



TRI-COUNTY
REGIONAL ENERGY NETWORK

SAN LUIS OBISPO • SANTA BARBARA • VENTURA

What A Load Calculation Is And Why One Is So Important

Judy Rachel – Home Performance Pro

July 7, 2026



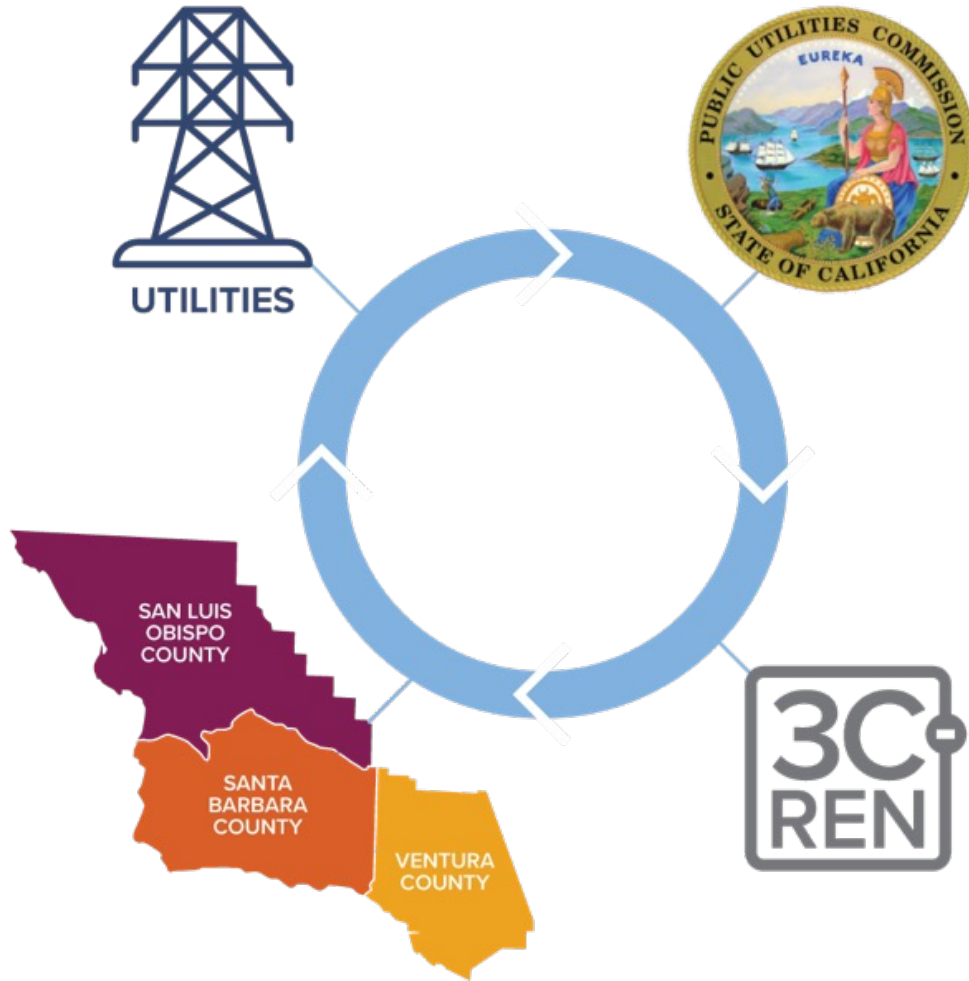
Before We Begin

Here are some quick reminders:

- Call in? Please **share** full name to confirm attendance
- To receive LUs, you **must attend** at least 80% of the training. Attendance will be verified
- Use the "**Chat**" to share questions or comments
- Slides/recording are **shared** after most events and can be found on 3C-REN's on-demand page
- 3C-REN does **not** allow **AI notetakers**, unless used to accommodate a disability



Tri-County Regional Energy Network



3C-REN is a collaboration between the tri-counties

Our programs reduce energy use for a more sustainable, equitable and economically vibrant Central Coast

Our free services are funded via the CPUC, bringing ratepayer dollars back to the region



Our Services

Incentives



HOME ENERGY SAVINGS

3c-ren.org/for-residents
3c-ren.org/multifamily



COMMERCIAL ENERGY SAVINGS

3c-ren.org/commercial

Contractors can enroll at
3c-ren.org/contractors

Training



BUILDING PERFORMANCE TRAINING

3c-ren.org/events
3c-ren.org/building



ENERGY CODE CONNECT

3c-ren.org/code

View past trainings at
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Technical Assistance



AGRICULTURE ENERGY SOLUTIONS

3c-ren.org/agriculture



ENERGY ASSURANCE SERVICES

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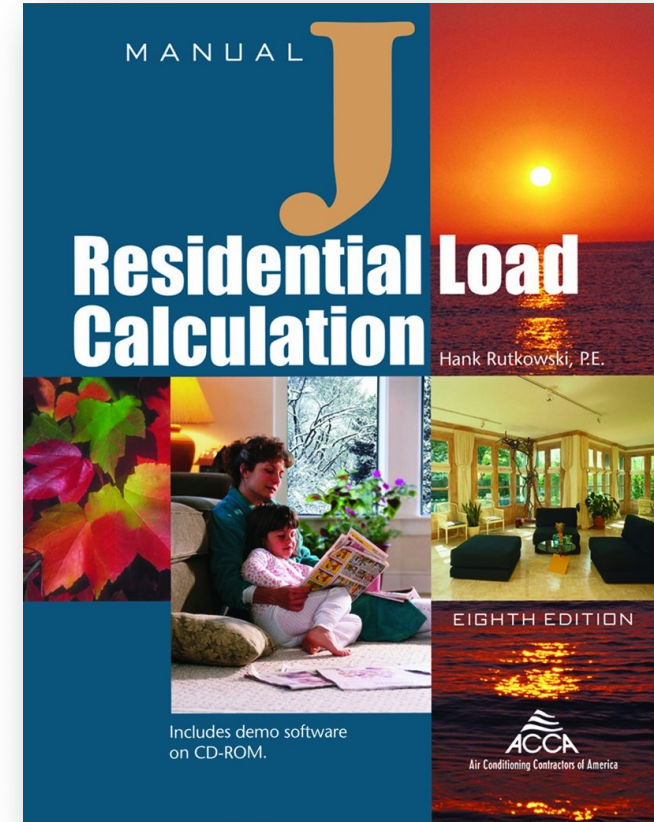
PRESENTER – JUDY RACHEL



1. Home Performance Technician
2. Contractor Field Mentor
3. Perform load calculations and HVAC system design
4. Field Research/Building Performance Testing
5. Diagnostic testing of existing HVAC systems
6. Trainer for Home/High Performance Homes, ACCA load calculations, Healthy Homes, use of diagnostic test equipment, combustion safety, etc.

AGENDA

- ❑ What a load calculation is.
- ❑ Overview – What goes into a load calculation.
- ❑ Is there an easier way?
- ❑ Why load calculations are so important.



| WHAT IS A LOAD CALCULATION?

The measure of energy the heating and / or cooling system needs to add or remove from a space to provide the desired level of comfort.

BUILDINGS ARE ENVIRONMENTAL SEPARATORS



HEAT IS A FORM OF ENERGY



Heat is transferred whenever there is a temperature difference between two materials or spaces.

