



WELCOME!

Success with Manufactured Homes a Statewide Case Study



2019 HPC National Home Performance
CONFERENCE & TRADE SHOW

APRIL 1-4, 2019 • Sheraton Grand Chicago • Chicago, IL



Success with Manufactured Homes Illinois

Overview of the mobile home weatherization training in Illinois

History of mobile home weatherization in Illinois

Perspectives of the training experience from trainees

Training outcomes, what's happening now



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Thank You

Indoor Climate Research and Training

Lori Shupe Paul Francisco

Paul Knight Randy Bennett

Bill Rose

Nate Price and Mike Hunter of RPC

WADI, BCMW, Crosswalk, CEFS, Tri-County, CEDA



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Training Design

State Dept of Commerce Inspectors

WX ICRT Trainers

WX Agency Program Coordinators

WX Agency Energy Auditors

WX Agency Architectural and Heating Contractors

WX Agency Crews



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Training Design

Classroom

Hands on

Learning assessments

Completed WX unit



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Training Design

Local support for the classroom, client and house



Training Design

Local support for tools and materials



Training Design

Day 1 Audit with diagnostics



Training Design

Day 2 Duct sealing and road barrier repair



Training Design

Day 3 Floor cavity insulation



Training Design

Day 4 Attic cavity insulation and air sealing



Joe Page

Pre numbers

1404 Sqft double wide

CFM50 3460 target 2214

Pressure pans 11 total range 9.7 to 1.5

Attic zone 1.5

Crawl zone 6.2



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Post numbers

1404 Sqft double wide

CFM50 3460 target 2214 **1718**

Pressure pans .6 to .2

Attic zone .6

Crawl zone 1.2



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Joe Page



Mobile Home Duct Sealing

No Pain, No Gain



Mobile home ductwork is often in very poor condition, this is a huge opportunity to crush air-sealing targets

1. Be systematic- **Clean** and seal every boot the same way.
2. Be smart- Use the Blower Door/Pressure Pan during duct sealing to verify your efforts. Bigger readings=bigger problems.
3. Be thorough- Not all duct related issues can be addressed with duct sealing alone.

Duct bucket items

Make a MH Duct sealing kit

- 5 gallon bucket
- Acetone
- Rubber (nitrile) gloves
- Mesh tape
- #8 Mastic
- Rags
- Hybrid butyl tape
- Small role flashing
- Snips
- Benders
- Sheet metal screws
- Duct masking tape
- Disposable respirators



Your duct sealing will only be as good as your duct cleaning!!



Become a pressure detective

- Run the furnace
- Run the blower door
- Use diagnostic equipment
- Pressurize the house
- Cut the underbelly
- Hunt down those cfm's!!



This mobile home had a 60% reduction in their power bill post weatherization.

Location	Supply R	
Front Room	7.5	.5
bath-room 1	6.4	.1
bedroom 1	7.7	.3
bedroom 2	7.1	.3
bedroom 3	8.6	.4
bedroom 4	10.1	.6
bathroom 2	20	6.5



Verify your duct sealing before insulating the underbelly!

Removing dense packed insulation out of a duct is not an easy task.





Now Let's Go!



Thoughts on the Efficacy of Mobile Home Training

Nate Price:
Champaign County Regional
Planning Commission
Urbana, IL



Initial Skepticism

- ▶ It took some time to realize the value of the training.
- ▶ Many people already dislike working on mobile homes.
 - ▶ Use non-traditional building materials.
 - ▶ Can require more creativity.
 - ▶ Older mobiles can be poorly manufactured.
- ▶ But then we started training
 - ▶ The first home we did caught on fire
- ▶ Luckily it was unrelated

Existing Standards and Methods

Standards

- ▶ CCRPC has historically struggled to meet expectations for mobile home energy performance.
- ▶ The Illinois Home Weatherization Assistance Program did adopt new Mobile Home standards prior to the training, but CCRPC was still trying to find ways to meet older, less effective standards.

Methods

- ▶ Contractors in many cases were still utilizing outdated methods.
- ▶ Air sealing was inconsistent and insulation was only improved in some cases.
- ▶ Assessors were unable to assign work based on the new IHWAP standards.

Typical Retrofits Installed Prior to Training (Champaign County)

- ▶ No additional insulation in the roof cavity.
- ▶ Only patching with fiberglass batt in the underbelly.
- ▶ Limited top-side duct sealing. (boot to trunk line and floor)
- ▶ No wall insulation measures.
- ▶ Most improvements were relative to mechanical systems

The Training Process

- ▶ CCRPC began with Weatherization assessors/inspectors.
 - ▶ Gave us the ability to conduct inspections with an eye towards new methods.
 - ▶ Gave Wx staff the ability to oversee and train contractors and crews.
- ▶ We then sent our contractors to learn directly from the trainer.
 - ▶ This allowed them to get the knowledge firsthand.
 - ▶ Provided credibility to the new methods.
- ▶ Each training was held with a mix of Wx staff, state technicians, and contractors/crew.
 - ▶ Each brought a different perspective to the process which improved everyone's understanding of the new methods.

