

# Measurement Tools & Verification of Savings Calculations

## C. Savings Calculation Fundamentals

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- Fundamental concept of savings calculations
- Adjustments
  - Routine
  - Non-routine

# Quantifying Savings

IPMVP Chapter 3:

Energy Savings = Baseline Energy Use – Post-Retrofit  
Energy Use  $\pm$  Adjustments

- Adjustments are:
  - Routine
  - Non-Routine

# Routine Adjustments

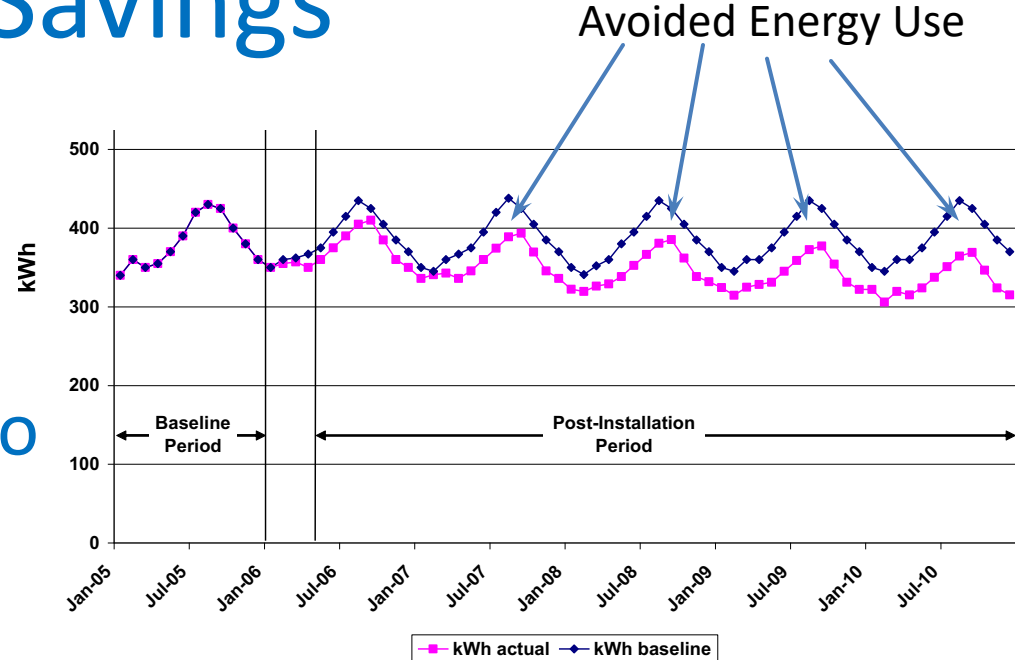
- Normal and expected variations in energy use due to operating conditions, weather, normal production rates, etc.
- Equation becomes:  
$$\text{Energy Savings} = \text{Adjusted Baseline Energy} - \text{Post-Installation Period Energy} \pm \text{Non-Routine Adjustments}$$

# Energy Models

- Energy models describe how baseline energy use is affected by routine parameters of interest
- Energy models can be:
  - Mathematical equations:  $\text{kWh}_{\text{save}} = \text{kW} (\text{HRS}_{\text{base}} - \text{HRS}_{\text{post}})$
  - Statistical relationships:  $\text{kWh}_{\text{save}} = f(T_{\text{outside}}, \text{time-of-week})$
  - Complex computer simulations of buildings: DOE-2, EnergyPlus, *eQUEST*
- The model enables one to determine what baseline use would have been under post-installation or any other conditions

# Savings

- Measured post-install use is subtracted from adjusted baseline to calculate Avoided Energy Use