BRITISH THERMAL UNIT (Btu)

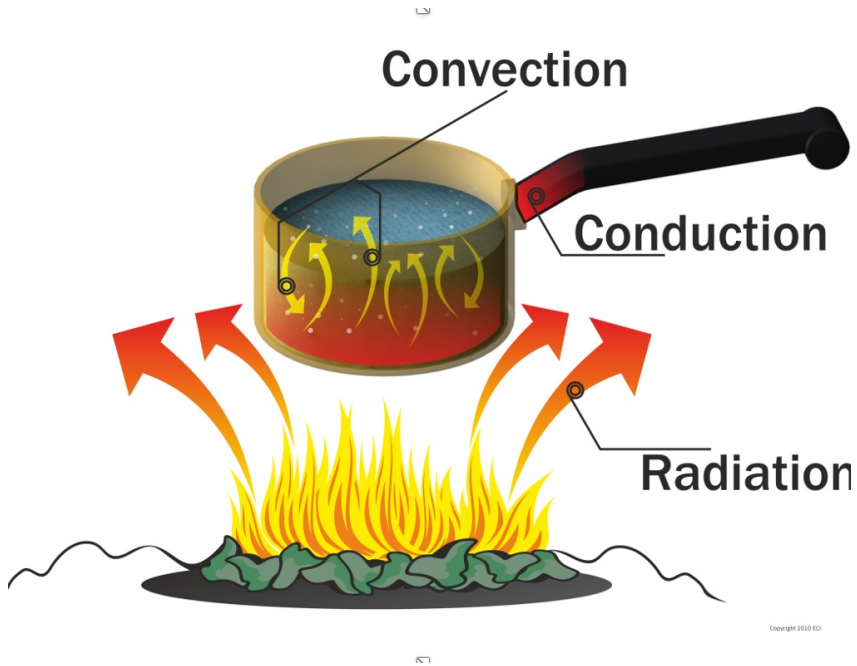
Unit used to measure heat loss or gain.

The amount of heat required to raise one pound of water one degree Fahrenheit.



Approximately the amount of heat released by burning one wooden match.

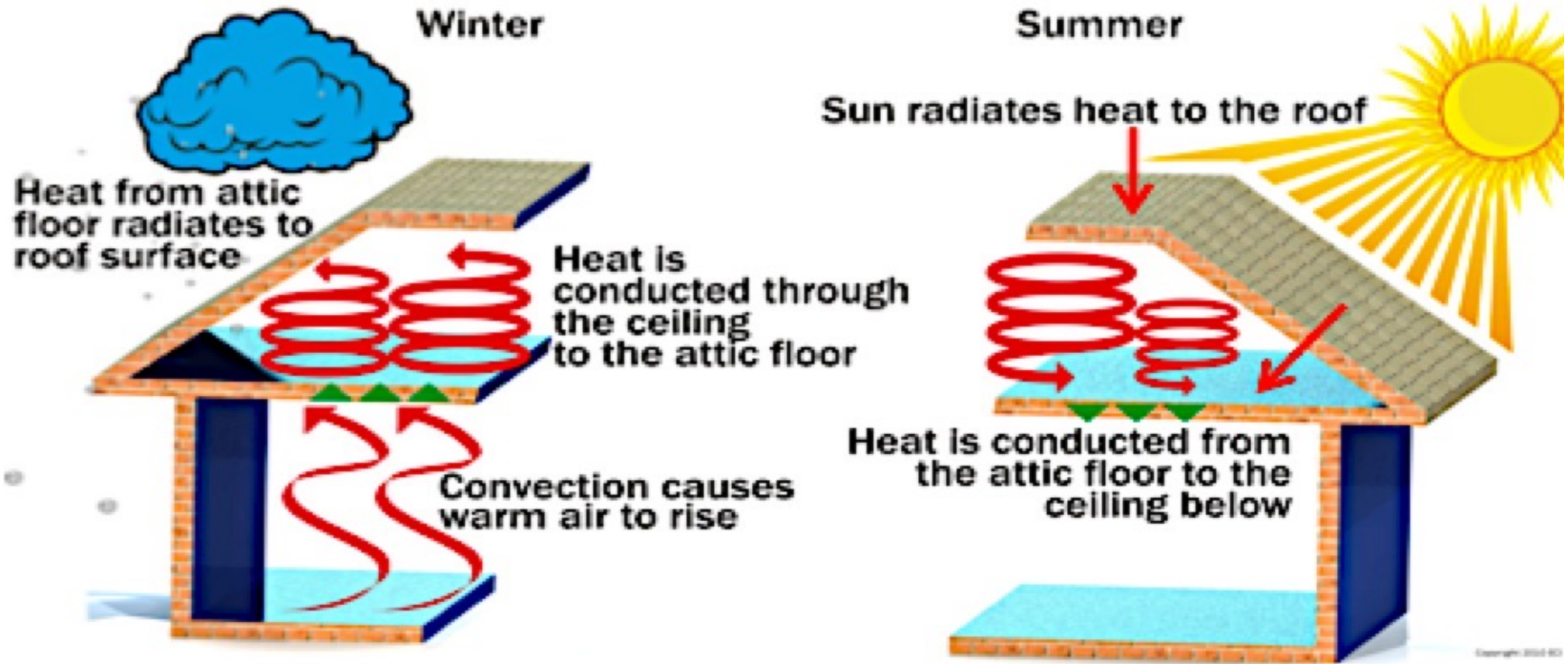
METHODS OF HEAT TRANSFER



Conduction – the movement of heat through a solid object. The objects must have physical contact

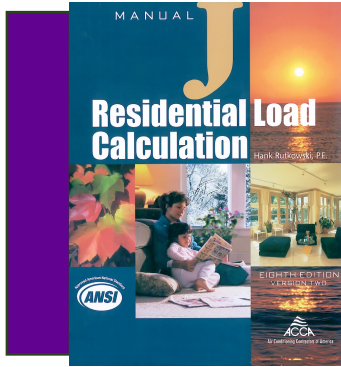
Convection – heat transferred by a moving fluid like air or water

Radiation – the transfer of heat, as a wavelength, through space



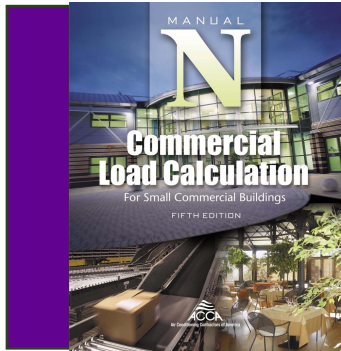
Heat transfer happens via conduction, convection and radiation.

LOAD CALCULATION PROCESS



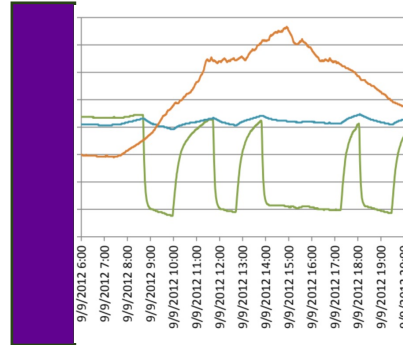
Manual J Residential Load Calculation

Manual J 8th Edition is the national ANSI-recognized standard for producing HVAC equipment sizing loads for single-family detached homes, small multi-unit structures, condominiums, town houses, and manufactured homes.



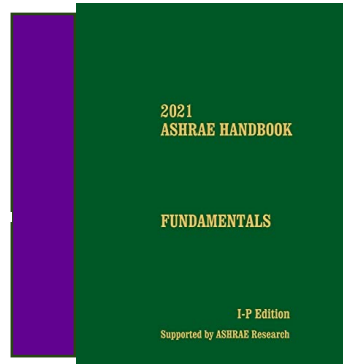
Manual N Commercial Load Calculation

Manual N details the load calculation procedure in the commercial construction industry.



