A microscopic view of spray foam insulation, showing a complex, interconnected network of blue and teal lines forming a porous, cellular structure. The lines vary in thickness and form irregular, interconnected shapes, creating a dense, web-like pattern. The background is white, making the blue and teal lines stand out prominently.

ENERGY EFFICIENCY COMMITTEE

SPRAY FOAM INSULATION

TRENTON, NJ

11-09-2017



PRESENTERS

KURT BEHNER

- SPF INDUSTRY FOR 25 YEARS

BILL PALMER

- 1980-2010 LANDSCAPE ARCHITECTURE, PLANNING & URBAN DESIGN
- 2010-CURRENT SR. DIRECTOR, ENERGY MGMT., ENERGY CONSULTING GROUP LLC, DIVISION OF KAMSON CORPORATION. A TOP 10 P4P PARTNER IN P4P APPROVALS.



PRIMARY SPF MANUFACTURERS

- LAPOLLA 
- DEMILEC 
- ICYNENE 
- CERTAINTEED 
- JOHNS MANVILLE 



PRESENTATION OUTLINE

- TYPES OF USES OF SPRAY FOAM INSULATION
- PRIMARY SPF SUPPLIERS
- HEAT TRANSFER: SPF ENERGY BENEFITS
- WALL FOAM APPLICATIONS AND BENEFITS
- ROOF FOAM APPLICATIONS AND BENEFITS
- CASE STUDIES

THREE TYPES OF SPRAY FOAM IN CONSTRUCTION

	LD	MD	Roof
Density (lb/ft³)	0.4 - 1.4	1.5 -2.3	2.5 - 3.5
Thermal Resistivity (R/in)	3.6 - 4.5	6.2 - 6.8	6.2 - 6.8
Blowing Agent	Water/CO ₂	Water/CO ₂ + Agent	Water/CO ₂ + Agent
Air Impermeable Material	✓	✓	✓
Integral Air Barrier System	✓	✓	✓
Integral Vapor Retarder (Class II Vapor Retardant @ ≥ 1-2", mfg. dependent)		✓	✓
Water Resistant		✓	✓
Cavity Insulation	✓	✓	
Continuous Insulation	✓	✓	✓
Low-Slope Roofing			✓
Structural Improvement		✓	✓
Suitable for Exterior Application		✓	✓

