

Zero Energy Home Fort Campbell

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Imagine



Create

Military Housing Privatization

- Business Partner to the military
 - Managing partner
 - 50 year lease
 - Develop, Build, Manage, and Maintain

- Actus Lend Lease
 - 40,000 military homes
 - 8 operational project sites
 - Sustainability

Goal

- Sustainable Concept
- Easy to Understand
- Tangible Benefit
- Stretch Goal

Definition

- Zero Energy Home
- Net Zero Energy Home
- Near Zero Energy Home

“Energy consumption equals energy production”

Current ZEH Homes

- High End Homes
 - Motivated Buyers
 - \$500,000 - \$800,000
- Subsidized Homes
 - Less than 1500 SF
 - Habitat for Humanity
 - Cost reduction thru grants, donations, subsidies
- Middle Income Home
 - Our focus

Our Project

- The “Woodlands”
- New Subdivision
- 521 new units
- 51 Single Family Homes, 470 duplex
- Zero Energy Home budget: \$500,000



FORT CAMPBELL RCI

THE WOODLANDS

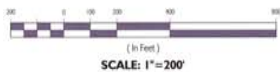
KENTUCKY/TENNESSEE ■ ACTUS LEND LEASE

OCTOBER 13, 2006





Preliminary Layout
Ft. Campbell Woodlands
 101st Airborne Division Road Clarksville, Tennessee





NDCEE

National Defense Center for Environmental Excellence



DoD Executive Agent
Office of the
Assistant Secretary
of the Army
(Installations and
Environment)

NDCEE Sustainability Installations Initiatives Task

Near Zero Energy Housing at Ft. Campbell

Energy Modeling Results

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The NDCEE is operated by:  *Concurrent Technologies Corporation*

Energy Modeling

- Purpose
 - Assess the expected energy use of various building features and systems
- Task Application
 - Optimize ZEH design and size photovoltaics
- Software
 - eQUEST (DOE-2)
- Application Focus
 - Energy savings rather than detailed design
 - Comparative results for technologies

ZEH Design Approach

■ Team members

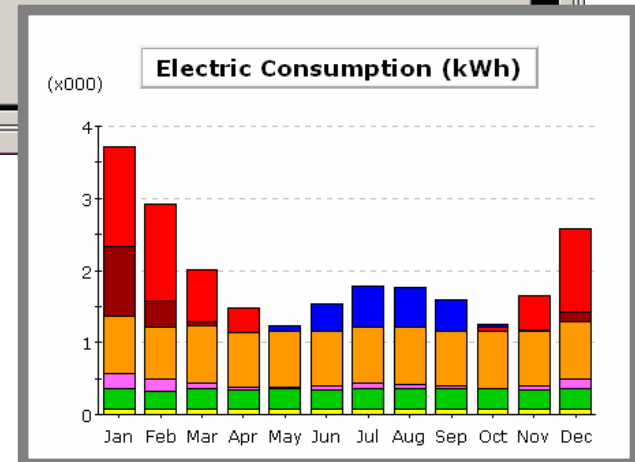
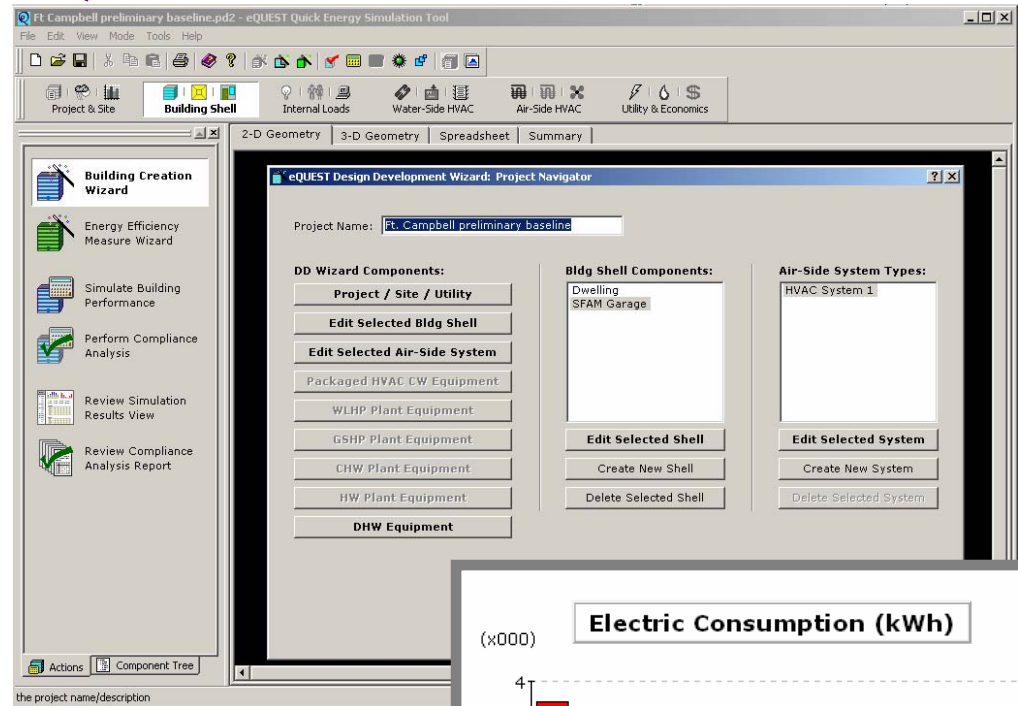
- Ft Campbell Housing
- Actus Lend Lease
- NDCEE
- URS