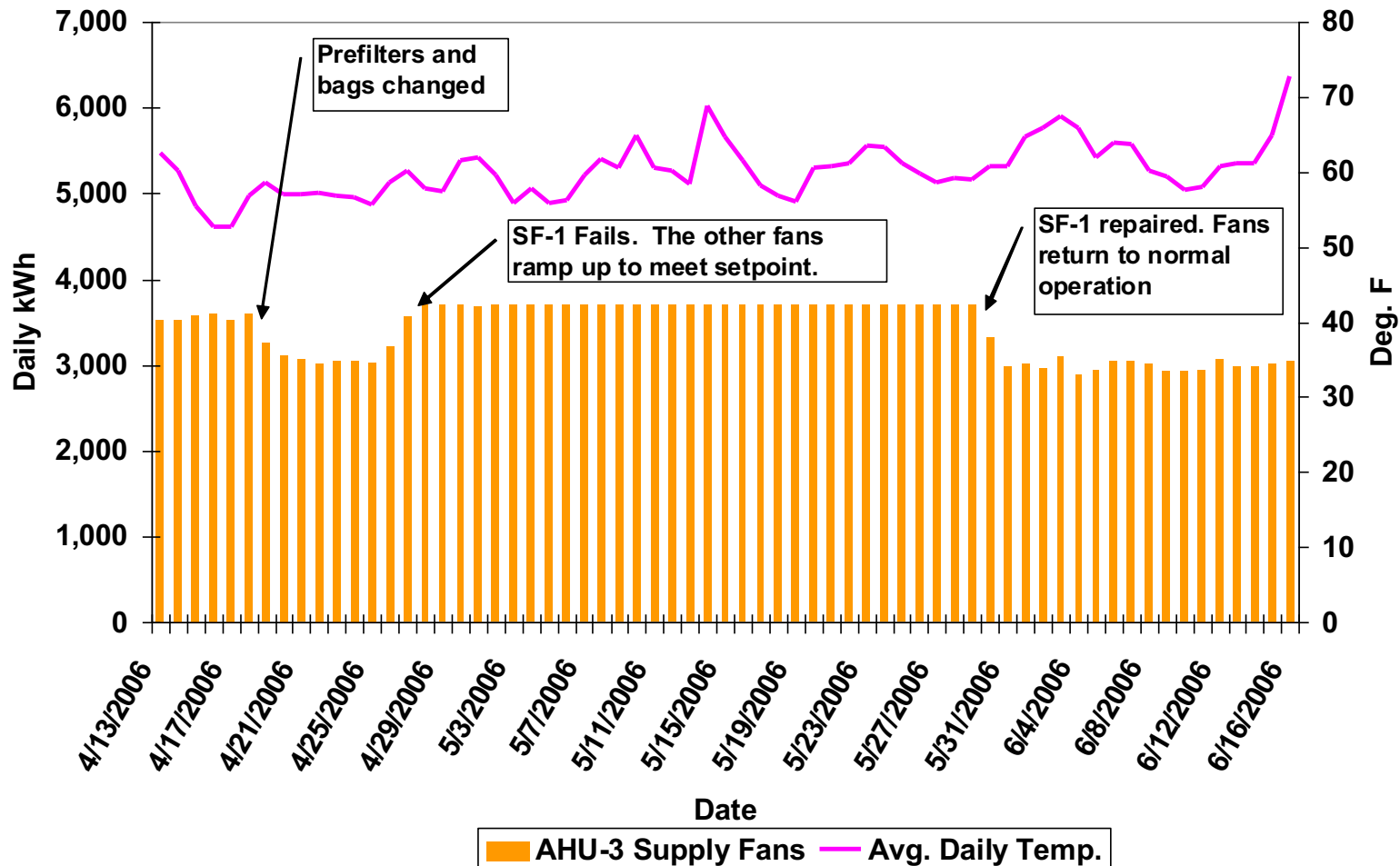


- Normalized Savings are calculated from baseline and post-install energy use under different conditions
  - e.g. typical meteorological year (TMY)
  - requires post-install model as well

