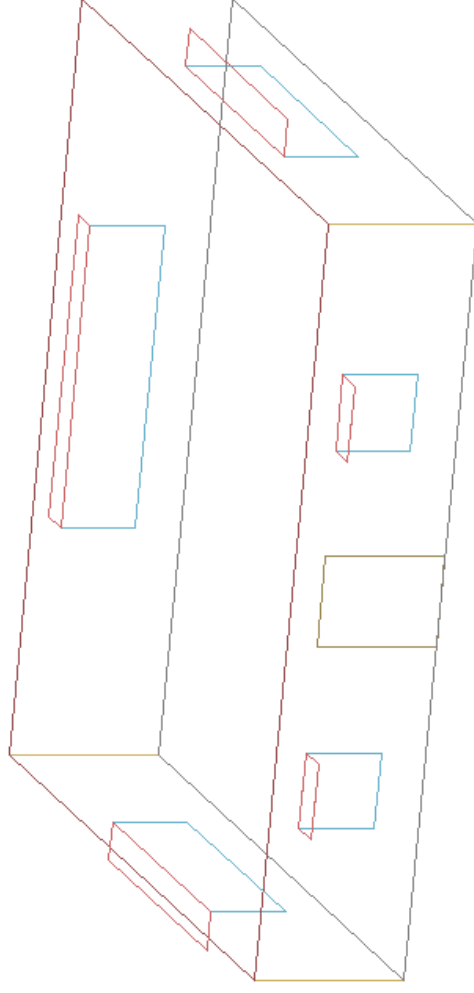
Room Temperature (Insulation R-15)



[Micro-Scale Impact

- Small Commercial Building Example
 - Area = 2,500 ft²
 - Insulated Roof vs. Non-Insulated Roof
 - R-15 Insulation Addition (Over Deck)
 - Lighting Compliance
 - From 3.1 W/ft² to 1.0 W/ft²
 - PREPA Utility Rate (Residential)
 - Monthly Fee \$3.00
 - First 425kWh at \$0.0435/kWh
 - After 425kWh at \$0.0497/kWh
 - Energy Adjustment Clause at \$0.15/kWh

[Micro-Scale Impact]