■ Technical Approach

- Project scoping
- Identification of Best Available Technologies (BATs)
- Data collection
- Develop modeling approach/run initial simulations
- Evaluate approach/software capabilities/simulation results
- Refine models and determine ZEH technology portfolio

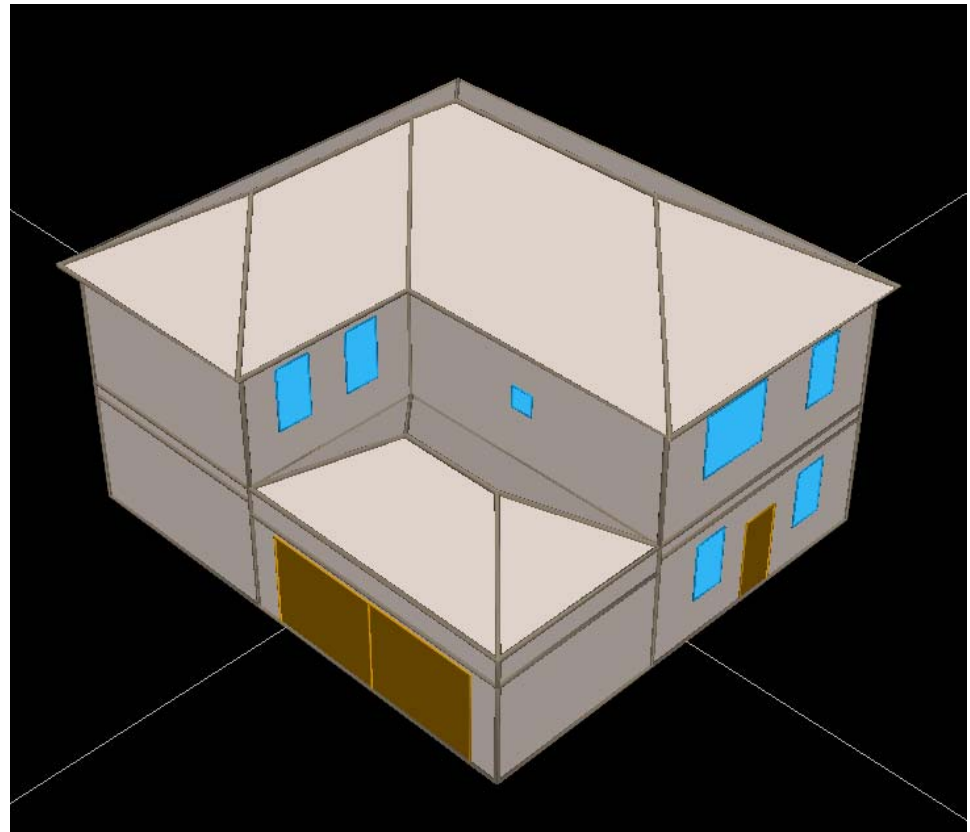
eQUEST

- Comprehensive energy simulation tool
- Publicly available
- Funded by California utility customers
- Administered by California Public Utilities Commission
- Simulation “engine” based on DOE-2 computer programs
- Modeler inputs building, system (HVAC, WH) and weather information
- Predicts hourly energy use and cost
- Building creation wizards
- Graphical reporting

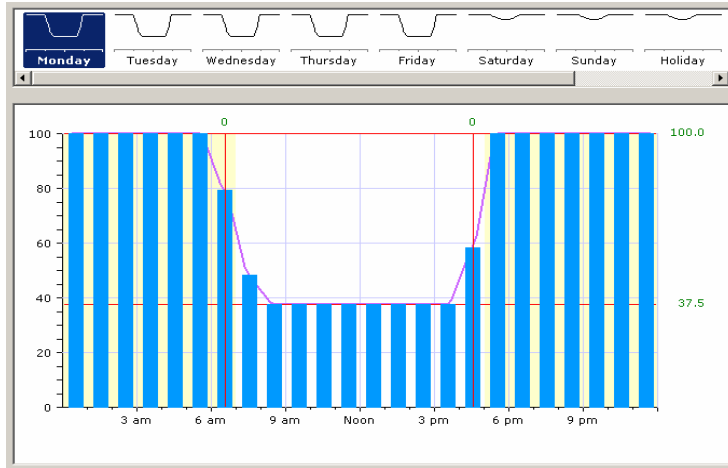


Baseline Ft. Campbell Single Family Home

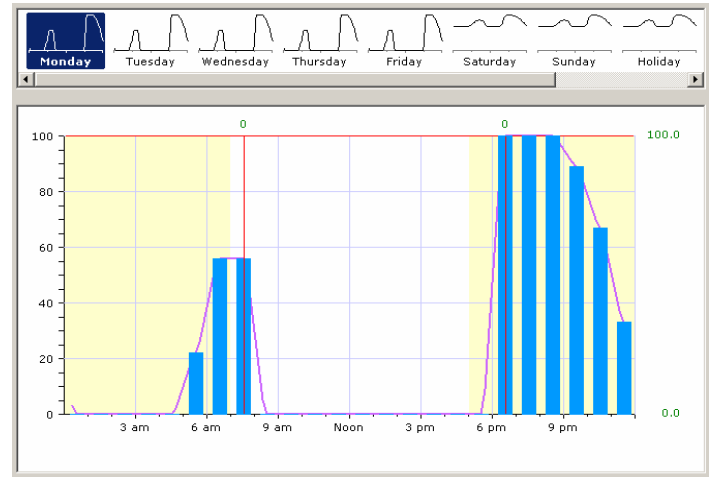
- 2 Story
- 2,100 ft² living space
- 325 ft² garage
- 2 x 4 metal frame
- R-13 batt in wall
- Asphalt shingle roof
- R-38 blown in cellulose
- Uninsulated slab foundation
- Double low-e windows
- Air source electric heat pump
- Electric water heater (20 gallons/person/day)
- Incandescent & fluorescent lighting
- West facing (worst case)