Typical Retrofits Installed After the Training (Champaign County)

- ▶ We insulate nearly every roof cavity with blown fiberglass.
- ▶ We now install blown fiberglass in every underbelly.
- ▶ Contractors are now performing underside duct sealing.
- ▶ Still not insulating walls yet.
- ▶ More opportunity to improve insulation levels.
- ▶ Seeing more improvement in air sealing.

Training Houses

Job #	Initial CFM50	Target	Final CFM50	Reduction %	Pre Duct Total	Post Duct Total	Duct Reduction %
1	2190	1576	1052	52%	42.4	8.6	80%
2	2144	1543	1427	33%	16.2	4.4	73%
3	1704	1226	943	45%	2	2	0%
4	1630	1173	866	47%	33.4	5.9	82%
5	2083	1494	1315	37%	18.7	5.5	71%
6	2966	1917	1391	53%	27.5	3.7	87%

Average Reduction

43%

78%



Things to Note

- ▶ Prep work is really important.
- ▶ Contractor did not seal the duct work.



Things to Note

- ▶ Prep work is really important
- ▶ Missed plumbing leak.



Things to Note

Overall workmanship has improved.



Things to note

- ▶ Client satisfaction has improved.
- ▶ Numerous reports of:
 - ▶ Usage reduction.
 - ▶ Improved comfort.
 - ▶ Noise reduction.
- ▶ Example:
 - ▶ Built in 1996, still had significant improvement.

Mobile Home Numbers

Illinois Weatherization Program

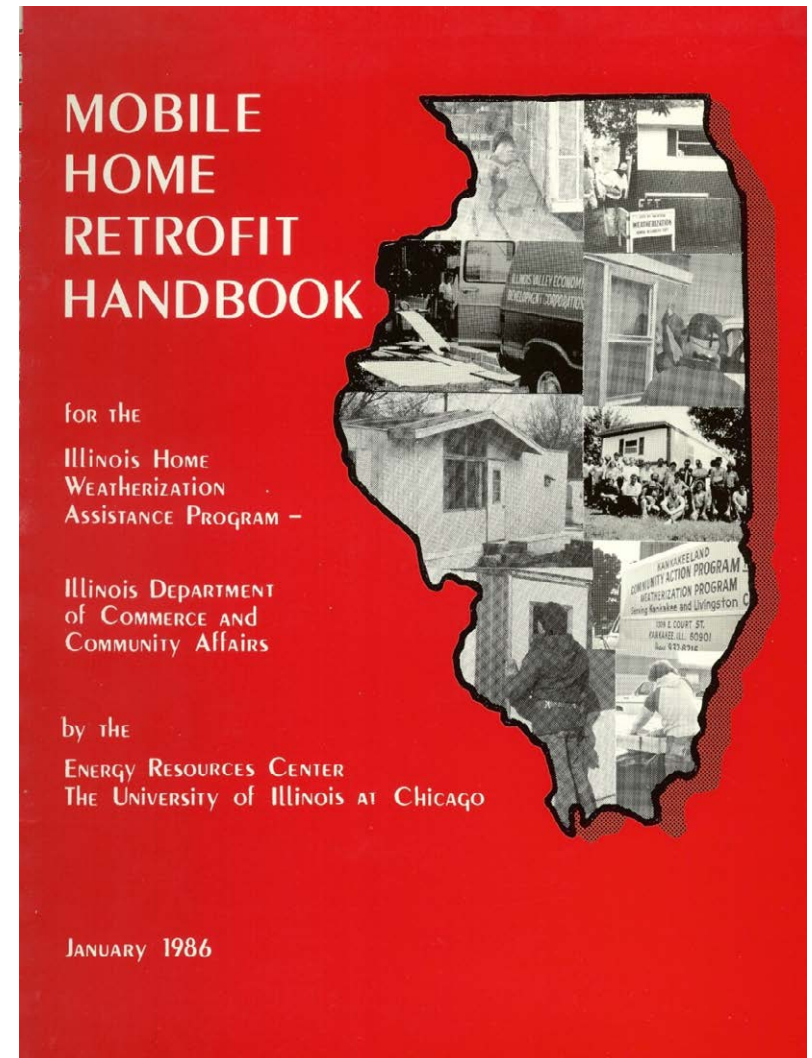


- 1983 – 1,510 mobile homes weatherized statewide
- 1984 – 1,805 mobile homes weatherization statewide