# Non-Routine Adjustments

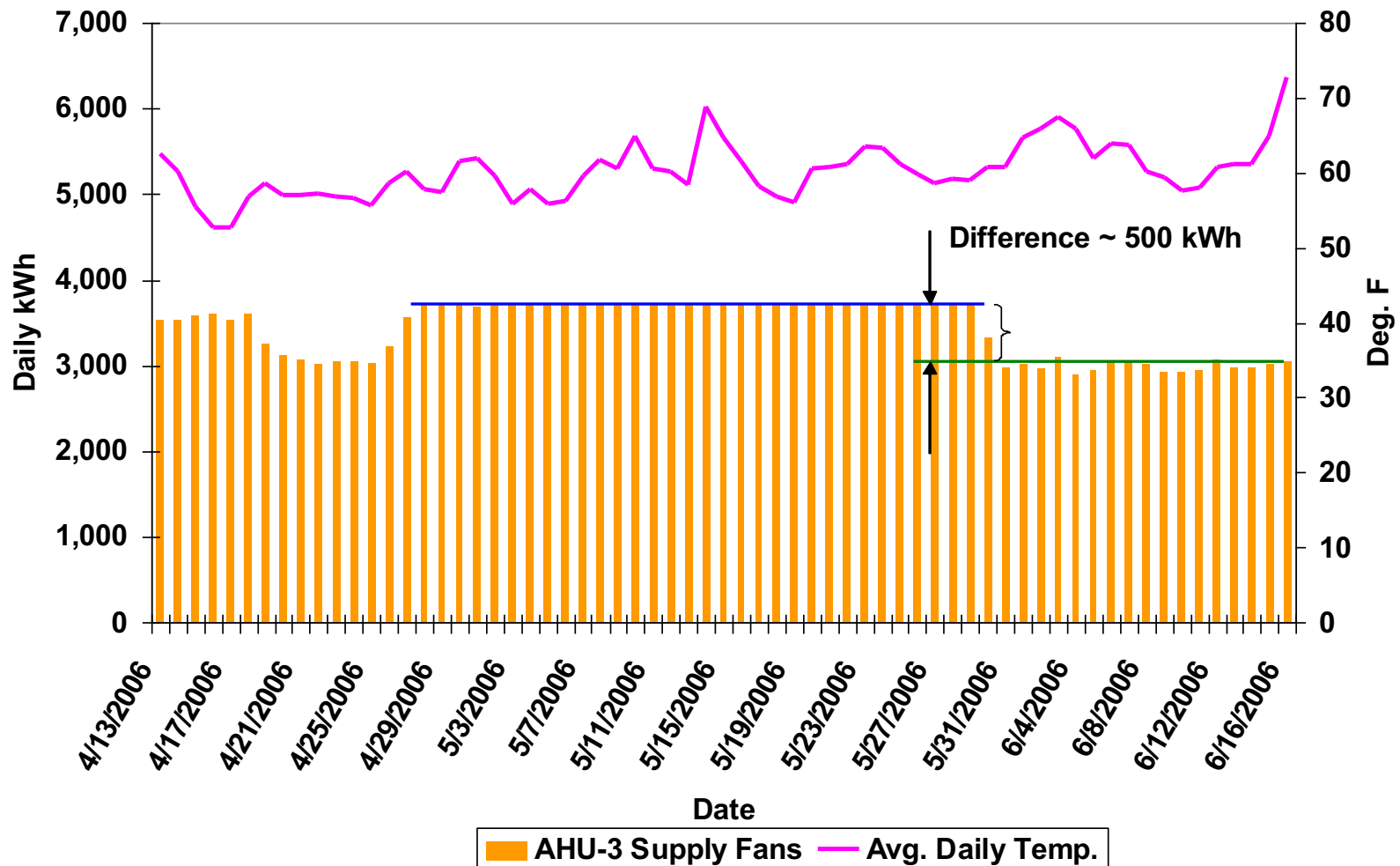
- Unexpected changes in energy use due to:
  - Tenants moving in or out
  - Chiller failure and replacement
  - New building loads (office eqp., servers, etc.)
  - Major renovations
- Accounting for impact:
  - Measure or estimate non-routine energy impact
    - Quantity and duration
  - Remove from adjusted baseline

# Non-Routine Adjustments





# Non-Routine Adjustment



# BEST Center Curricula, Resources & Recordings

## Academic Programs

Georgia Piedmont Technical College - Building Automation Systems

Milwaukee Area Technical College - Sustainable Facilities Operations

Laney College - Commercial HVAC Systems

City College San Francisco - Commercial Building Energy Analysis & Audits

## Professional Development Materials, Presentations & Videos

National Institutes

Building Automation Systems Instructor Workshops

Webinars (e.g., BEST Talks)

## Faculty Profile Videos

## Reports & Case Studies

## Marketing Resources

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