Building - The Box
The Wind

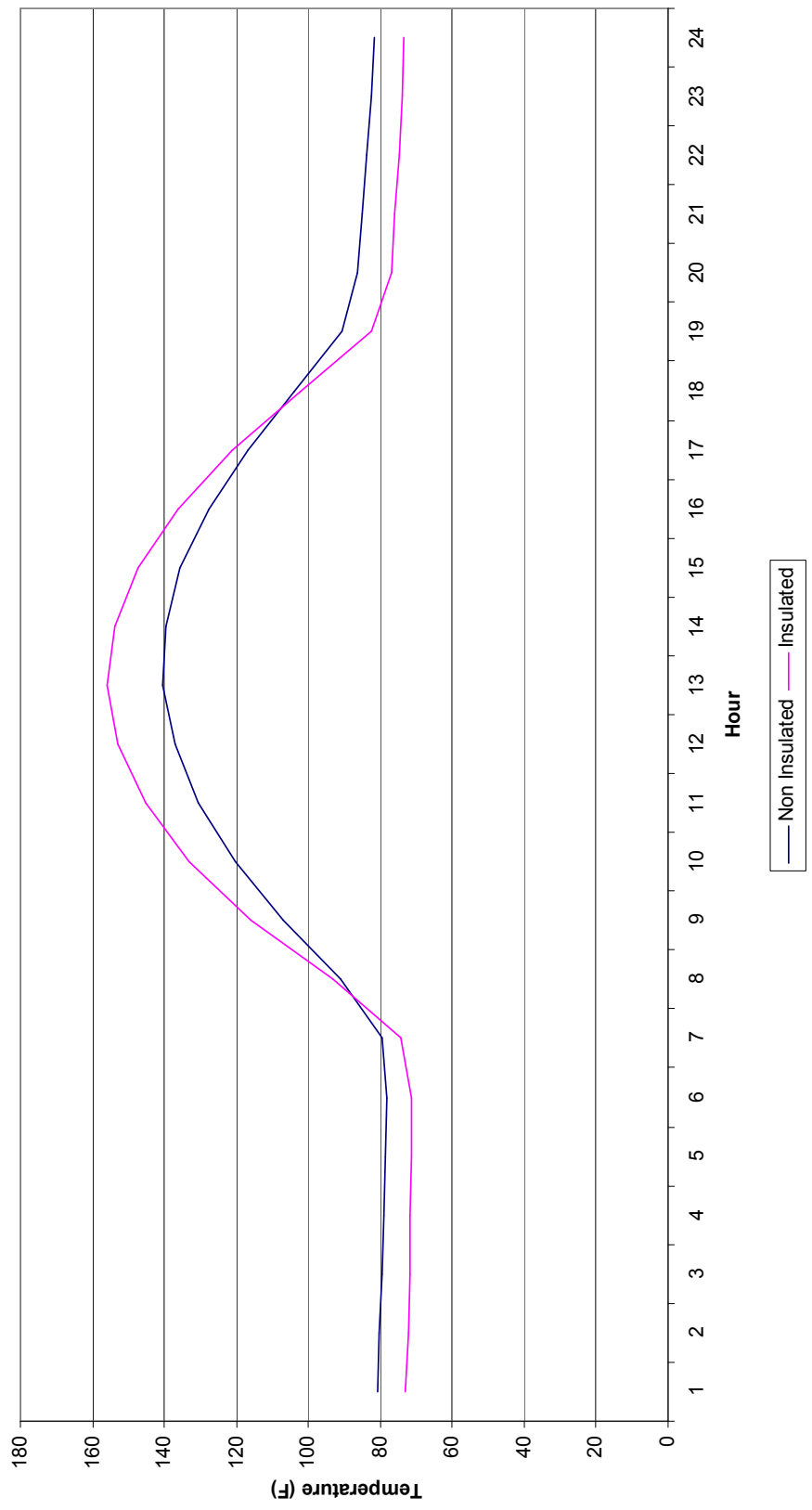
- $2,500\text{ft}^2$
- $\text{WWR} = 0.175$
- $L \times W = 50\text{ft} \times 50\text{ft}$
- AC Single Stage DX, $\text{COP} = 3.81 / \text{EER} = 13$
- San Juan TMY2 Weather File

[Micro-Scale Impact

- Insulated Roof vs. Non-Insulated Roof
 - Energy Savings = **\$564.50/yr**
 - Cooling Load
 - Improvement = 2.41 Tons
 - Savings @ \$1,500/ton = **\$3,615.00**
 - Improvement Cost
 - Original @0.72/ft² = \$1,800.00
 - New System @ \$4.00/ft² = \$10,000.00
 - Increment = **(\$8,200.00)**
 - Cost Analysis
 - Net Cost Increment = \$4,585.00
 - Simple Payback Period = **8.12 years**