HOW IT'S INSTALLED

PORTABLE SPRAY RIGS HAVE ALL REQUIRED EQUIPMENT



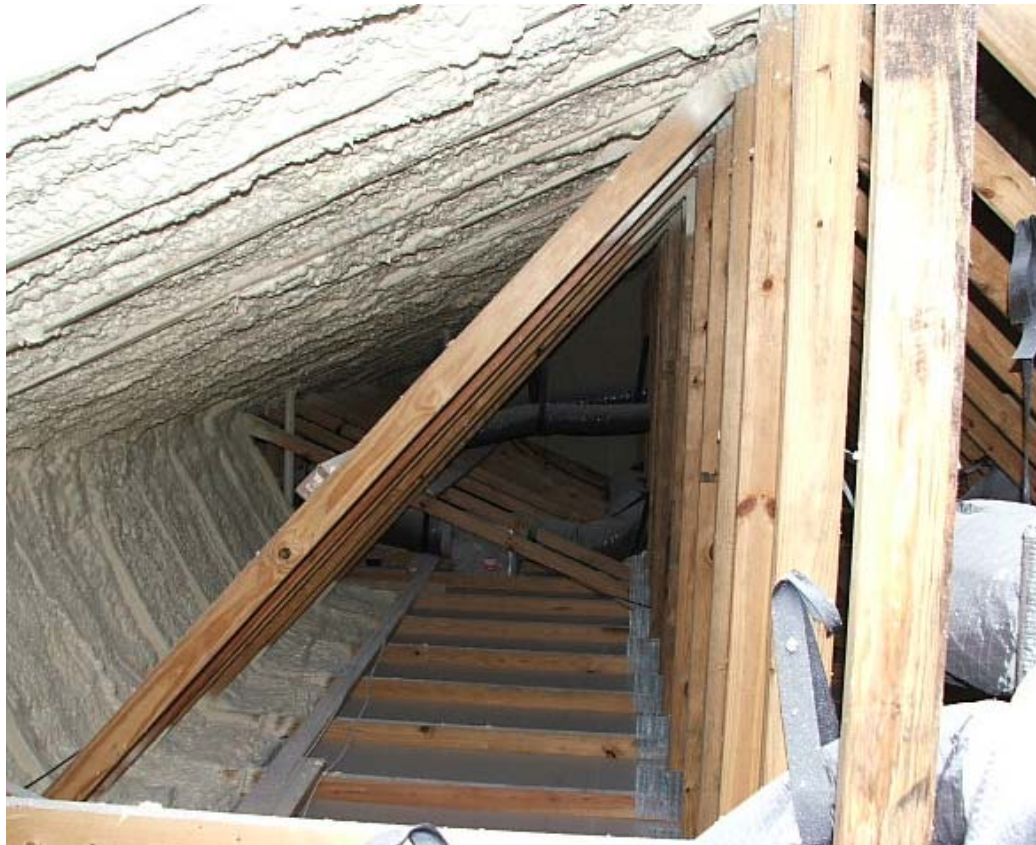
REACTOR HEATS AND PUMPS THE CHEMICALS



THE GUN COMBINES THEM



THERMAL OR IGNITION BARRIER





THERMAL BARRIER

A **THERMAL BARRIER** IS A PRODUCT APPLIED BETWEEN FOAM PLASTICS (INCLUDING SPRAY POLYURETHANE FOAM) AND INTERIOR SPACES DESIGNED TO DELAY THE TEMPERATURE RISE OF FOAM DURING A FIRE SITUATION AND TO DELAY OR PREVENT THE FOAM'S INVOLVEMENT IN A FIRE.

THE IBC AND IRC DEFINE AN APPROVED 15-MINUTE THERMAL BARRIER AS ONE WHICH IS EQUAL IN FIRE RESISTANCE TO ½" GYPSUM WALLBOARD WHEN TESTED TO ASTM E 119 OR NFPA 275 STANDARDS. TYPICAL EQUIVALENT THERMAL BARRIERS INCLUDE

1. SPRAY-APPLIED CEMENTITIOUS MATERIALS
2. SPRAY-APPLIED CELLULOSE MATERIALS
3. PORTLAND CEMENT PLASTER
4. OTHER VARIOUS PROPRIETARY MATERIALS



ALTERNATE THERMAL BARRIER

ALTERNATIVE THERMAL BARRIERS MUST UNDERGO A LARGE SCALE FIRE INTEGRITY TEST SUCH AS NFPA 286, UL 1040, UL 1715, OR FM 4880.

THE MOST COMMONLY USED ALTERNATIVE THERMAL BARRIER ARE INTUMESCENT LATEX COATINGS



IGNITION BARRIER

THE IBC AND IRC ALLOW AN EXCEPTION TO THE THERMAL BARRIER REQUIREMENT IN ATTICS AND CRAWL SPACES WHERE ENTRY IS MADE FOR REPAIRS OR MAINTENANCE OR SERVICE OF UTILITIES. IN THESE CASES THE FOAM PLASTIC IS PROTECTED AGAINST IGNITION USING ONE OF THE FOLLOWING PRESCRIPTIVE IGNITION BARRIERS. IGNITION BARRIERS DO NOT AFFORD AS HIGH OF DEGREE OF PROTECTION AS THERMAL BARRIERS BUT ARE CONSIDERED ACCEPTABLE FOR ATTICS AND CRAWLSPACES WHERE ENTRY IS LIMITED.

1. 1 ½" THICK MINERAL FIBER INSULATION
2. ¼" THICK WOOD STRUCTURAL PANEL
3. 3/8" PARTICLEBOARD
4. ¼" HARDWOOD
5. 3/8" GYPSUM BOARD
6. 0.016 THICK CORROSIVE RESISTANT STEEL (27 GAUGE)



ALTERNATIVE IGNITION BARRIERS

A CODE PRESCRIBED IGNITION BARRIER SHALL NOT BE REQUIRED WHEN SATISFACTORY TESTING IS CONDUCTED WITH EXPOSED FOAM PLASTIC INSULATION OR WITH A FOAM PLASTIC INSULATION SYSTEM, SUCH AS FOAM PLASTIC INSULATION AND ANY COVERING, IN ACCORDANCE WITH APPENDIX X OR APPENDIX D 1.0 OF ACCEPTANCE CRITERIA FOR SPRAY-APPLIED FOAM PLASTIC INSULATION AC-377.