Measured Performance Load Calculation Method

Uses live measurements in the building to calculate the heating and cooling Btu/h needed to provide the desired indoor temperature at determined design conditions.



ASHRAE HANDBOOK FUNDAMENTALS

To provide the engineer, the architect and contractor alike, with a useful and reliable reference data book relating to the art of heating and ventilating. A wide range of data within the scope of the field is presented and every effort has been made to present the material in a practical and useful manner.

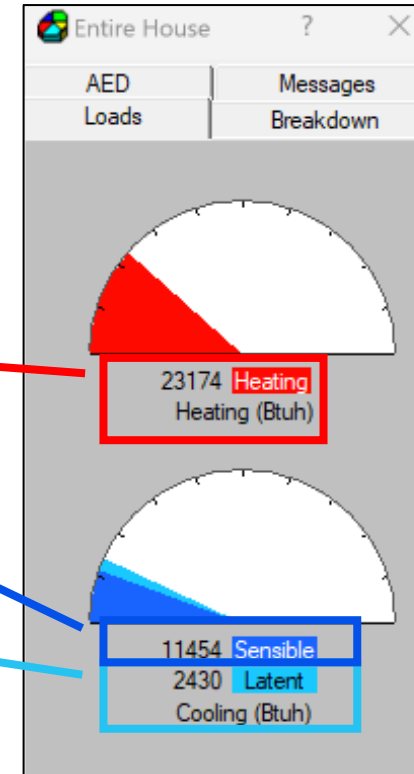
THE LOAD CALCULATION RESULTS

Provide the information necessary to select appropriately sized space conditioning equipment.

1. Heating Btuh

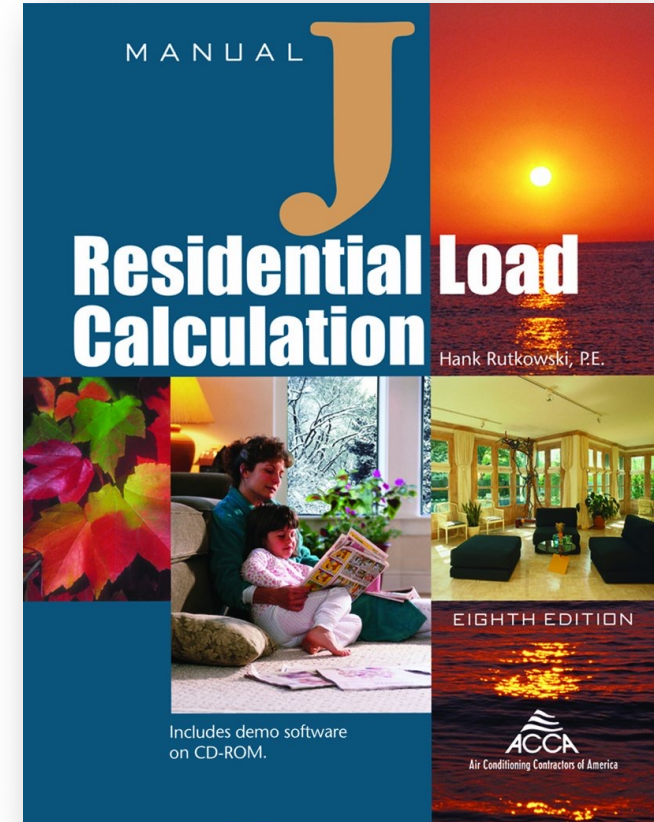
2. Sensible Cooling Btuh

3. Latent Cooling Btuh



AGENDA

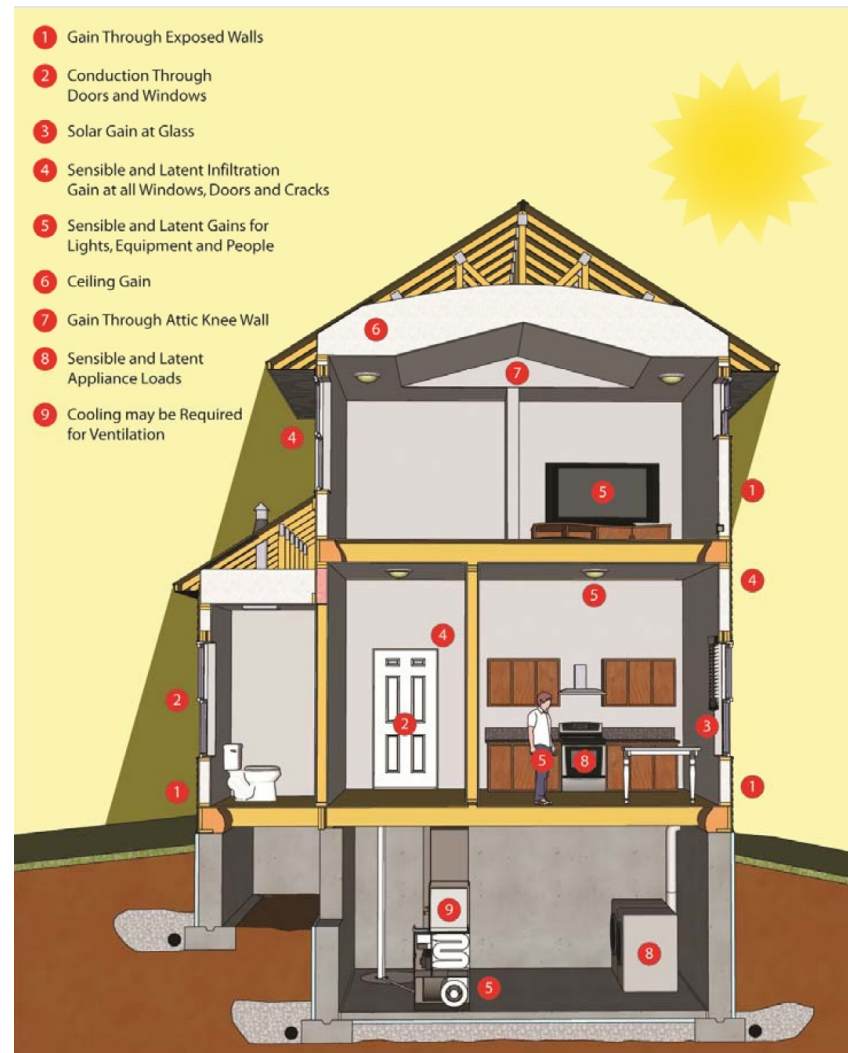
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- ❑ Is there an easier way?
- ❑ Why load calculations are so important.