Energy Savings = 0%

Mobile Home Retrofit Program

- 1985 Mobile Home Retrofits
 - ❑ Replace jalousie windows (23)
 - ❑ Weatherstrip jalousie windows (6)
 - ❑ Install uninsulated skirting (23)
 - ❑ Install ground cover (16)
 - ❑ Install vents on skirting (17)
 - ❑ Floor insulation (10)
 - ❑ Insulated skirting (10)
 - ❑ Inside storm windows (29)
 - ❑ Storm doors (30)



Mobile Home Retrofit Program

- Recommendations:
 - Air sealing (interior)
 - Replace jalousie windows
 - Floor insulation, or
 - Insulated, non-vented skirting
 - Furnace
 - Tune-up
 - Insulate/air seal duct
 - Water Heater
 - Wrap



Draft Busters



Window Replacement



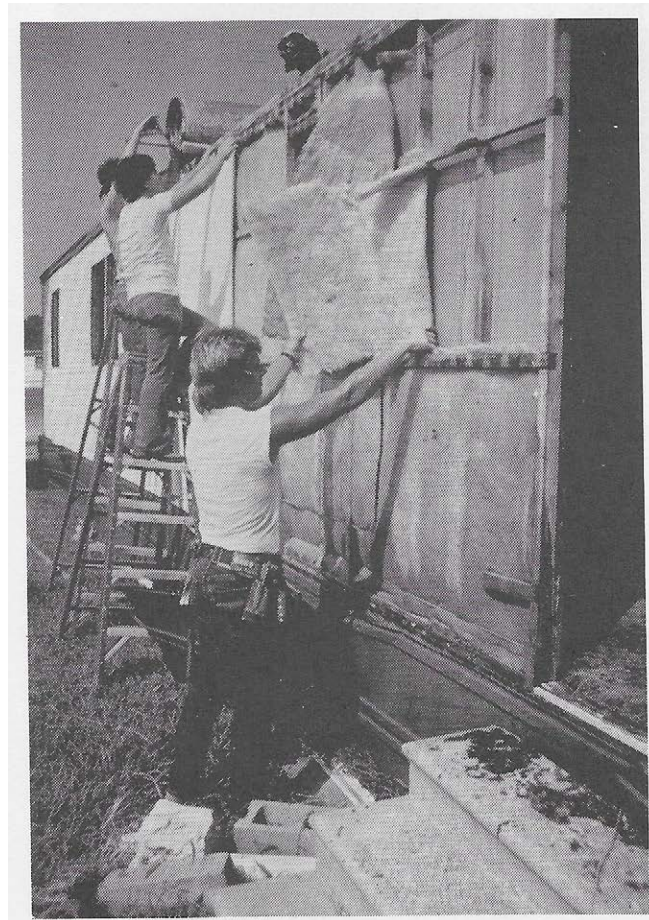
Floor Insulation



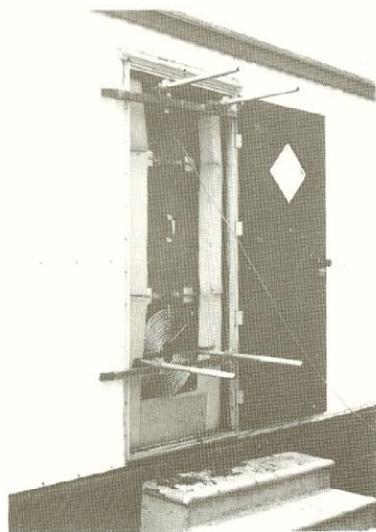
Door Replacement



Roof Insulation



Wall Insulation



Blower Door

Energy Savings

PY	Mobile Homes	Single Family	%
2004	950	7,787	12.2%
2005	941	7,457	12.6%
2006	947	7,878	12.0%
2007	1,074	8,331	12.9%
2008	986	7,578	13.0%

July 2004 through June 2005

- Average savings in mobile homes – 7.9% (68 therms)
- Average savings in single-family homes – 13.4% (222 therms)



- July 2010 through June 2011
 - Average savings in mobile homes – 7.6% (64 therms)
 - Average savings in single-family homes – 12.4% (171 therms)

Illinois Home Weatherization Assistance Program Blower Door Summary for PY18 (July 1, 2017 – June 30, 2018)

	Average Pre	Average Post	Average Target	Difference	% of Target	Total Jobs	Target & 10%	Percentage Met
2-4	2548	1598	1684	-86	-5.10%	49	40	81.63%
MH	2907	1743	1890	-147	-7.75%	223	194	87.00%
SF	3736	2077	2218	-140	-6.33%	1302	1091	83.79%