ATTICS AND CRAWL SPACES

- AC-377 – GOVERNS FOAM PLASTICS AND REQUIRES:
 - APPENDIX X
 - FULL SCALE TEST USED TO ACHIEVE COMPLIANCE WITH IBC SECTION 2603.4.1.6, AND IRC SECTIONS R316.5.3 AND R316.5.4 WITHOUT REQUIRING A “PRESCRIPTIVE IGNITION BARRIER” SUCH AS
 - 1.5” MINERAL FIBER
 - ¼” STRUCTURAL WOOD PANEL, PARTICLE BOARDS OR HARDBOARD
 - 0.016 CORROSIVE RESISTANT STEEL
 - OR OTHER MATERIAL INSTALLED IN SUCH A MANNER THAT THE FOAM INSULATION IS NOT LEFT EXPOSED AND CONSISTENT WITH THE TYPE OF CONSTRUCTION.
 - END USE CONFIGURATION
 - IBC SECTION 2603.9 AND IRC SECTION 316.6
 - APPENDIX D 1.0



RE-OCCUPY / RE-HABITATION

- 24 HOUR RE-OCCUPANCY IS STANDARD RECOMMENDATION WHEN PROPERLY INSTALLED
- BASED ON SOME CONCERNS, A SPF INDUSTRY EVALUATION WAS RECENTLY COMPLETED TO ESTABLISH ACCEPTABLE RISK-BASED RE-ENTRY AND RE-OCCUPANCY TIMES
 - STUDY CONCLUSIONS
 - SAFE WORKER RE-ENTRY REQUIRES 1-HR VENTILATION AFTER 20 ACH
 - SAFE RE-OCCUPANCY BY RESIDENTS REQUIRES ADDITIONAL 1 ACH FOR 7-HOURS.
 - **** MANUFACTURER DEPENDENT ****

PRESCRIPTIVE R-VALUE AND SPF THICKNESS REQUIREMENTS

Climate Zone	Ceiling R-Value	Wood Framed Wall	Mass Wall	Floor	Basement Wall	Slab	Crawlspace Wall
Zone 4 Requirement	49	20 or 13+5	8/13	19	10/13	10	10/13
CC/OC Required Thickness (In)	7.2/12.9	3.0/5.3	8=1.3/2.1 13=2.0/3.4	2.8/5.3	10=1.6/2.6 13=2.0/3.5	1.6/2.6	10=1.6/2.6 13=2.0/3.5
Zone 5	49	20 or 13+5	13/17	30	15/19	10	15/19
CC/OC Required Thickness (In)	7.2/12.9	3.0/5.3	13=2.0/3.4 17=2.6/4.5	4.4/7.9	15=2.3/4.0 19=2.9/5.0	1.6/2.6	15=2.3/4.0 19=2.9/5.0



APPLICATION & STRUCTURAL BENEFITS

Specimen	Max Racking Load (pounds)	Max Racking Deflection (inches)	Max Racking Set (inches)
OSB with R-19	4,800 lbs.	1.045"	.516"
OSB with SPF	6,000 lbs.	.767"	.142"
Drywall with R-19	2,400 lbs.	.856"	.413"
Drywall with SPF	5,380 lbs.	.945"	.407"