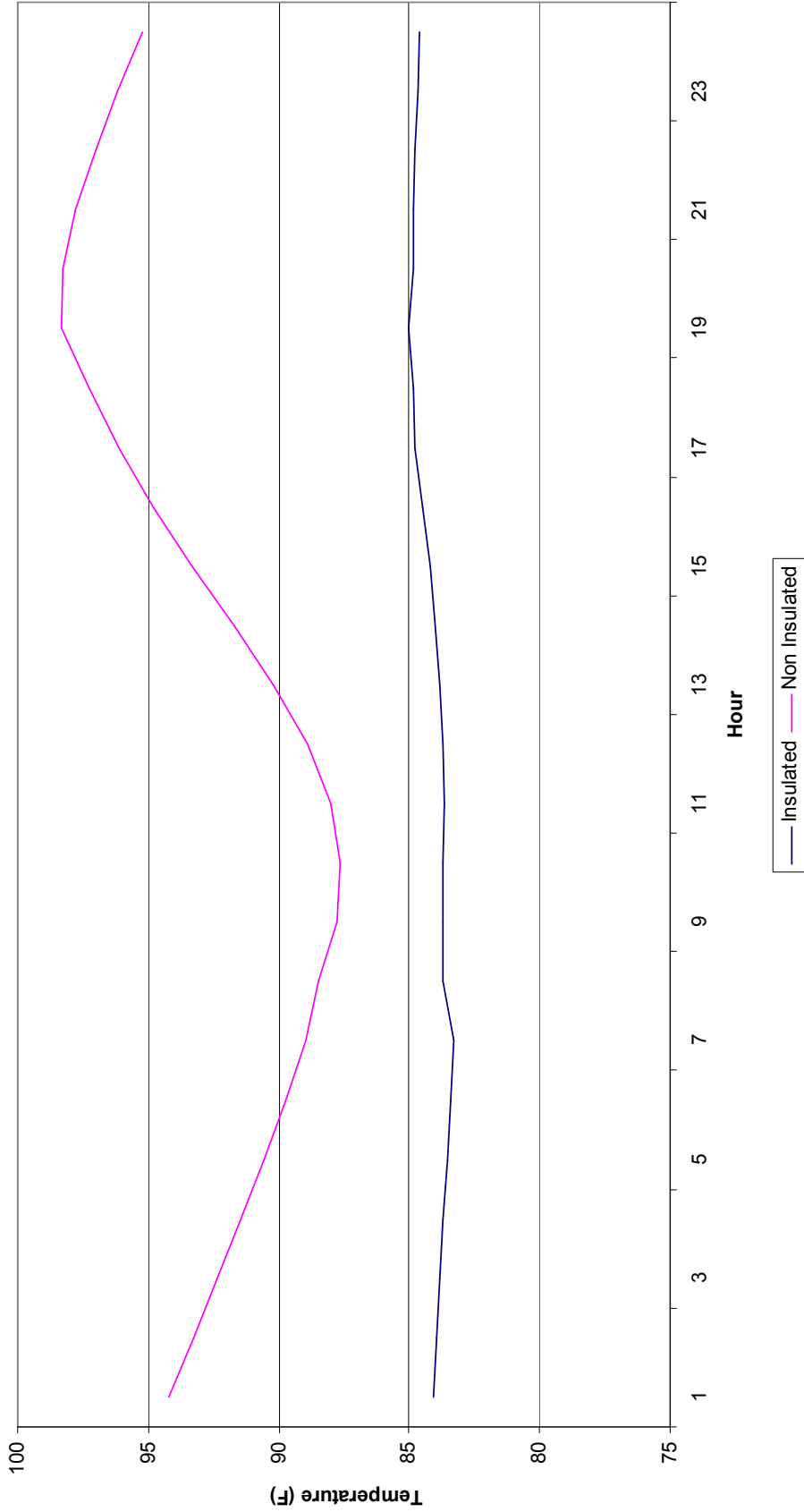
Micro-Scale Impact

Outside Surface Temperature



Micro-Scale Impact

Inside Surface Temperature Variation



[Micro-Scale Impact]

- Lighting Compliance
 - Energy Savings = **\$3,244.43/yr**
 - Cooling Load
 - Improvement = 1.31 Tons
 - Equipment Savings @\$1,500/ton = **\$1,965.00**

[Micro-Scale Impact]

- Puerto Rico Commercial Case
 - ASHRAE 90-70 to ASHRAE 90.1-2004
 - Hospital
 - Energy Reduction = 13%
 - Office
 - Energy Reduction = 16%
 - Retail
 - Energy Reduction = 42%

[Macro-Scale Impacts]

- More details at: www.energycodes.gov
- Case Studies at State Assistance Program Reports
 - Assessment of impacts from Adopting the 2006 International Energy Conservation Code for Residential Buildings in Illinois
 - Analysis of Potential benefits and Costs of Adopting ASHRAE Standard 90.1 – 2004 and a Commercial Building Energy Code in Tennessee

[End of Presentation]

- Commentaries can be sent to
 - ibenitez@ads.gobierno.pr
- Thanks for your Participation Today