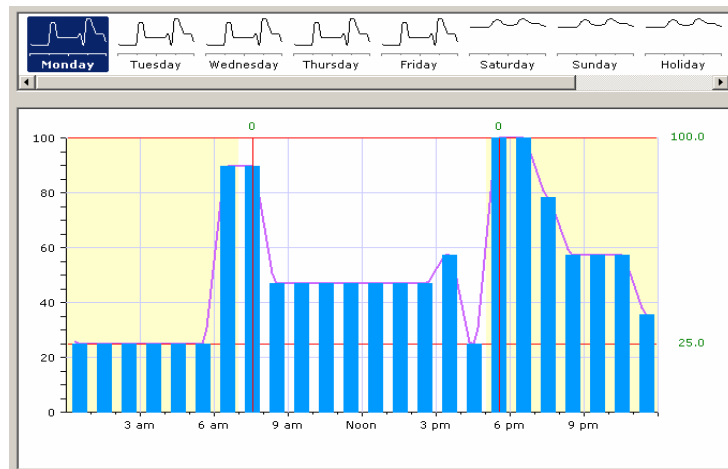
Profiles



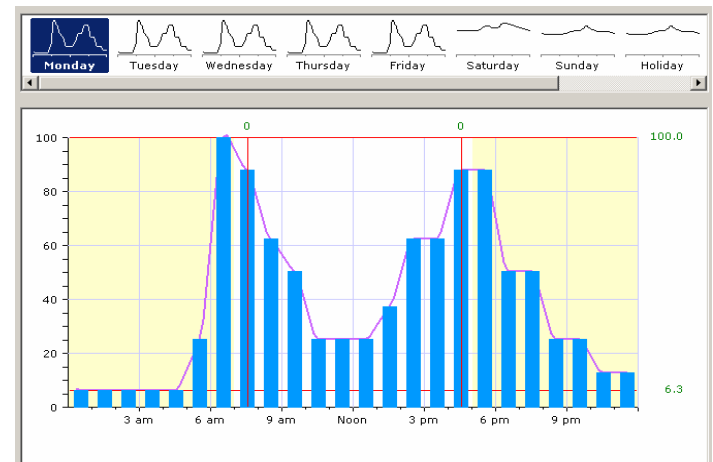
Occupancy



Lighting

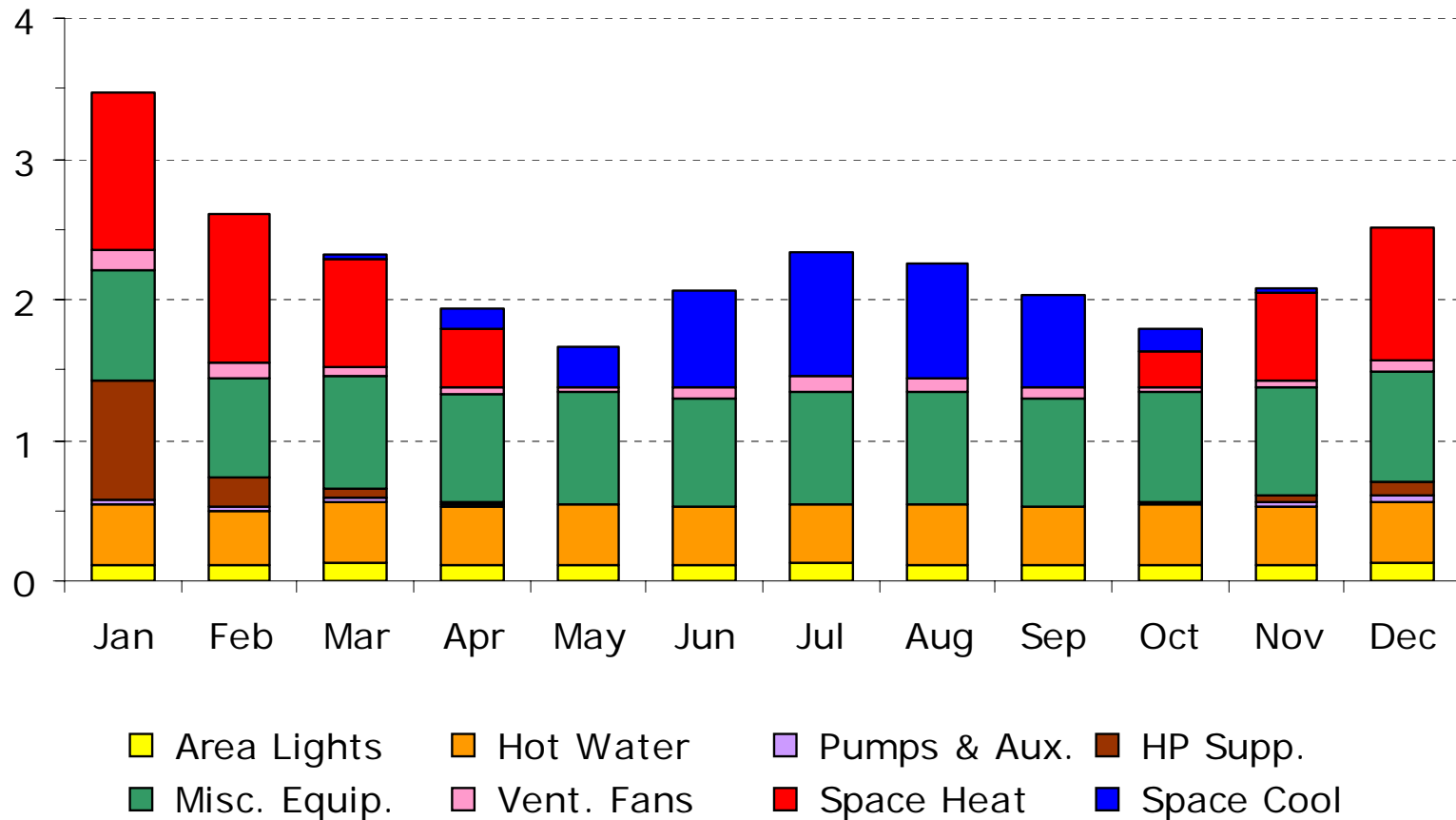


Equipment



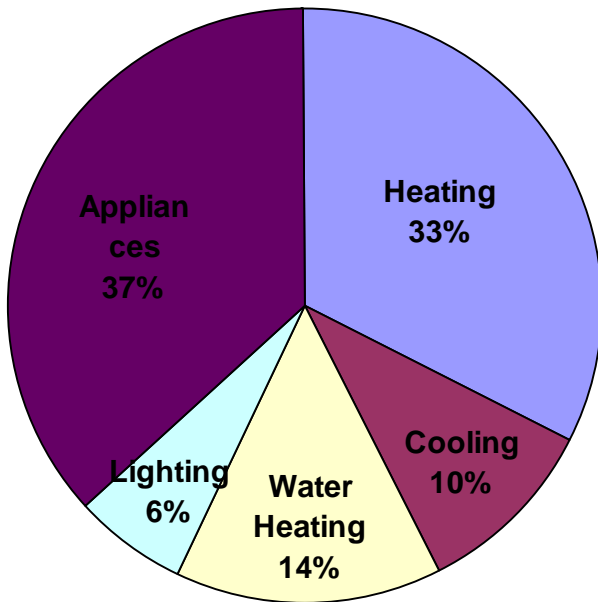
Hot Water

Baseline Electric Consumption (1,000 kWh)

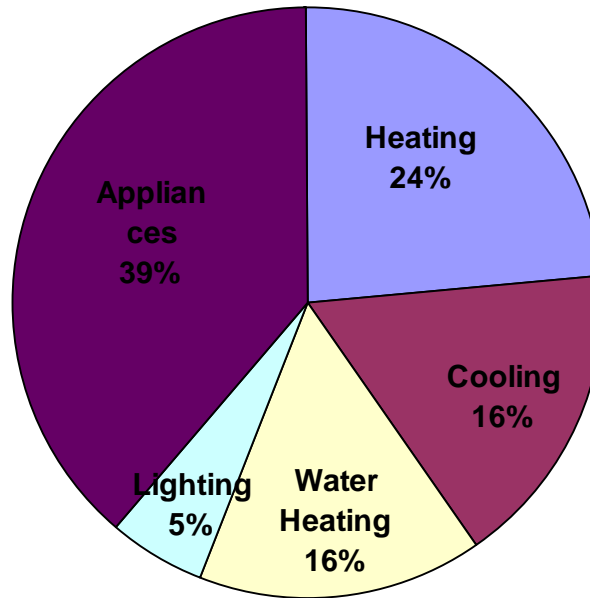


Comparison of Baseline Results to DOE RECS Data (by Census Division)