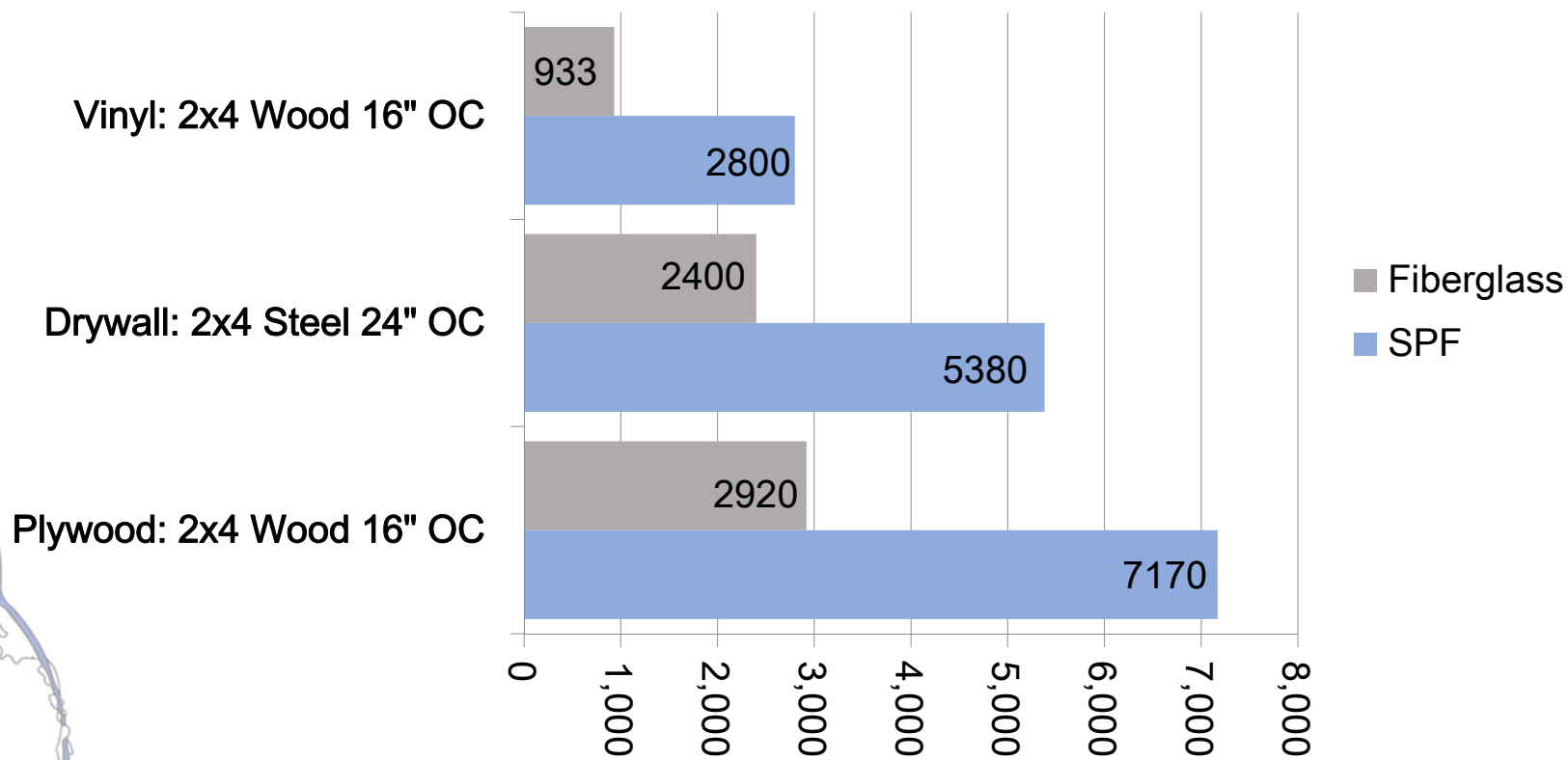
1996 NAHB Racking Performance of Metal Wall Panels Racking Test Results

APPLICATION & STRUCTURAL BENEFITS

Stud Spacing	SPF PANELS		NON-SPF PANELS	
	Vinyl Sheathed	5/8" Plywood	Vinyl	5/8" Plywood
16" OC	2,800 lbs.	5,300 lbs.	913 lbs.	2,890 lbs.
24" OC	2,420 lbs.	6,387 lbs.	_____	_____
32" OC	2,588 lbs.	_____	_____	_____
48" OC	2,298	_____	_____	_____
16" OC - BRACED	_____	_____	3,853 lbs.	5,262 lbs.

1992 NAHB Wall Performance Testing of 2"x 4" wood stud panels
 Average Maximum Racking Load (Pounds) Supported by Each Panel Configuration