Mobile Home Workshops

- Current: on-going MH workshops
- Current: on-going MH workshops
 - Duct repair & sealing



Mobile Home Workshops

Blower Door Numbers (CFM50):

Pre-workshop: 2050

Target: 1472

Post-workshop: 1479

<i>Pressure Pan</i>	<i>Pre-Workshop</i>	<i>Post-Workshop</i>
Bed #1	1.5	0.2
Bath	0.7	0.5
Bed #2	1.3	0.5
LR-R#1	1.1	0.4
LR-R#2	0.8	0.2
Kit	0.5	0.3
Master Bed-R#1	0.8	0.2
Master Bed-R#2	1.0	0.3
Master Bath	1.1	0.2
	8.8	2.8



MANUFACTURED HOUSING

Efficient Comfort Providing Savings



Maurice Gaston

My Background

Ohio Native

Construction Background

- ❖ Carpenter- New Construction Framer/ Renovation

Education

- ❖ Bachelors of Fine Arts- Interior Design
- ❖ Chicago Reap Commercial Real Estate Graduate

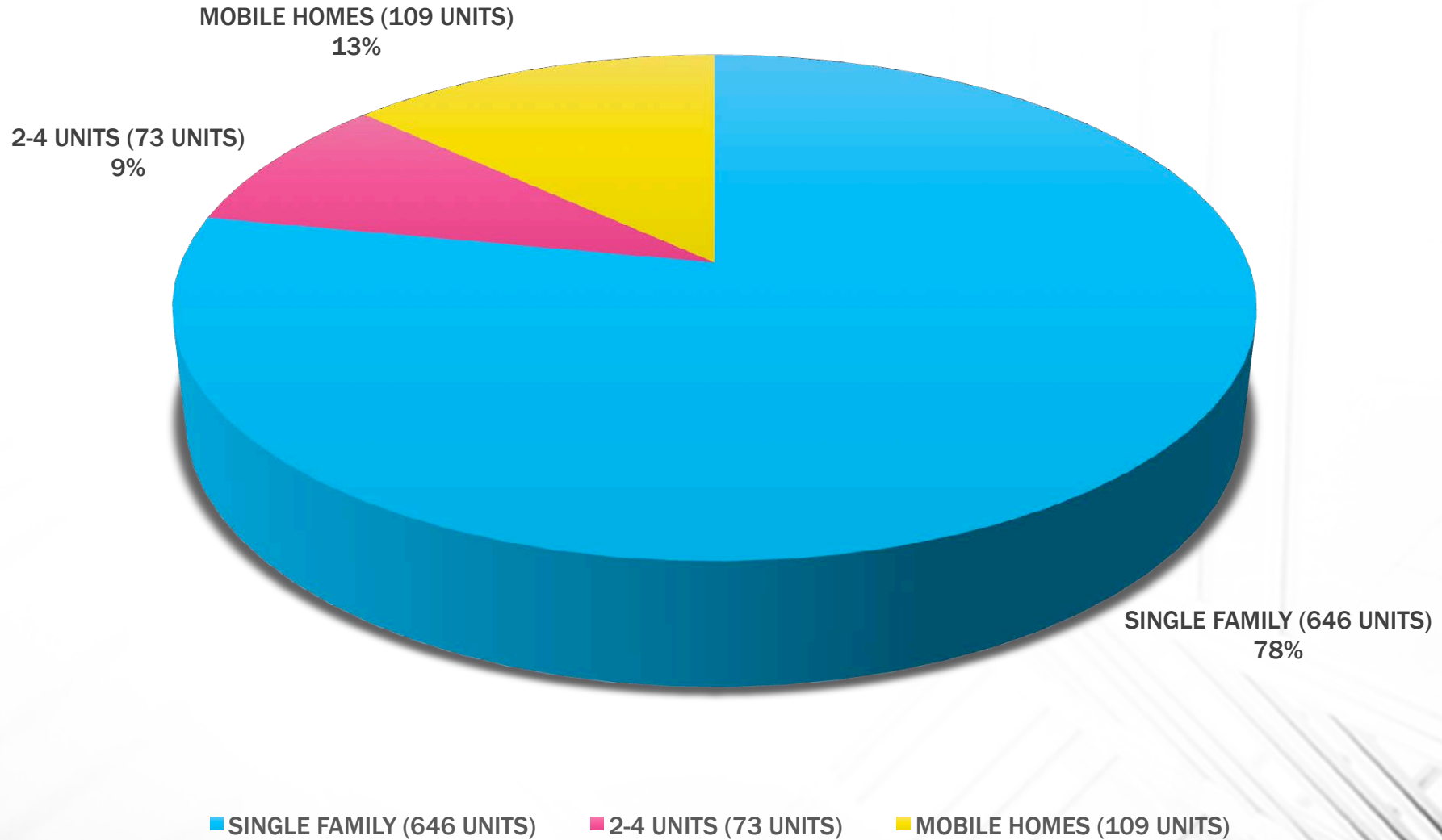
Skills

- ❖ Photography, Adobe, Autocad, Auto Desk Viz, Drafting

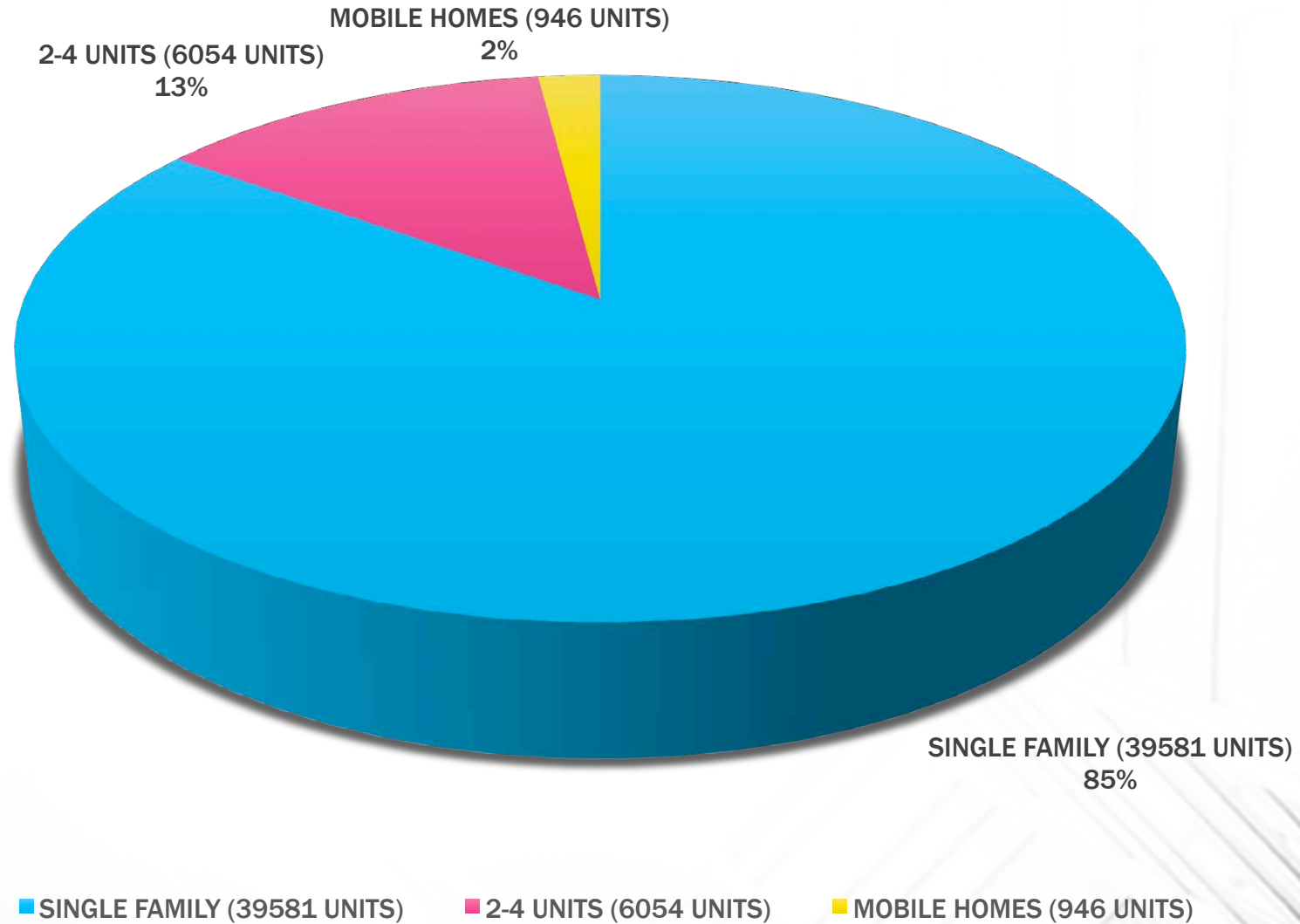
Certifications

- ❖ Certified Auditor Recognized by the Office of Energy Assistance
- ❖ Lead Renovator
- ❖ OSHA 10, OSHA 30 Card Holder
- ❖ BPI- Building Analyst Professional
- ❖ BPI- Energy Auditor
- ❖ BPI- Quality Control Inspector
- ❖ Construction Management Certification
- ❖ Illinois Home Inspector Certification

