



FLORIDA SOLAR ENERGY CENTER®

Creating Energy Independence

Improved Hot Water Code Calculation

Interim Progress Report

**FBC Energy Technical Advisory
Committee Teleconference Meeting
March 3, 2017**

A Research Institute of the University of Central Florida



Research Purpose and Goal

- Characterize hot water waste sources
- Characterize implications of climatic differences on hot water use
- Characterize energy impacts of hot water recirculation systems and controls with respect to energy consumption in Florida homes
- Recommend Florida-specific methods to employ in the Florida Energy Code for residential hot water use and energy consumption calculations



Hot Water Systems Research

- Principal factors not adequately considered by standard building energy code hot water calculations:
 - Variation in service water temperatures by climate location
 - Hot water system design significantly impacts both the quantity of hot water used and energy consumption
 - Hot water circulation pumps can reduce hot water use but also dramatically increase energy use



Expected Outcome and Impact on the Code

Project report will include recommendations suitable for consideration by the FBC in determining the most appropriate Florida-specific methods, procedure and calculation for determining the energy use effectiveness of domestic hot water systems for the residential FEC.



Research Approach

Four project tasks:

- Task 1: A “hot water” and “energy” search terms literature review
- Task 2: Development of hot water energy use calculation procedures by month, climate, circulation design and hot water system type



Research Approach

Four project tasks (cont.):

- Task 3: Compare hot water energy use for 2, 3, and 4-bedroom homes in Miami, Orlando and Jacksonville calculated with new procedures vs. use determined by current code calculation
- Task 4: Using EnergyGauge simulations, determine and document the difference in overall energy code performance scores for two sample homes (hot water e-Ratios and total e-Ratios)



Progress to Date

- Task 1 literature review listing provided with interim report
- Task 2 calculation procedures developed (draft interactive Excel sheet and draft code modification language provided with interim report)



Progress to Date

Literature Review:

- Searched on "hot water distribution" and "energy" terms in NREL, LBNL, ASHRAE and DOE BA databases + general search + other
- 40+ pertinent documents identified
- Review to date shows:
 - Anticipated levels of waste
 - Anticipated use factors— including plumbing design, insulation, climate (time of year and location) and occupant demographics



Progress to Date

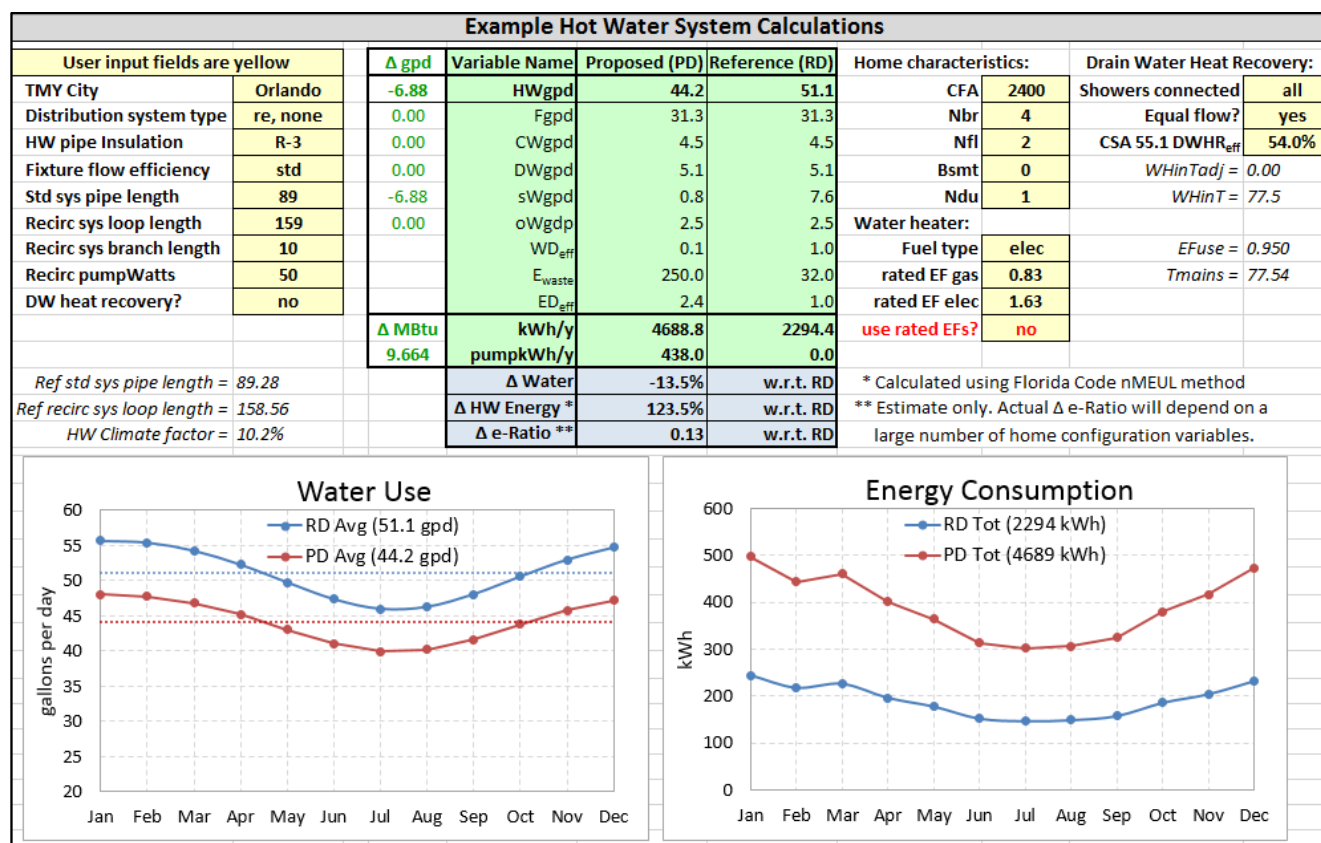
Calculation Procedure Development:

- Starting point was ANSI/RESNET 301-2014 Addendum A-2015
- Florida-specific adaptations include:
 - Calculation by month
 - Florida climate adjustment (T_{mains} and F_{mix})
 - FL climate examples: Tallahassee, Jacksonville, Daytona Beach, Orlando, Tampa and Miami
- Solar and HRUs addressed “upstream”



Progress to Date

Interactive Hot Water System Calculator (Draft)



Progress to Date

Proposed Code Change Language (Draft)

PROPOSED DOMESTIC HOT WATER SYSTEM CHANGES

TABLE R405.5.2(1)— SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS. Modify as follows:

TABLE R405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service water Heating ^{d, e, f, g}	As proposed Fuel Type: Same as proposed Use (gal/day): same as proposed design determined in accordance with Appendix # Efficiency: in accordance with prevailing Federal minimum standards Energy Consumption: determined in accordance with Appendix #.	Fuel Type: As proposed $Use (Ggal/day) := 30 + (10 \times N_{dw})$ determined in accordance with Appendix # Efficiency: As proposed Energy Consumption: determined in accordance with Appendix #.

[All other parts of the table to remain unchanged.]

Add new Appendix # to read as follows:

APPENDIX #

CALCULATION OF HOT WATER ENERGY CONSUMPTION



Next Steps

- Task 3: Compare hot water energy use for 2, 3, and 4-bedroom homes in Miami, Orlando and Jacksonville calculated with new procedures vs. use determined by current code calculation
- Task 4: Using EnergyGauge simulations, determine and document the difference in overall energy code performance scores for two sample homes



Project Completion

- Literature review summary
- Document Task 3 and 4 results
- Final report delivered by June 1st