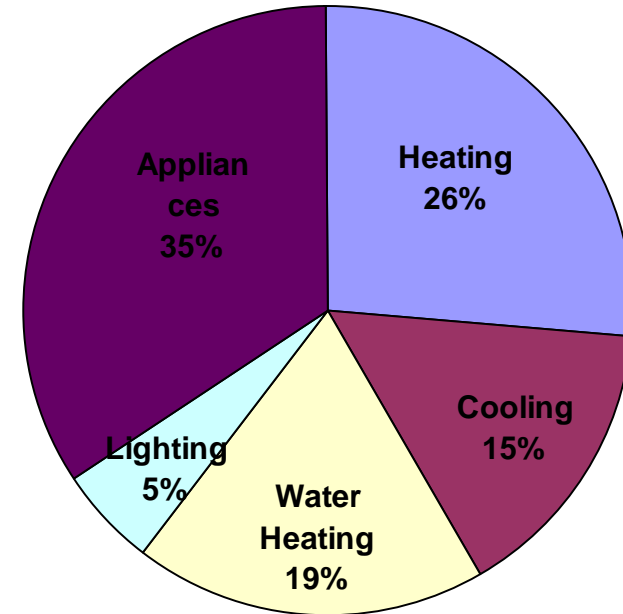
RECS Data
Midwest, East
North Central



RECS Data
South, East
South Central

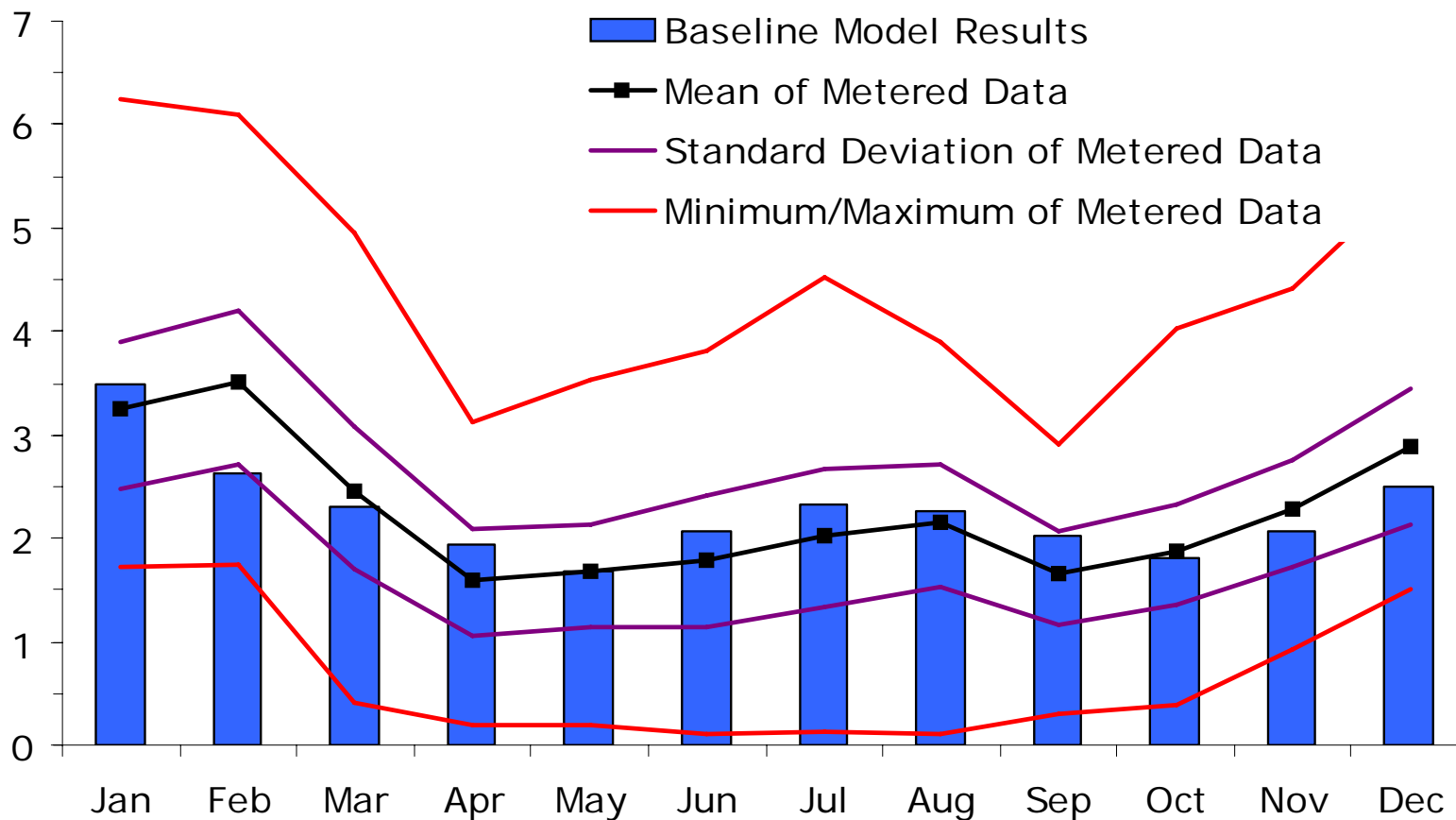


Ft Campbell
Baseline Energy