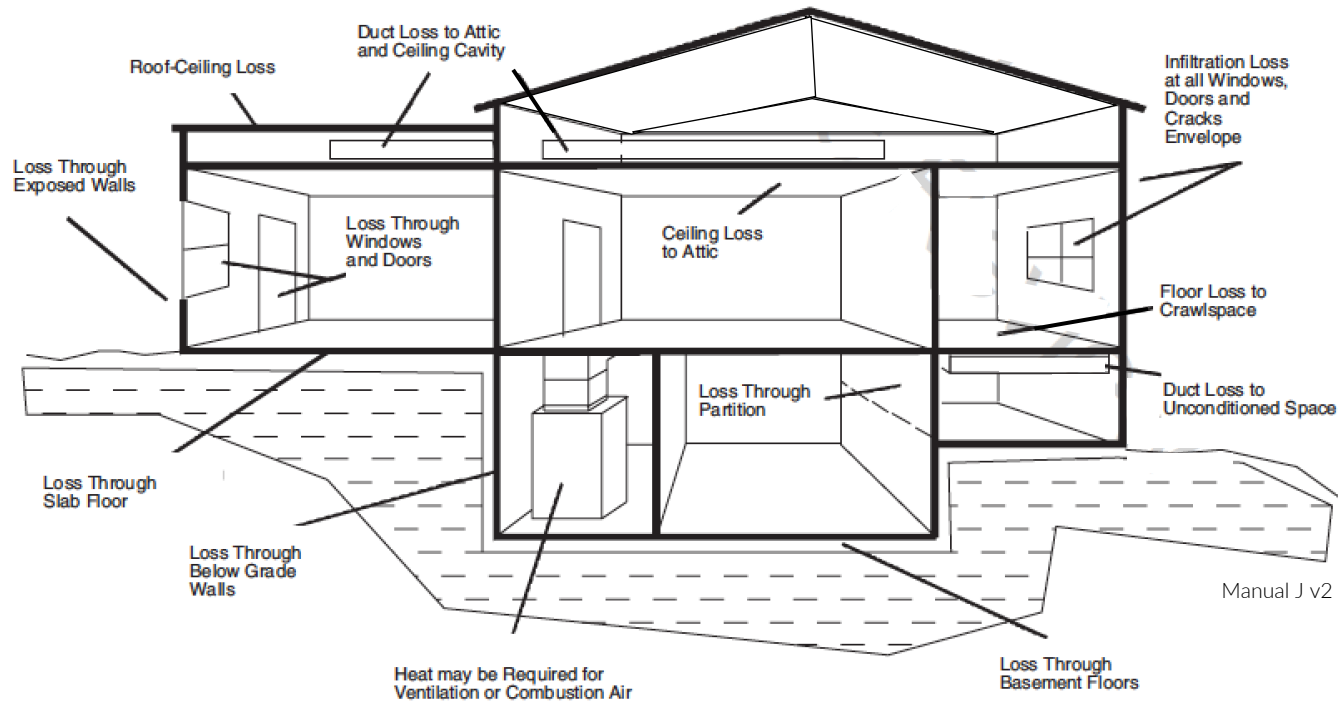


TYPES OF HEATING AND COOLING LOADS

Each dwelling has a unique set of enclosure loads determined by:

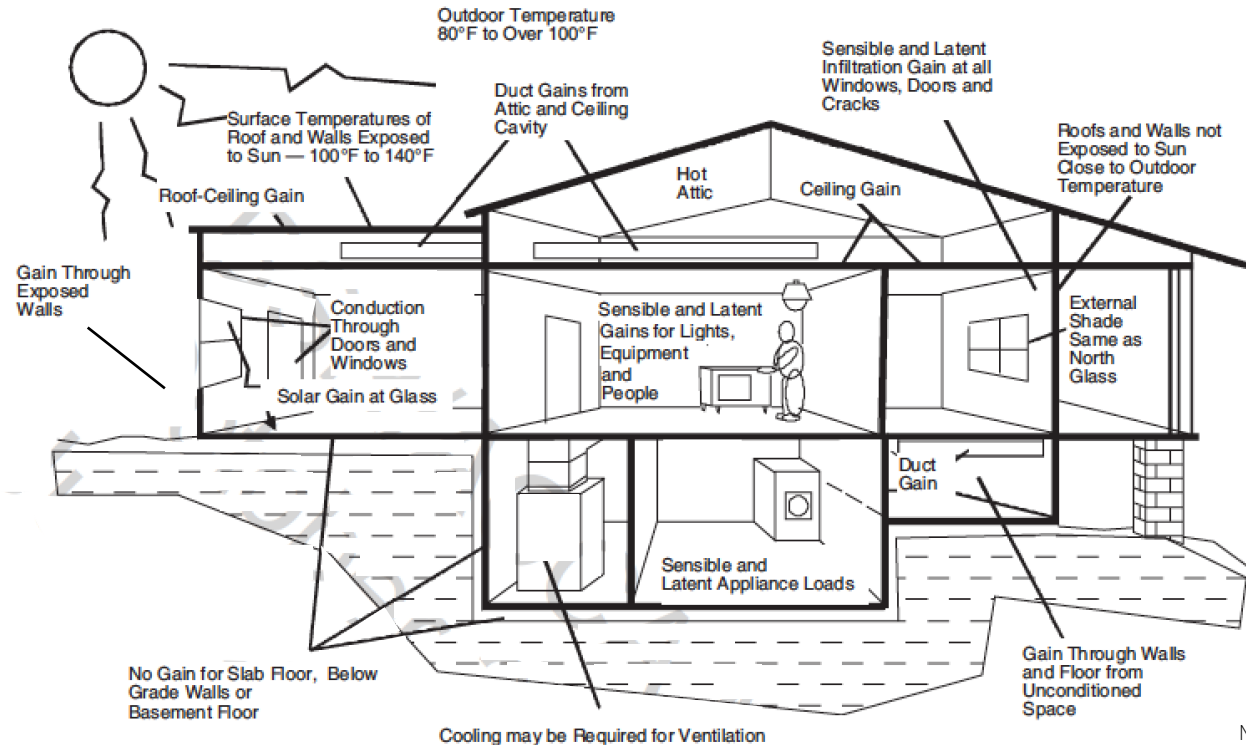
- 1) Local weather
- 2) Architectural features of the dwelling
- 3) Materials and techniques used to build the structure,
- 4) Type of appliances
- 5) Number of full-time occupants





TYPES OF HEATING LOADS

The enclosure load is the sum of the component loads, which may include a ceiling load, a wall load, a fenestration (window, glass door or skylight) load, a door (wood or metal) load, a floor load and an infiltration load.



TYPES OF COOLING LOADS

For cooling, an internal (occupant and appliance) load is added to the enclosure loads.

SYSTEM LOADS



Ducts

Ventilation

Hot water piping

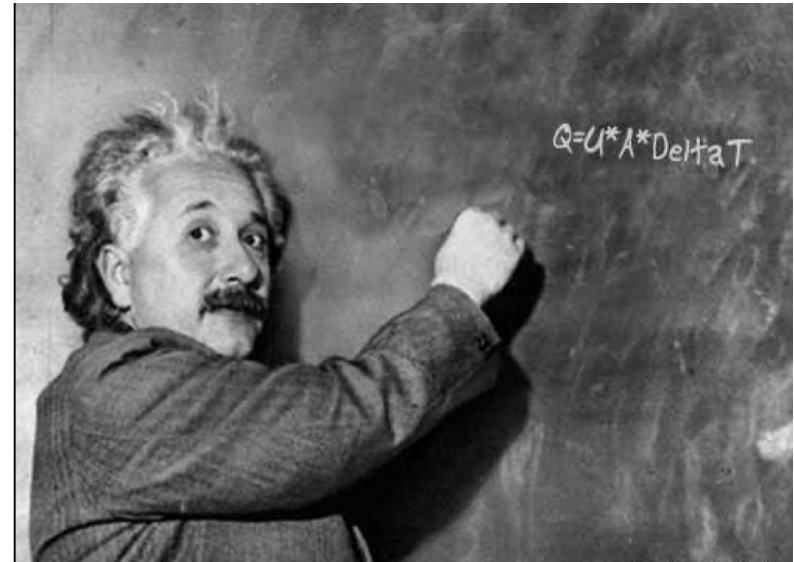
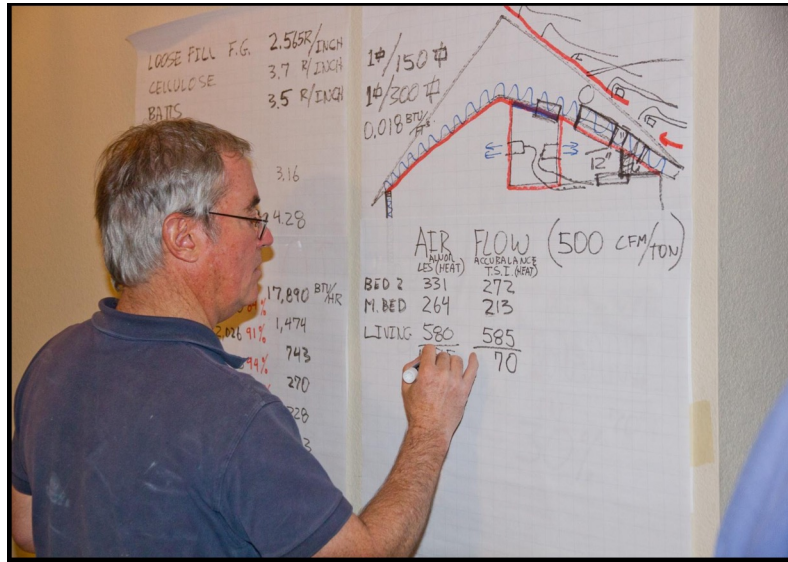
Winter humidification