Energy Audits 2009- 2019



CEDA Audits 2009- 2019



Truss Type

- Bowstring Truss
- Standard Sloping
- Double Wide

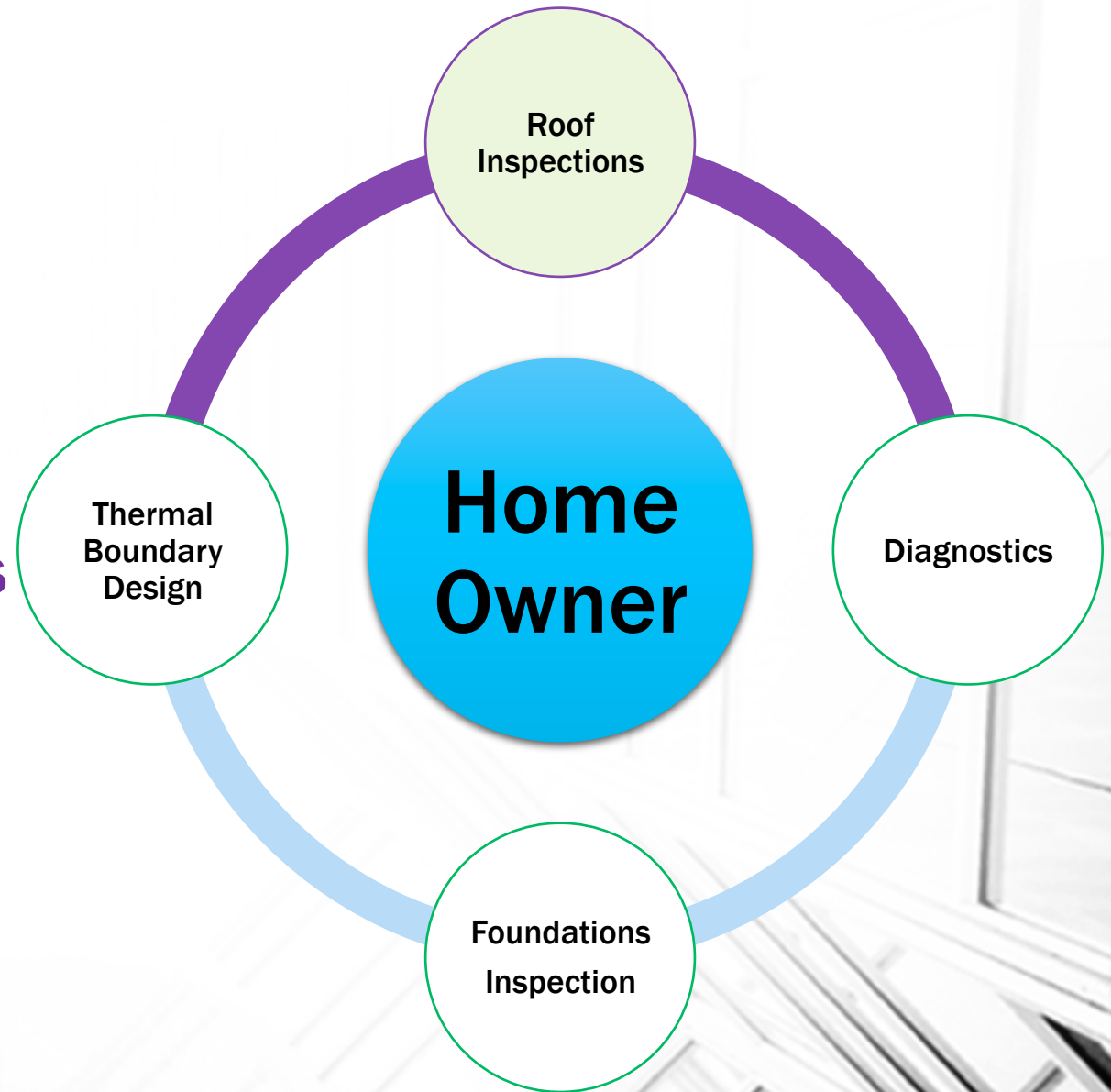
Roof Type

- Rubber
- Metal
- Shingle

Penetrations/ Inspection Points

- Roof Condition
- Gutter/ Downspout Condition, J Channels
- Flashing
- Hot Water Tank Flue Pipe
- Furnace Flue Pipe
- Roof Vents/ Soil Stack