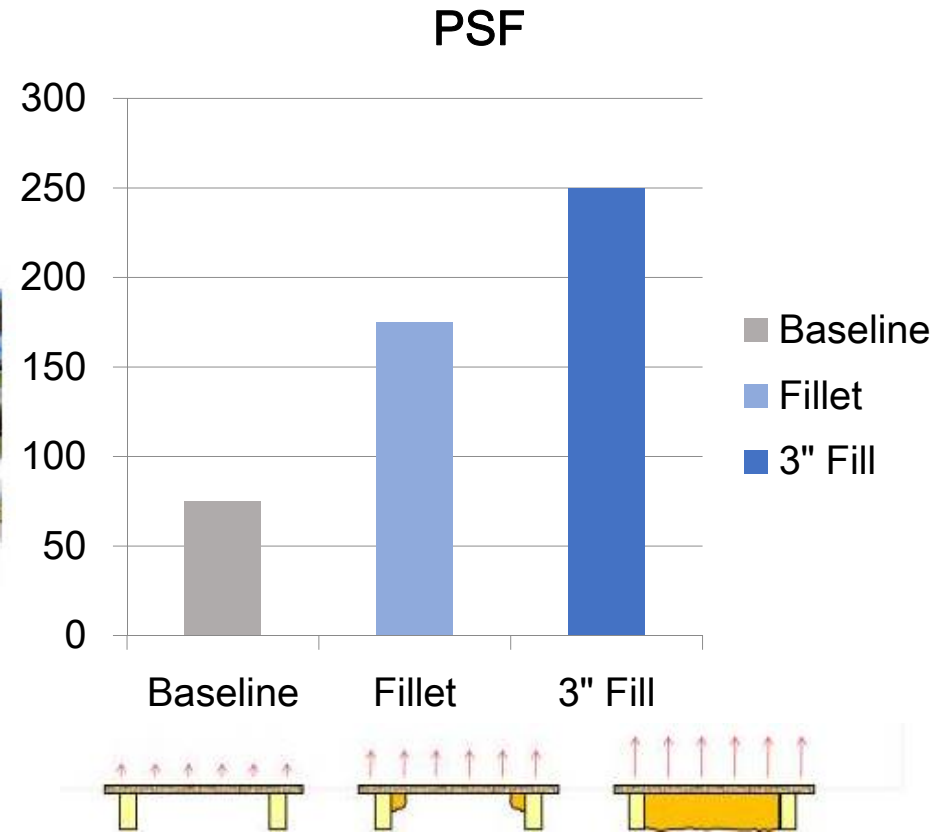
RACKING STRENGTH



UPLIFT RESISTANCE



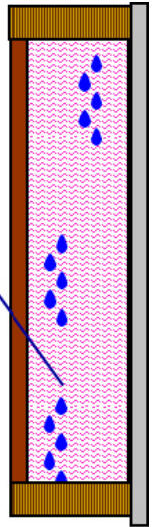
Houses with damaged or missing roof sheathing in Florida



AIR & MOISTURE CONTROL

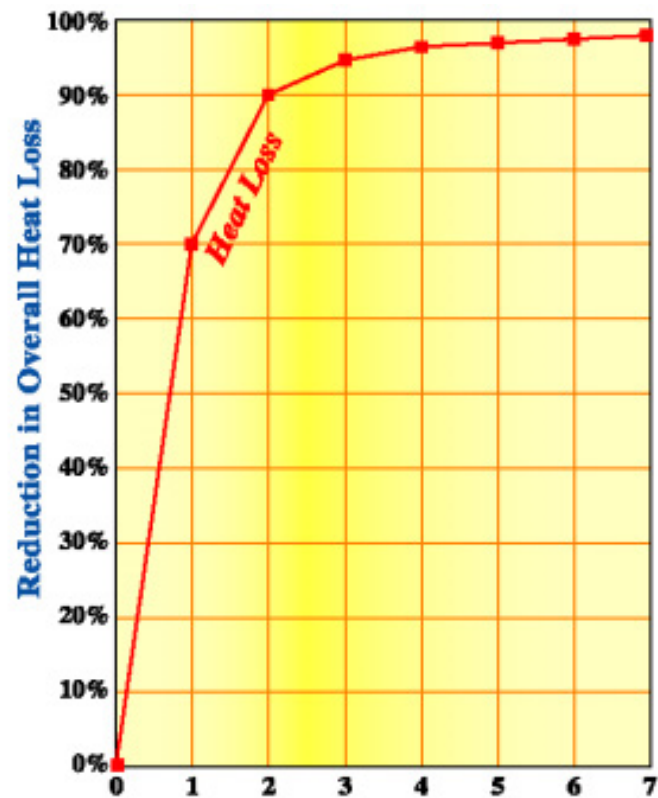
- VAPOR
 - INVISIBLE AND MIGRATES THROUGH MOST MATERIALS
 - IT CAN CONDENSE AND CAUSE PROBLEMS
 - ON THE SHEETROCK DURING SUMMER
 - ON THE SHEATHING DURING WINTER
- WIND DRIVEN RAIN AND FLOODING
 - POTENTIAL WATER INGRESS IS MINIMIZED
 - CC SPF IS THE ONLY FEMA APPROVED INSULATION FOR FLOOD ZONES