Model



RECS: Residential Energy Consumption Survey

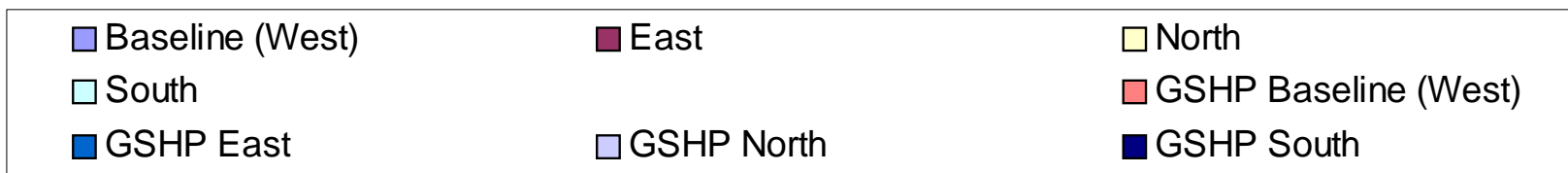
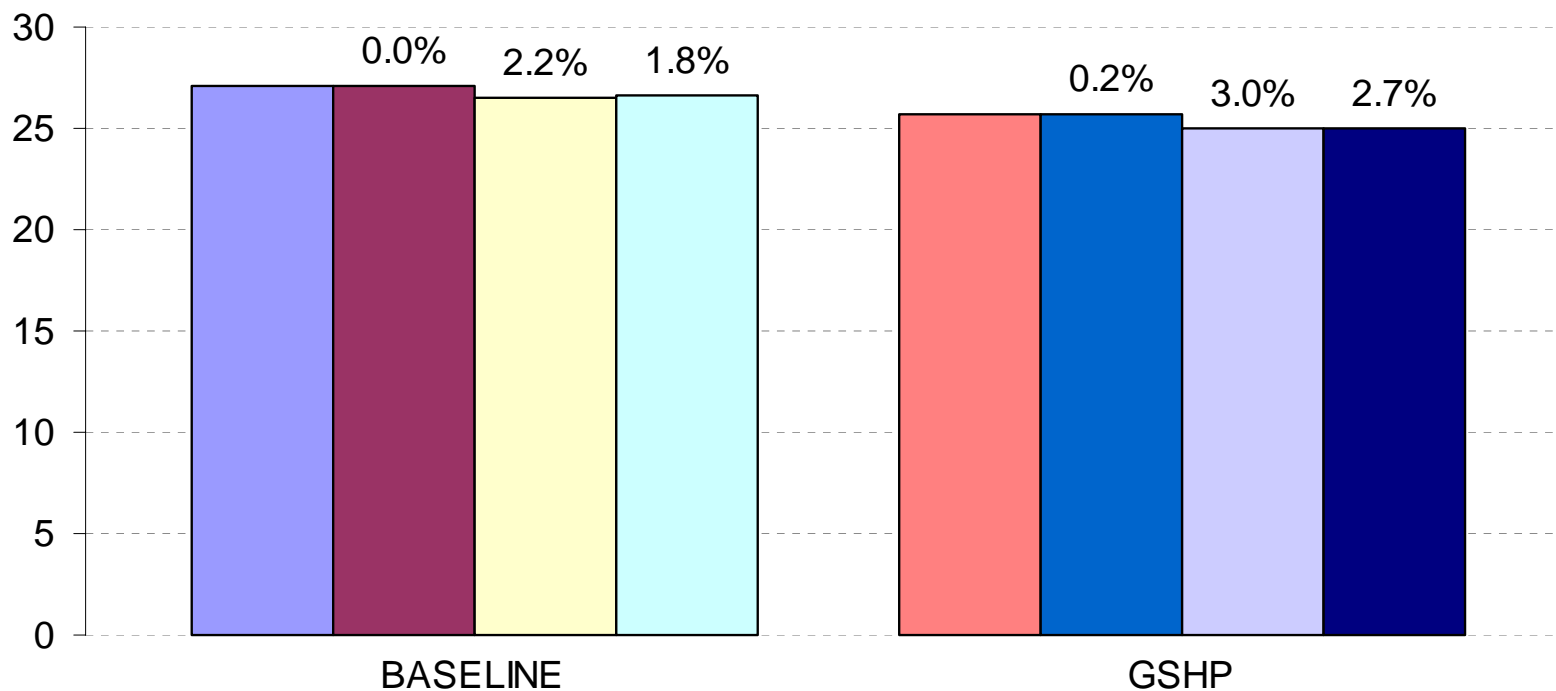
Comparison of Baseline Results to Metering Data