Blower motor

HEAT TRANSFER IS COMPLICATED

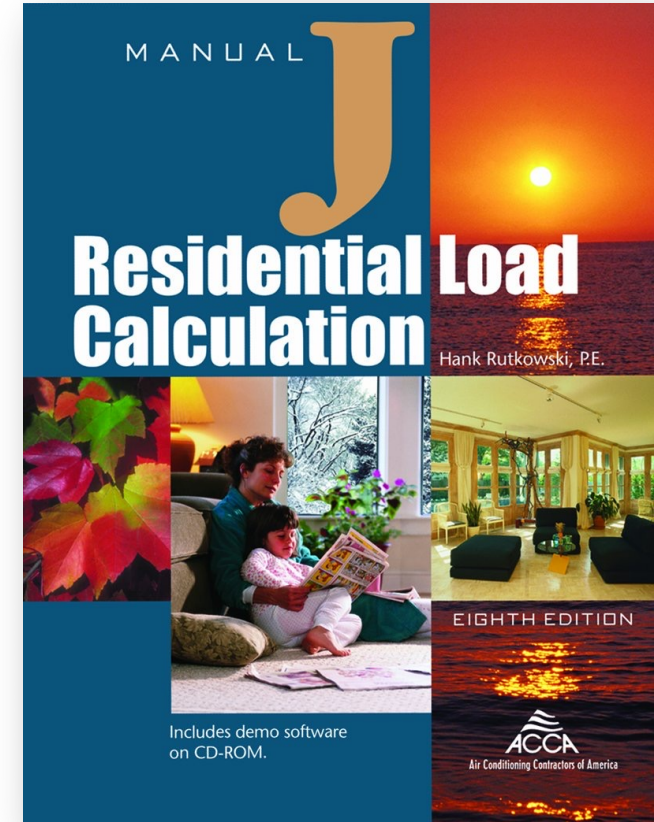
The load calculation procedure is a gross simplification of the physics and mathematics necessary to determine the amount of energy needed in a space to provide comfort.

Manual J v2.5 pg 13



AGENDA

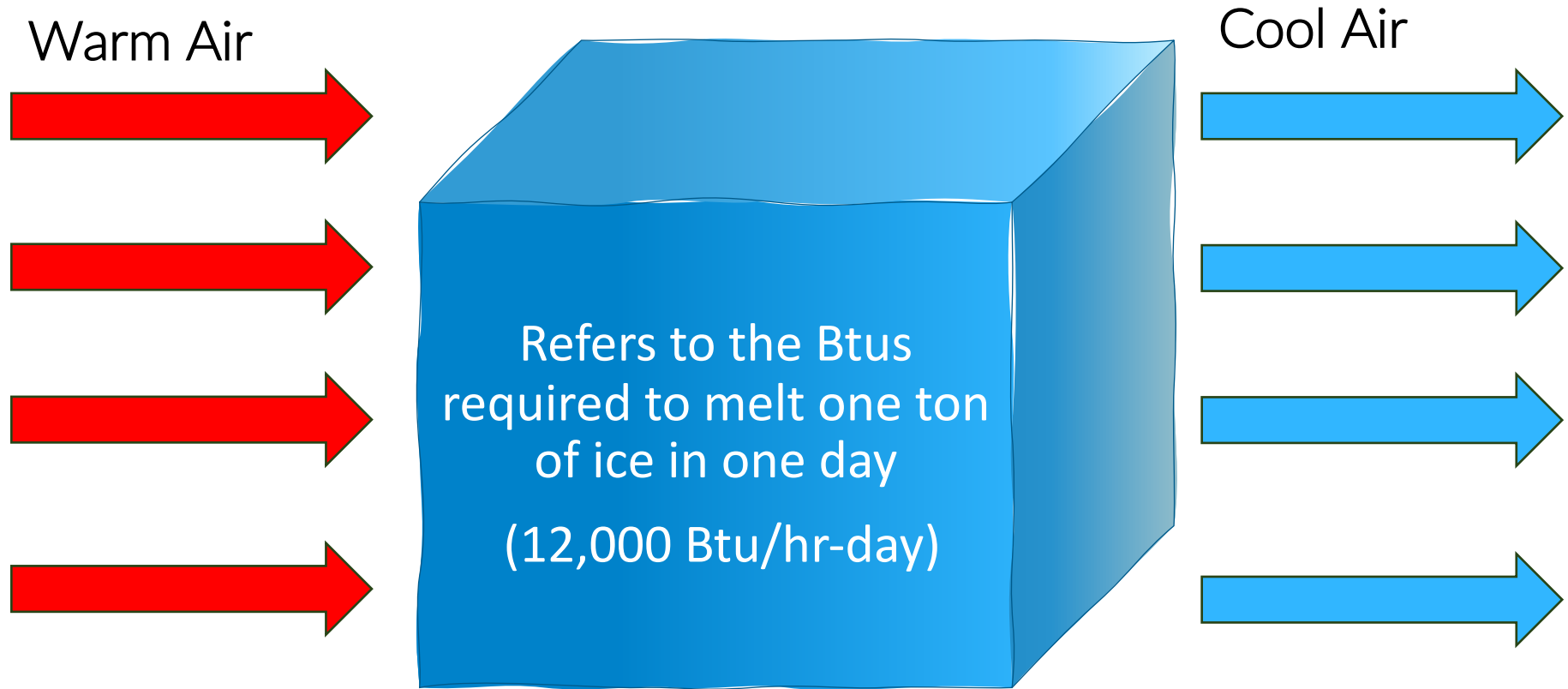
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- ❑ **Is there an easier way?**
- ❑ **Why load calculations are so important.**