ROOF INSPECTION



THERMAL BOUNDARY INSPECTION

Wall Types

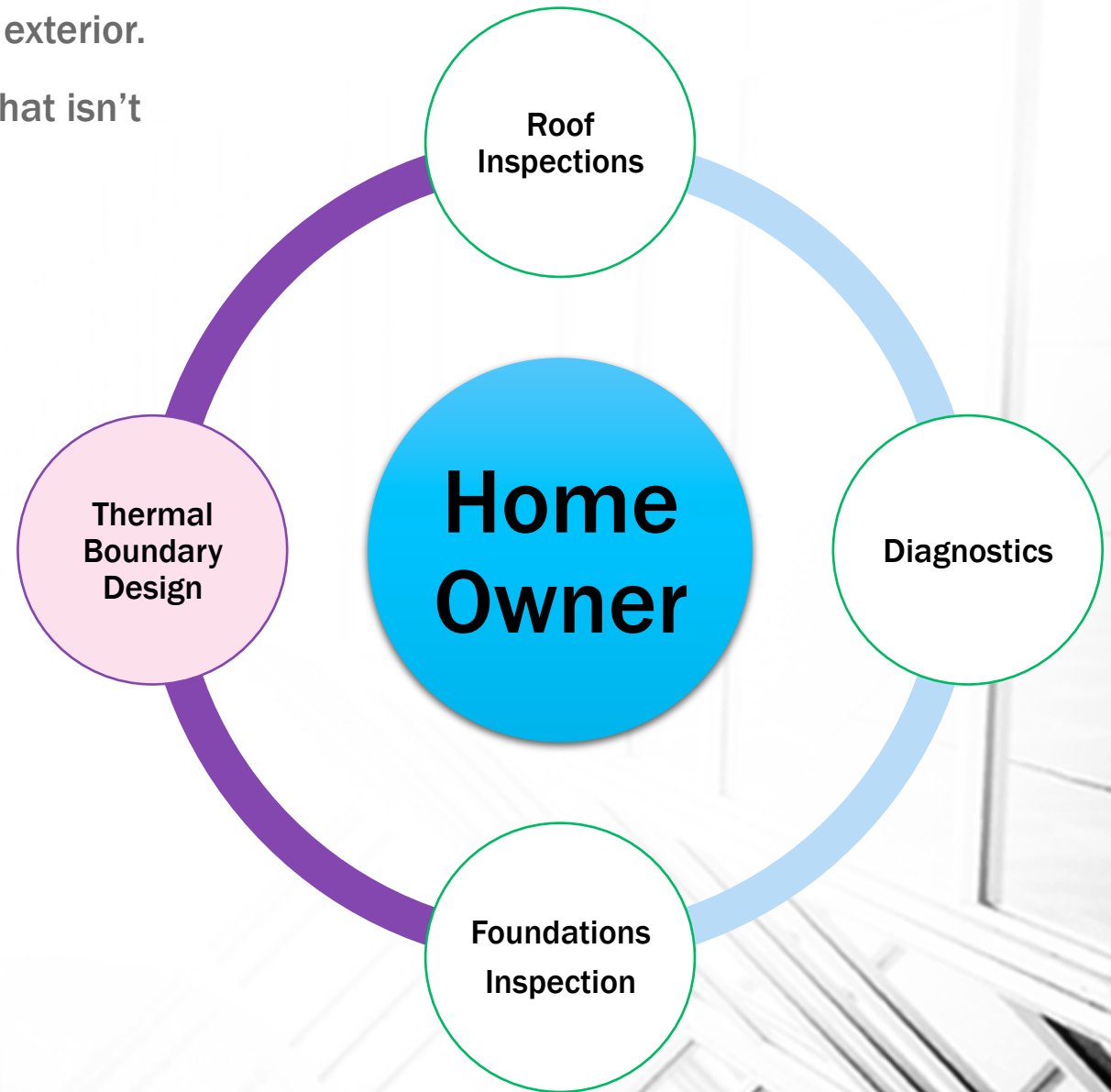
- Vapor-Barrier Walls- Plastic under the interior panel.
- Pressure-Envelope Walls- Air barrier on the exterior.
- Ventilated Walls- Corrugated Metal Siding that isn't "airtight".