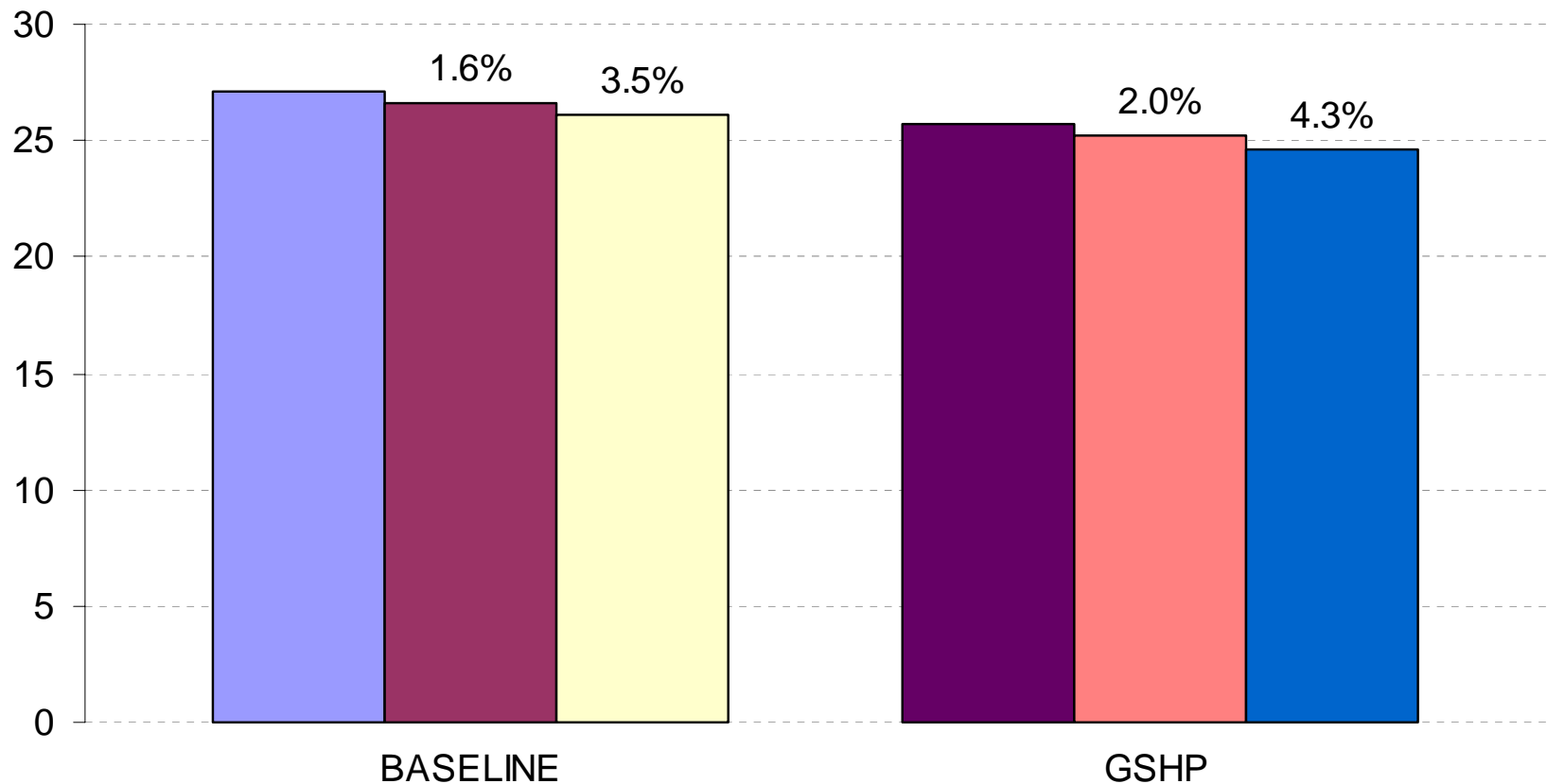
Evaluated Technologies

- Orientation
- Wall Construction: various stud sizes, wood, steel, SIP, ICF
- Insulation: R13 batt, spray foam, ICF, SIP
- Windows: double-glazed, low e vinyl, e film
- Doors: metal insulated, wood frame, removal of French doors, fins
- Overhangs: house, windows
- Roofing: asphalt, rubber, concrete, metal
- Attic Space: R30 blown w/ radiant barrier, vapor retarder, attic fan, radiant barrier drape, R45 blown