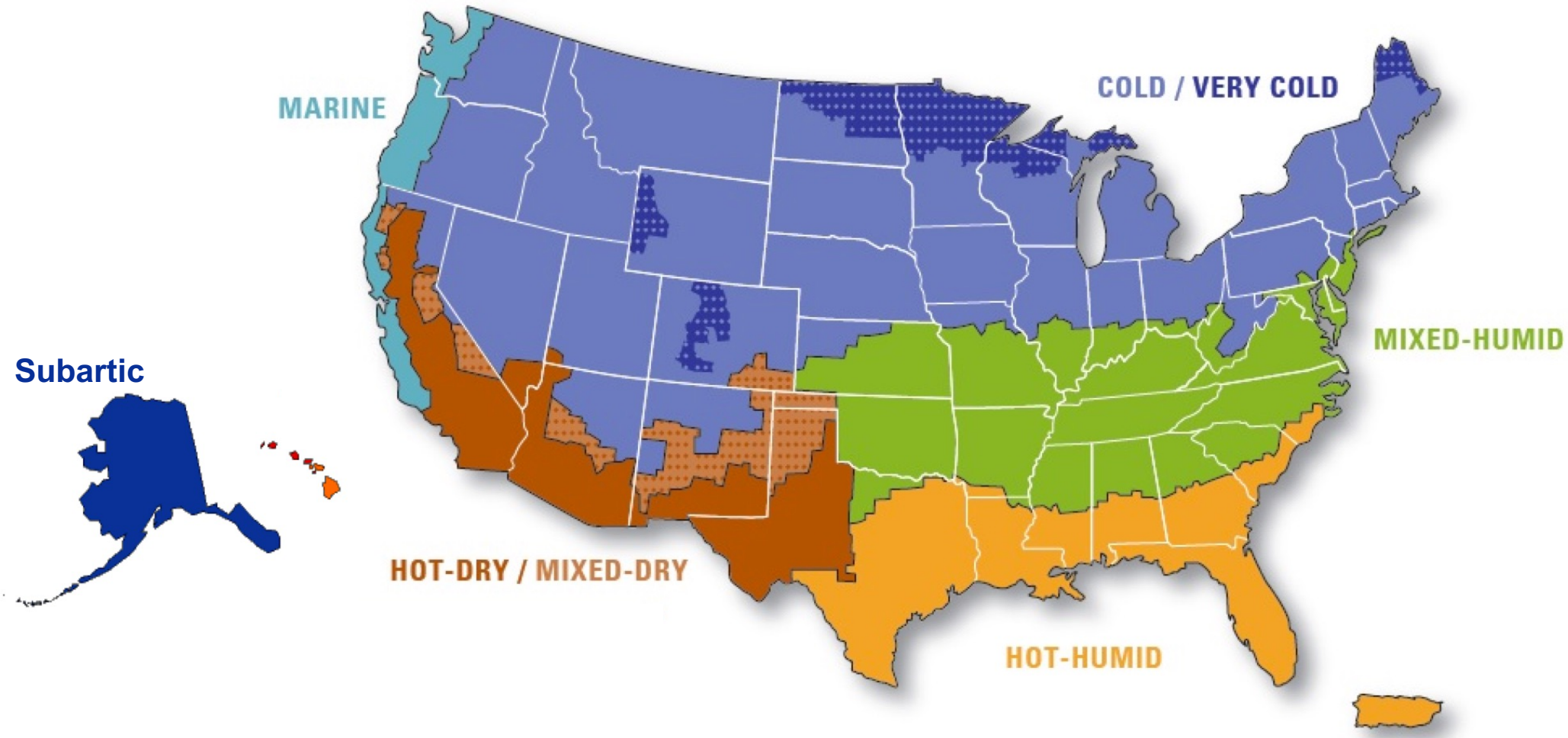


IS THERE AN EASIER WAY?

Are there '*rules of thumb*' that are good enough for specifying heating and cooling equipment capacity?

TON OF CAPACITY





America's Newest Game Show for HVAC Designers and Contractors



WHAT CAPACITY SYSTEM DOES THIS HOUSE NEED?



Location: Ventura

Conditioned Space:
2467 sq. ft

Year Built: 2024

Floor: SOG

Roof: Unvented Attic

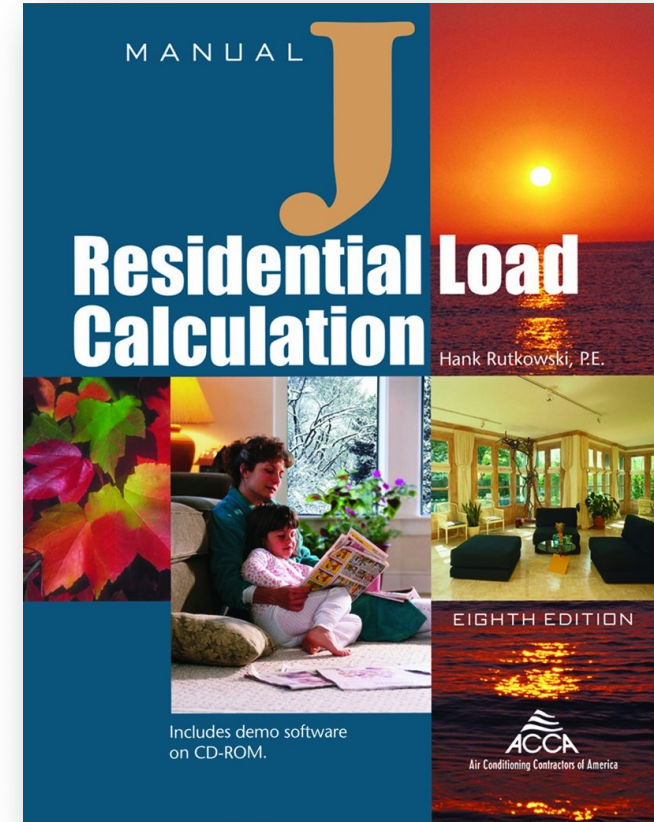
Walls: 2 x 4 Stick Framed

IS THERE AN EASIER WAY?

No

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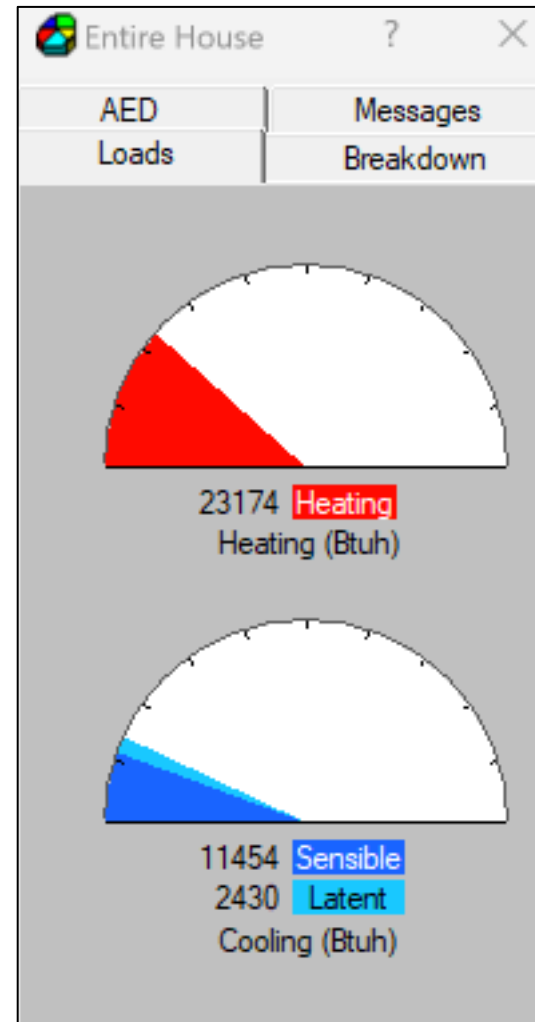


WHY ARE LOAD CALCULATIONS SO IMPORTANT?

The foundation of the space conditioning system design process.

BENEFITS

Provide design values for sensible & latent equipment capacity.



HVAC DESIGN PROCESS



The load calculation is the **first step** of the iterative HVAC design procedure.



The values determined by the heating and cooling load calculation drive the equipment selection process towards correctly sized equipment.