Conventional insulation allows water vapor transmission



INSULATION EFFICIENCY

- DIMINISHING RATE OF RETURN
- 3" OF SPRAY FOAM (R20) WILL REDUCE 95% OF HEAT LOSS
 - EXACT VALUES WILL VARY BY MANUFACTURER





OC – SPF PROVIDES SUPERIOR SOUND ATTENUATION

- MASS BARRIERS BLOCK TRANSMISSION OF LOW FREQUENCY SOUND
- OC-SPF ABSORBS MID TO HIGH FREQUENCY SOUND
- IN COMBINATION THE TWO CAN CREATE AN EFFECTIVE SOUND ATTENUATOR
- AIR-TIGHT, VOID-FREE WALLS MINIMIZE SOUND PATHWAYS

WHEN APPLIED TO A ROOF...





SPF ROOFING FEATURES AND BENEFITS

- MONOLITHIC
- HIGHEST INSULATION VALUE
- CONFORMS TO UNUSUAL SUBSTRATES
- OVER 40 YEARS OF PERFORMANCE HISTORY
- FULLY ADHERED
- 2.5 – 3.0 DENSITY
- SELF FLASHING
- UL-790 CLASS A RATED
- SUSTAINABLE
- NO LATERAL WATER MIGRATION
- AVOID COSTLY TEAR-OFF
- ELIMINATES THERMAL BRIDGING

VERSATILE RETROFIT ROOF SYSTEM

- STRONG YET LIGHTWEIGHT
- 240 POUNDS ON A 1-1/2" SPRAYED TO A PIECE OF CARDBOARD
- THE THICKER...THE STRONGER



VERSATILE RETROFIT ROOF SYSTEM

BEFORE

AFTER





ENERGY SAVINGS CASE STUDIES

Kamson has been evaluating multiple energy efficiency measures for the past 8 years, specific to it's multifamily portfolio. Measures have been installed individually and in combination with multiple ECM's to isolate energy savings and to optimize the return on investment. These measures include:

- Condensing heating and domestic hot water equipment
- Wireless TAC and thermostatic controls with set point limits and remote monitoring
- Electric motorized zone valves that isolate individual or small groups of similar apartments
- Spray foam insulation in attics and crawl spaces. Often, blown-in cellulose augments attic SPF.
- LED lighting – both common area and in-unit retrofit work
- Water conservation

CONCLUSION

Spray foam insulation in attics and crawl spaces effectively reduces natural gas heating by 12-16%. Moreover, our residents have more comfortable homes!!

Kamson encourages NJCE program management to re-evaluate how SPF is incentivized in its various programs.



CASE STUDIES

OVERVIEW OF METHODOLOGY

- POST-RETROFIT PERFORMANCE OF THE BUILDINGS WAS ANALYZED USING E-TRACKER SOFTWARE DEVELOPED BY UNIVERSITY OF DAYTON FOR THE US EPA ENERGY STAR BUILDINGS PROGRAM.
- THE SOFTWARE PERFORMS STATISTICAL ANALYSIS OF PRE-RETROFIT UTILITY BILLS TO ESTABLISH CORRELATION BETWEEN ENERGY CONSUMPTION AND OUTDOOR TEMPERATURE DURING PRE-RETROFIT PERIOD.
- THE RESULTING REGRESSION EQUATION IS THEN USED TO PROJECT CONSUMPTION DURING POST-RETROFIT PERIOD HAD THE RETROFIT NOT BEEN PERFORMED.
- THE ENERGY SAVINGS FROM RETROFIT ARE CALCULATED BY COMPARING ACTUAL POST-RETROFIT BILLS TO CONSUMPTION PROJECTED BY REGRESSION EQUATION FOR UN-RETROFITTED BUILDING POST-RETROFIT WEATHERCONDITIONS.
- THE CONFIDENCE OF THE STATISTICAL ANALYSIS VARIES FOR THE FOUR PROJECTS DEPENDING ON THE QUALITY OF REGRESSION FIT, AMOUNT OF POST-RETROFIT DATA, AND THE WEATHER DURING POST-RETROFIT PERIOD.