- Foundation: slab w/ and w/o insulation, crawl w/ batt, spray and perimeter insulation
- HVAC: heat pump, improved SEER, GSHP, two zone GSHP
- Hot Water: tank, GSHP assist
- Lighting: incandescent, fluorescent, CF, daylighting
- Appliances: Energy Star, high efficiency

Orientation, Annual Energy Consumption (1,000 kWh)

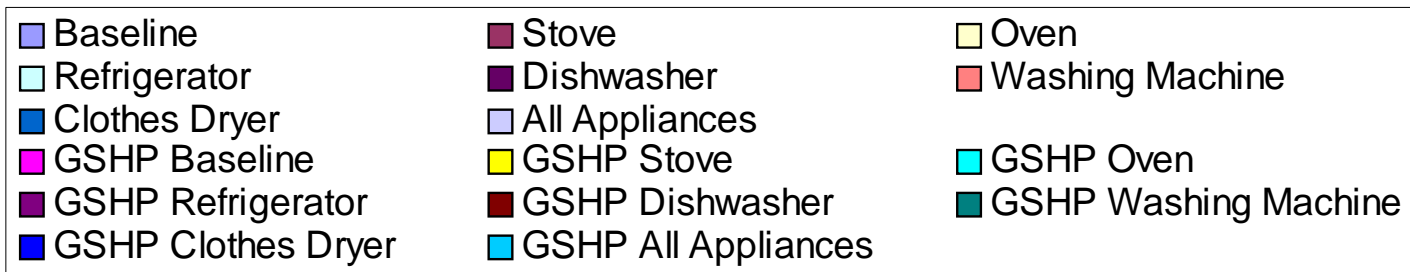
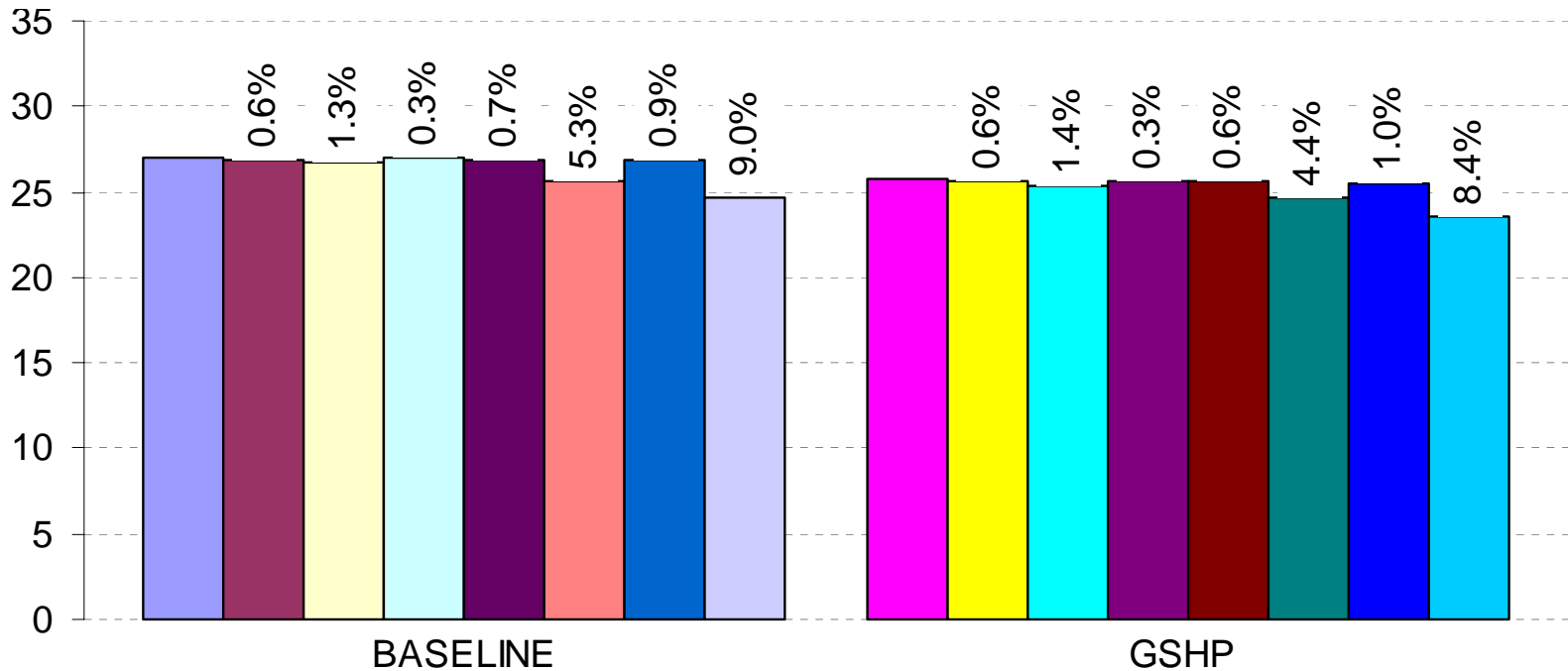


