SUSTAINABLE COMFORT

Energy Modeling Programs

James Moriarty
Vice President

Purpose

- Basics of energy modeling simulations
- Benefits and uses of various programs
- Summary of available software tools
- Considerations for Affordable Housing

What is Energy Modeling?

Software simulation programs that take the building geometry, construction materials, insulation & mechanical systems, to combine with local weather conditions to develop custom estimates for energy use over time.

Consider:

- Load Calculations consider only the worst case scenario to determine maximum size of equipment
- Energy Modeling considers all interactions throughout the entire year to generate hourly simulations of energy use

What is Energy Modeling?

Various uses & applications for energy modeling

Brogan Manor

Existing Buildings Retrofits

Evaluate existing builds energy use to evaluate energy savings opportunities

Ebenezer Square – LEED Platinum

New Construction Program Compliance

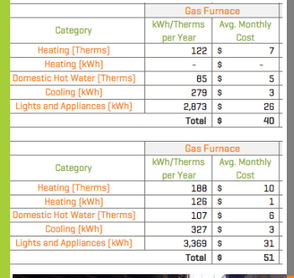
Evaluate new buildings for program compliance such as Energy Star, LEED, or Passive House.

Tilley Lofts – LEED Platinum

Decision Making

Assist in optimum decision making for energy efficiency for features such as insulation levels, mechanical systems, & building orientation.

Programs



Category	Gas Furnace kWh/Therms per Year	Gas Furnace Avg. Monthly Cost
Heating [Therms]	122	$ 7
Heating [kWh]	-	$ -
Domestic Hot Water [Therms]	85	$ 5
Cooling [kWh]	279	$ 3
Lights and Appliances [kWh]	2,873	$ 26
	Total	$ 40

Category	Gas Furnace kWh/Therms per Year	Gas Furnace Avg. Monthly Cost
Heating [Therms]	188	$ 10
Heating [kWh]	126	$ 1
Domestic Hot Water [Therms]	107	$ 6
Cooling [kWh]	327	$ 3
Lights and Appliances [kWh]	3,369	$ 31
	Total	$ 51

Simple Heat Loss

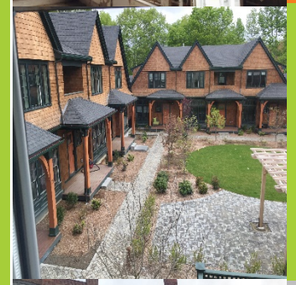
USES: Quick decision making

SOFTWARE: Excel

Energy Auditing

USES: Energy improvement evaluations on existing buildings

SOFTWARE: TREAT



HERS Rating

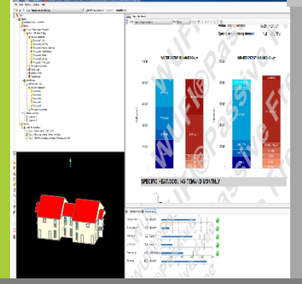
USES: Homes & Low Rise Multifamily
Energy Star Homes Certification

SOFTWARE: REM/Rate

ASHRAE 90.1 Appendix G

USES: Whole building energy simulations
Energy Star High Rise Certification

SOFTWARE: eQuest, Trane TRACE, Carrier HAP



Passive House

USES: Super low load buildings
Passive House Certification

SOFTWARE: WUFI & PHPP

Category	Gas Furnace		VRF System	
	kWh/Therms per Year	Avg. Monthly Cost	kWh/Therms per Year	Avg. Monthly Cost
Heating (Therms)	122	$ 7	-	$ -
Heating (kWh)	-	$ -	1,649	$ 15
Domestic Hot Water (Therms)	85	$ 5	85	$ 5
Cooling (kWh)	279	$ 3	254	$ 2
Lights and Appliances (kWh)	2,873	$ 26	2,873	$ 26
	Total	$ 40		$ 48

Simple Heat Loss Calculation

Excel

Benefits

- Quick to create, provides instant feedback
- Available at the time of decision making

Limitations

- Based on individuals experience
- Lack of detail can lead to over or underestimating savings
- Rarely done at the time of greatest need

Energy Auditing
TREAT

Benefits

- Calibrates to existing utility bills
- Evaluate energy efficiency upgrades
- Determine cost effective strategies

Limitations

- Not applicable to new construction
- Not used in many certification programs
- Time consuming to evaluate simple retrofit options

HERS Rating
REM/Rate

Benefits

- Dedicated to homes & multifamily low rise
- Used by most state utility companies to demonstrate energy savings for new construction
- Recognized by Energy Star, LEED, Enterprise Green Communities
- Robust network of HERS Raters, fees reasonable

Limitations

- Does not include common areas, simple single zone analysis
- Does not provide realistic utility estimating, especially for multifamily/senior
- Methods designed for single family homes

ASHRAE 90.1 Appendix G

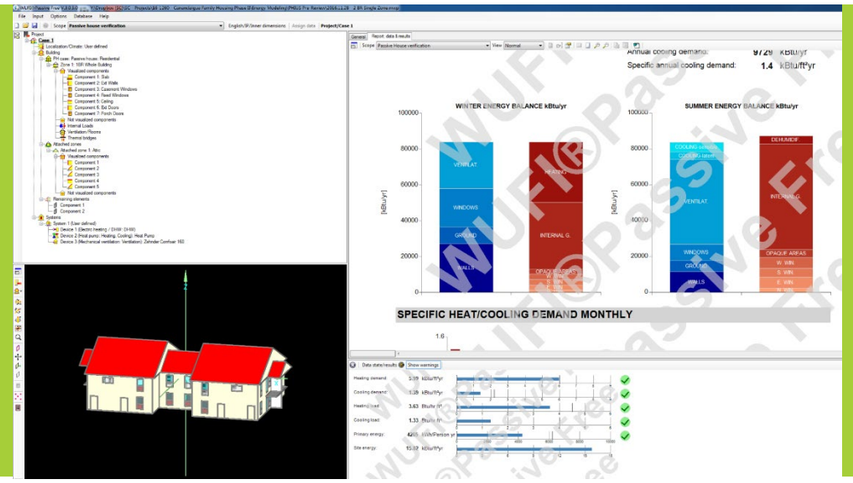
eQuest, Trane TRACE, Carrier HAP

Benefits

- Handles complex mechanical & building configurations
- More detailed inputs for nearly everything, lighting, fans, pumps, etc.
- Recognized by Energy Star, LEED, Enterprise Green Communities for high rise projects (6+ stories, sometimes 4-5 stories)

Limitations

- Costly to create, experience needed, usually created by a PE
- Created late in the design process after many major decisions already made
- Outputs not easy to understand, made for Engineers



Passive House

WUFI, PHPP

Benefits

- Module for thermodynamic modeling of building assemblies (i.e. will walls create moisture problems)
- Very detailed envelope inputs for super insulated buildings

Limitations

- Time consuming to create
- Does not handle cooling loads well, separate engineering load calculation needed for equipment sizing
- Typically single zone analysis for building envelope only

Affordable Housing Considerations

- Utility costs savings are vitally important for low income residents & long term building owners/operators
- Affordable Housing driven largely by compliance to obtain funding
- Energy modeling and efficiency usually brought into projects through programs (Utility Incentives, Energy Star, LEED, Passive House)
- Need better utility cost data to better inform utility estimates for high performance buildings

Summary

- Energy simulations are important for comparing energy efficiency options
- Consider cost and time to create vs. information gained
- Energy models used for program compliance don’t always provide realistic utility estimates
- Avoid information overload, work with partners who can condense information to help make decisions

Questions?

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