CASE STUDY

JACOB FORD VILLAGE APARTMENTS

Project Name:

Jacob Ford Village
1 Washington Ave
Morristown, New Jersey

Owned and Managed by Home Properties, LP

Number of Apartments	270
Number of Buildings	19

Project Description:

- Installation of AirTight Closed Cell Spray Foam Insulation in the attic and crawl spaces providing a seamless air barrier.
- Installation of High Efficiency Boilers and Hot Water Heaters.
- Installation of Building Controls and Thermostats, an energy automation solution for control and monitoring.
- Energy Efficient Lighting



Jacob Ford Summary of First Year Gas use Performance post Upgrade

pre retrofit gas use	186,340 therms
Modeled Energy Savings	103,762 therms

pre retrofit Load 10/14-09/15	202,585 therms
Post retrofit Load 10/14-09/15	119,964 therms
Actual Gas Savings	82,621 therms
Actual DHW Gas Savings	5,916 therms
Actual Heat Gas Savings	76,705 therms

Actual Gas Savings	41%
Actual DHW Gas Savings	13%
Actual Heat Gas Savings	49%

Savings resulting from Insulation	13%
Savings resulting from Apartment Controls	9%
Savings resulting from Boiler Upgrade	13%
Savings resulting from DHW Upgrade	2%
Savings resulting from Pipe Insulation	3%
Total Savings	41%



CASE STUDIES

DAHNER PARK APARTMENTS

- DAHNER PARK APARTMENTS IS A TWO STORY APARTMENT BUILDING LOCATED IN GARFIELD, NJ.
- THE SCOPE OR RETROFIT FOR THE PROJECT INCLUDED INSTALLATION OF FOAM INSULATION IN THE ENTIRE FACILITY AND REPLACEMENT OF EXISTING HEAT TIMER CONTROL BY AN OUTDOOR TEMPERATURE RESET CONTROLLER WITH WEB BROWSER FOR REMOTE MONITORING AND CONTROL.

37% SAVINGS



CASE STUDIES

REA REALITY APARTMENTS

- REA REALITY APARTMENTS IS A TWO STORY APARTMENT BUILDING LOCATED IN LODI, NJ.
- THE SPACE HEATING FOR THE FACILITY WAS A CENTRAL HEAT PLANT WITH BASEBOARDS INSTALLED IN EACH APARTMENT.
- THE FACILITY DID NOT HAVE THERMOSTATS FOR TEMPERATURE CONTROL, WITH MANUALLY OPERATED ZONE VALVES USED FOR SPACE HEATING. RETROFIT INCLUDED INSTALLATION OF FOAM INSULATION TO THE UNDERSIDE OF THE ROOF DECK.
- IN ADDITION, EXISTING HEAT TIMER CONTROL WAS REPLACED BY OUTDOOR TEMPERATURE RESET CONTROLLER WITH WEB BROWSER FOR REMOTE MONITORING AND CONTROL, AND WIRELESS (Z-WAVE) THERMOSTATS WERE INSTALLED IN ALL ZONES AND SET TO 71° F AS UPPER LIMIT.

39% SAVINGS



CASE STUDIES

STONEY HILL APARTMENTS (BUILDING 8)

- STONEY HILL APARTMENT (BUILDING 8) IS A TWO STORY APARTMENT BUILDING LOCATED IN EATONTOWN, NJ.
- THE ENVELOPE RETROFIT FOR THE PROJECT INCLUDED INSTALLATION OF 1.5” CLOSED CELL FOAM INSULATION ON THE ATTIC FLOOR WITH 8” BLOWN CELLULOSE ON TOP AND 2” OF CLOSED CELL FOAM INSULATION ON THE CRAWL SPACE CEILING.
- IN ADDITION, INDIVIDUAL APARTMENT HEATING CONTROLS WERE ADDED, AND THE NEW WEB BASED CONTROLS OF HEATING AND HOT WATER (DHW) WERE INSTALLED.

29% SAVINGS



CASE STUDIES

Building Name	Post-Retrofit Period, Days	Gas Savings – Therms	Gas Saving %
Dahnert Park	365	4,992	37%
Rea Realty	370	6,384	39%
Stony Hill Building #8	365	3,249	29%

THANK YOU!

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