Lighting, Annual Energy Consumption (1,000 kWh)

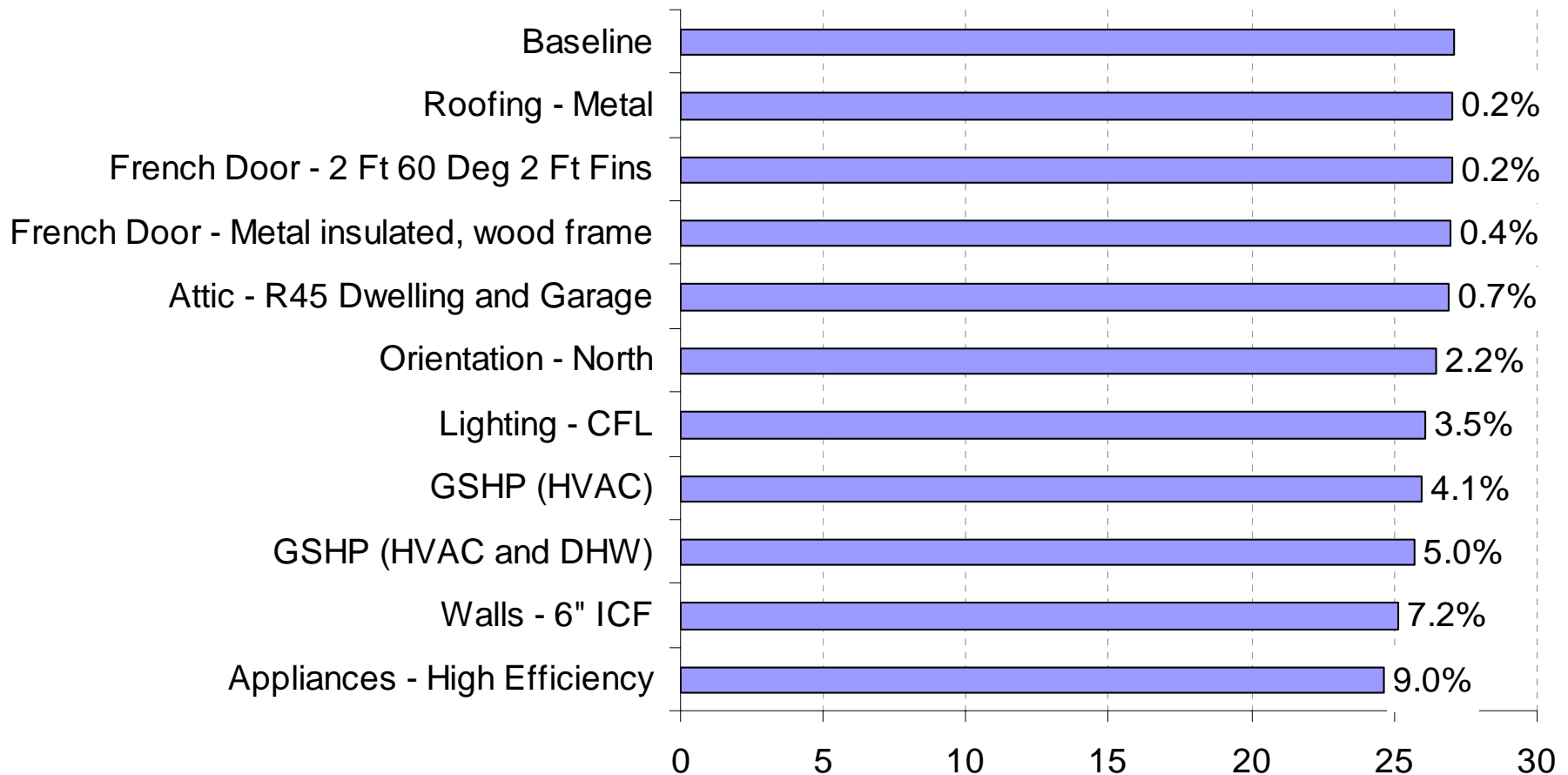


■ Baseline ■ Fluorescent ■ CFL ■ GSHP Baseline ■ GSHP Fluorescent ■ GSHP CFL

Appliances, Annual Energy Consumption (1,000 kWh)



Summary of Parametric Savings



Model Issues/Deficiencies

- Software developed for commercial buildings
- Accuracy associated with specific components and systems uncertain
- Little detailed data available for verifying baseline modeling results
- Energy requirements also dependents on behavior of the occupants
- Modeling all possible design options time consuming

Potential Next Steps

- Integrated design process for developing synergies between architecture and mechanical/electrical systems
- Natural day-lighting options
- Dual loop ground source heat pump
- Model south facing windows with overhangs to take advantage of solar gain in winter, and shading summer sun
- Economic feasibility analysis
- Code review to determine minimum requirements for building envelope and mechanical/electrical systems

Questions

NDCEE Sustainability Installations Initiatives Task Near Zero Energy Housing at Ft. Campbell Energy Modeling Results

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