CONCLUDES:

Accurate load calculations have a direct impact on



Operating Energy Efficiency



Occupant Comfort

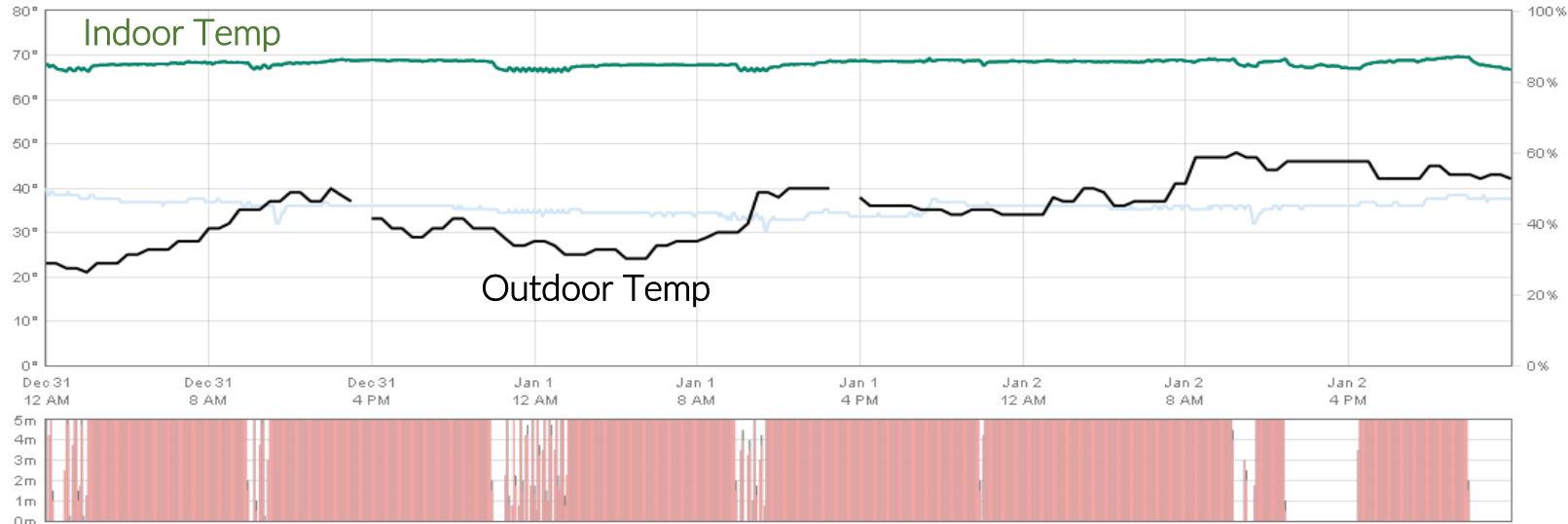


Indoor Air Quality



Building Durability

RIGHT-SIZING HVAC EQUIPMENT



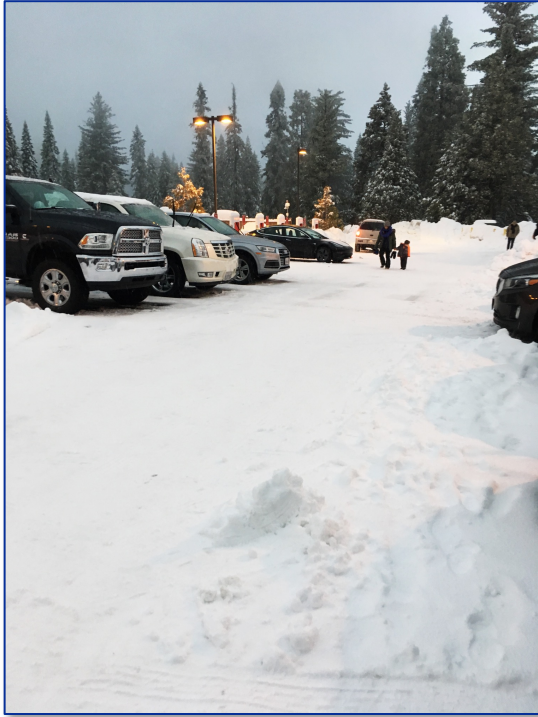
Heat Runtime

Reduced operating cost

Improve reliability (minimize short cycling)

BENEFITS

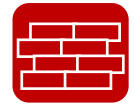
Provide specified comfort & humidity control at **design conditions**.



Provide acceptable comfort & humidity control at **part-load conditions**.



BENEFITS



Reduce the possibility of indoor mold and mildew.



BENEFITS

Building Analysis

Entire House

Judy Rachel

Job:

Date: Feb 20, 2025

By:

Phone: (818) 720-8920 Email: info@judy Rachel.com Web: judy Rachel.com

Project Information

For: 2954 Blair St, New Orleans, LA

Design Conditions

Location:

New Orleans NAS, LA, US

Indoor:

Indoor temperature (°F) 70

Design TD (°F) 36

Relative humidity (%) 30

Moisture difference (gr/lb) 9.5

Heating

Cooling

Outdoor:

Dry bulb (°F) 34

Daily range (°F) 15 (L)

Wet bulb (°F) 78

Wind speed (mph) 15.0

Infiltration:

Method Simplified

Construction quality Average

Fireplaces 1 (Average)

Heating

Component	Btuh/ft²	Btuh	% of load
Walls	3.3	4205	18.0
Glazing	11.1	1586	6.8
Doors	14.0	538	2.3
Ceilings	1.1	2172	9.3
Floors	4.1	7773	33.2
Infiltration	3.7	4570	19.5
Ducts		2582	11.0
Piping		0	0
Humidification		0	0
Ventilation		0	0
Adjustments		0	0
Total		23423	100.0

Cooling

Component	Btuh/ft²	Btuh	% of load
Walls	2.1	2712	20.9
Glazing	21.9	3129	24.1
Doors	9.7	372	2.9
Ceilings	1.7	3082	23.3
Floors	0	0	0
Infiltration	0.8	934	7.2
Ducts		2509	19.7
Ventilation		0	0
Internal gains		0	0
Blower		0	0
Adjustments		0	0
Total		12987	100.0

Latent Cooling Load = 2515 Btuh

Overall U-value = 0.086 Btuh/ft²·F, Window / Floor Area = 7.5 %

Data entries checked.

2025-Mar-26 11:00:58

Page 1

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V:\Development\PC 2025\PC 2025 House.mpg Calc=SLB Front Door back W

Demonstrate “due diligence”
in a court of law.



Consequences Of Not Making A Detailed And Accurate Load Estimate

Errors (accidental, or an effort to manipulate output) in the load estimate filter through the entire design and cause the installation to miss the mark.

Manual J v2.5 pg xvi

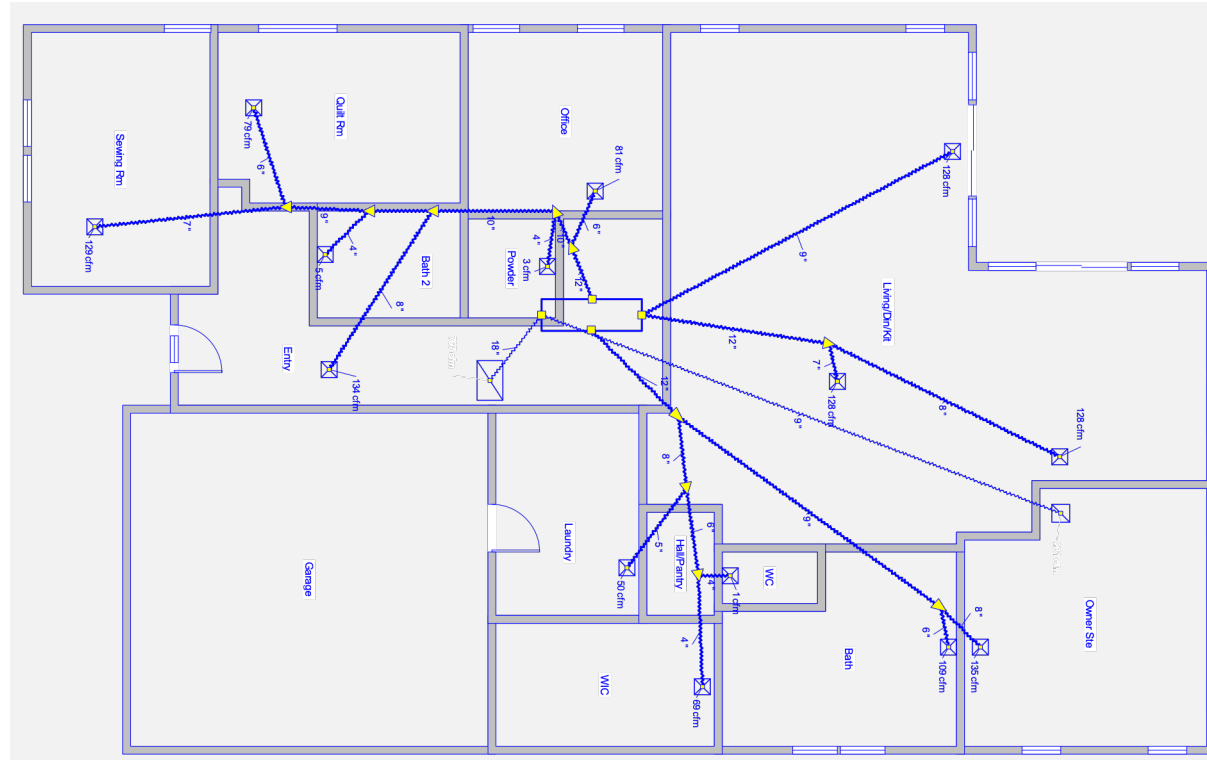
EQUIPMENT OVERSIZING



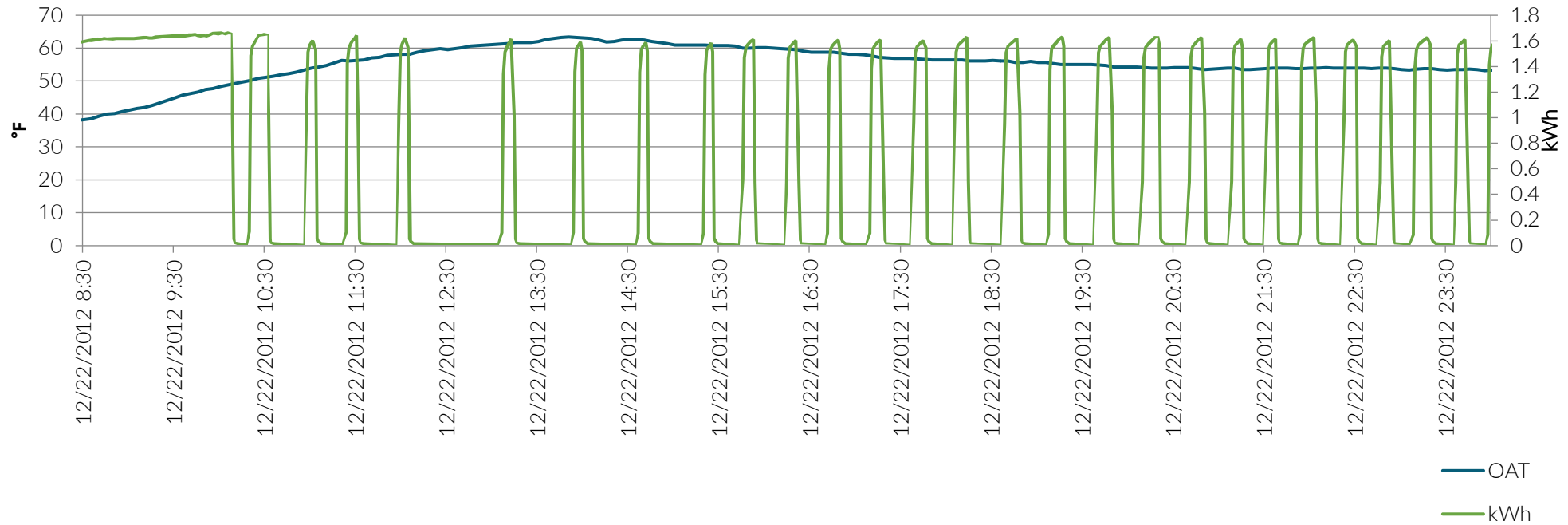
Translates to:

- Larger equipment
- Reduced operating efficiency
- Increases the installed cost and operating cost
- Imposes unnecessary loads on utility grids

EQUIPMENT OVERSIZING



Duct sizes and numbers of runs must also be increased to account for the significantly increased system airflow



CONSEQUENCES - OVERSIZING

Cause short cycling which affects comfort, system efficiency, operating cost and reduces equipment life.

CONSEQUENCES



Discomfort

- Cause discomfort during design-day weather.
- Produce marginal or unacceptable comfort at part-load conditions.
- Reduce the equipment's ability to control indoor humidity.

INDOOR MOLD GROWTH



- In the cooling season in humid climates, cold clammy conditions can occur due to reduced dehumidification caused by the short cycling of the equipment.
- Excess humidity in the conditioned air delivered to a space may lead to mold growth within the house.

Strategy Guideline: Accurate Heating and Cooling Load Calculations
<https://www.nrel.gov/docs/fy11osti/51603.pdf>

CONSEQUENCES



Less defensible in a court of law

| TAKE-AWAYS

- 1) Understand what a load calculation is.
- 2) Experienced that the national rule of thumb for sizing space conditioning systems is **not** a substitute for an accurate load calculation.
- 3) Recognize the importance of performing a load calculation prior to specifying the heating and cooling equipment for a building.

SUMMARY

- Performing an accurate load calculation is the only way to have any confidence as to what the heating and cooling needs of a building are.
- The load calculation is the first step in the HVAC design process.
- Accurate load calculations have a direct impact on operating energy efficiency, occupant comfort, indoor air quality and building durability.



ON-DEMAND WEBINARS AVAILABLE

- **Load Calculation Site Survey Essentials**
- **Using Wrightsoft for Residential Load Calculations**

https://www.3c-ren.org/on-demand-trainings/?_odt_instructor=home-performance-pro-judy-rachel

UPCOMING WEBINAR

Critical Details for Accurate Load Calculations

September 3rd @ 11:00 am – 1:00 pm

<https://www.3c-ren.org/event/critical-details-for-accurate-load-calculations/>

| THANK YOU



CONNECT WITH ME:

judyrachel.com

judy@judyrachel.com

Questions about Title 24?

3C-REN offers a *free* Code Coach Service

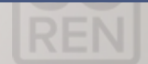


Online:
3c-ren.org/code

Call:
805.781.1201

Energy Code Coaches are local experts who can help answer your Title 24 Part 6 or Part 11 questions.

They can provide code citations and offer advice for your res or non-res projects.



Thanks for coming!



Today's Slides and Recording are Coming to Your Inbox Soon!

Upcoming Courses:

- Recovery Ventilator: Installation, Energy Savings, and Compliance (7/15)
- Ask the Experts with Grant Murphy: Energy Compliance and Modeling (8/19)
- Introduction to Residential HVAC Design (8/20)
- 2025 Energy Code: Multifamily Ventilation (9/1)
- Ask the Experts with **Judy Rachel** (tentative 11/12)