Exterior Construction

- Metal Siding
- Vinyl Siding
- Wood Composite
- Aluminum Siding
- Brick Veneer

Interior Construction'

- 2 x 2 Construction
- 2 x 3 Construction
- 2 x 4 Construction
- 2 x 6 Construction



Foundation Site Location/ Construction

- Soil Type
- Footing- Wood or Concrete
- Pier
- Concrete Blocks Capped with 2x8 Wood Block Cushion
- Anchor / Tie-Downs Connections from the Anchor Head to The I- Beam/Corner Fitting

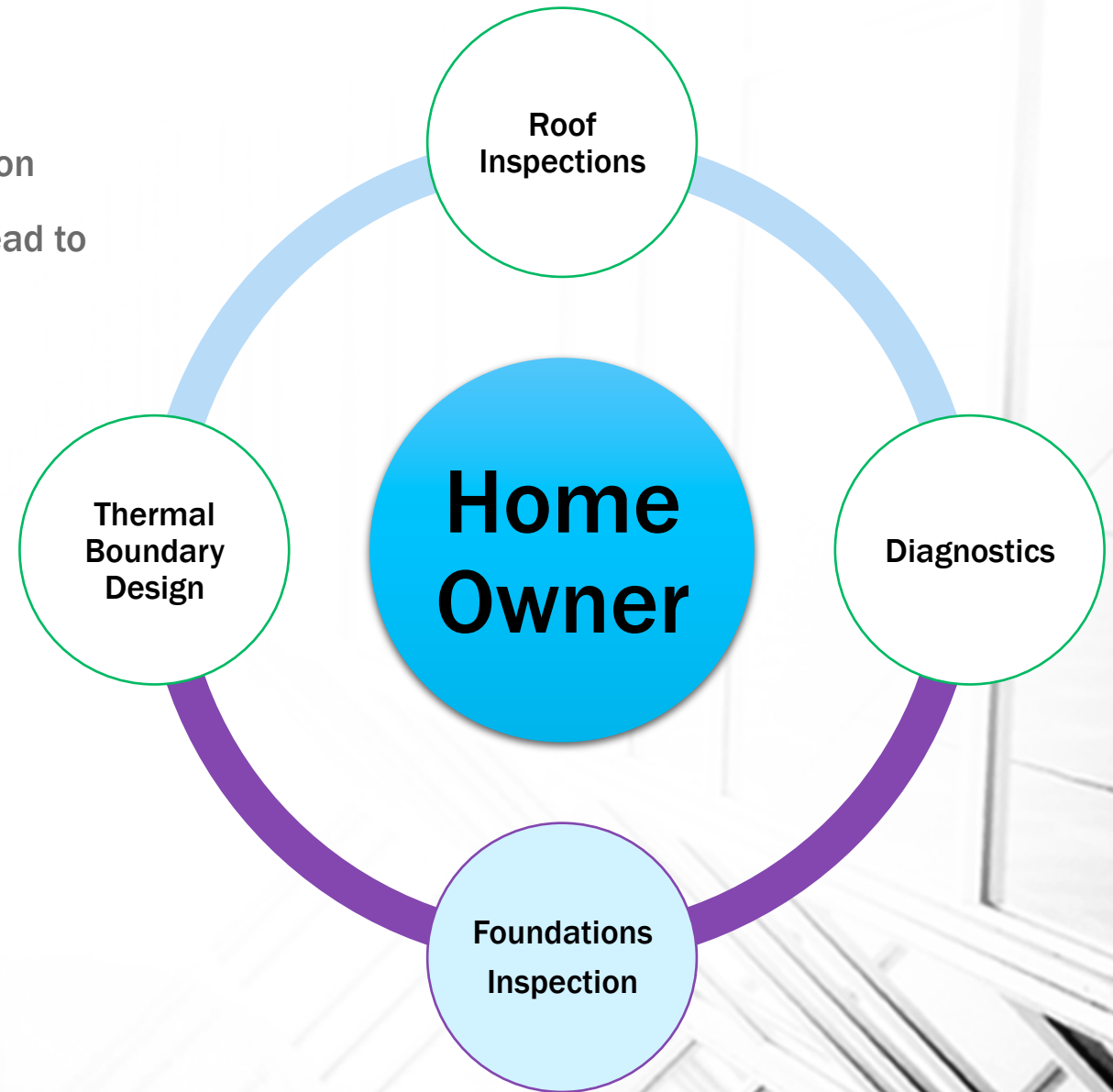
Frame Type

- Crosswise (Hanging Belly)
- Lengthwise (Flat Belly)

Penetrations/ Inspection Points

- Hot Water Tank Fresh Air Intake
- Furnace Condensate Drainage
- Hot Water Tank Discharge Pipe
- Dryer Termination
- Fresh Air Intakes
- Central A/C Units/ Cold Air Return

Foundation Inspection



Safety Equipment- Mandatory During Field Visit

- Tyvek Suit, Mask, Bump Cap, Kneepads, Flashlight, Ladder

Blower Door

- With IR Camera

Pressure Pans- Duct Sealing

- Supply
- Returns

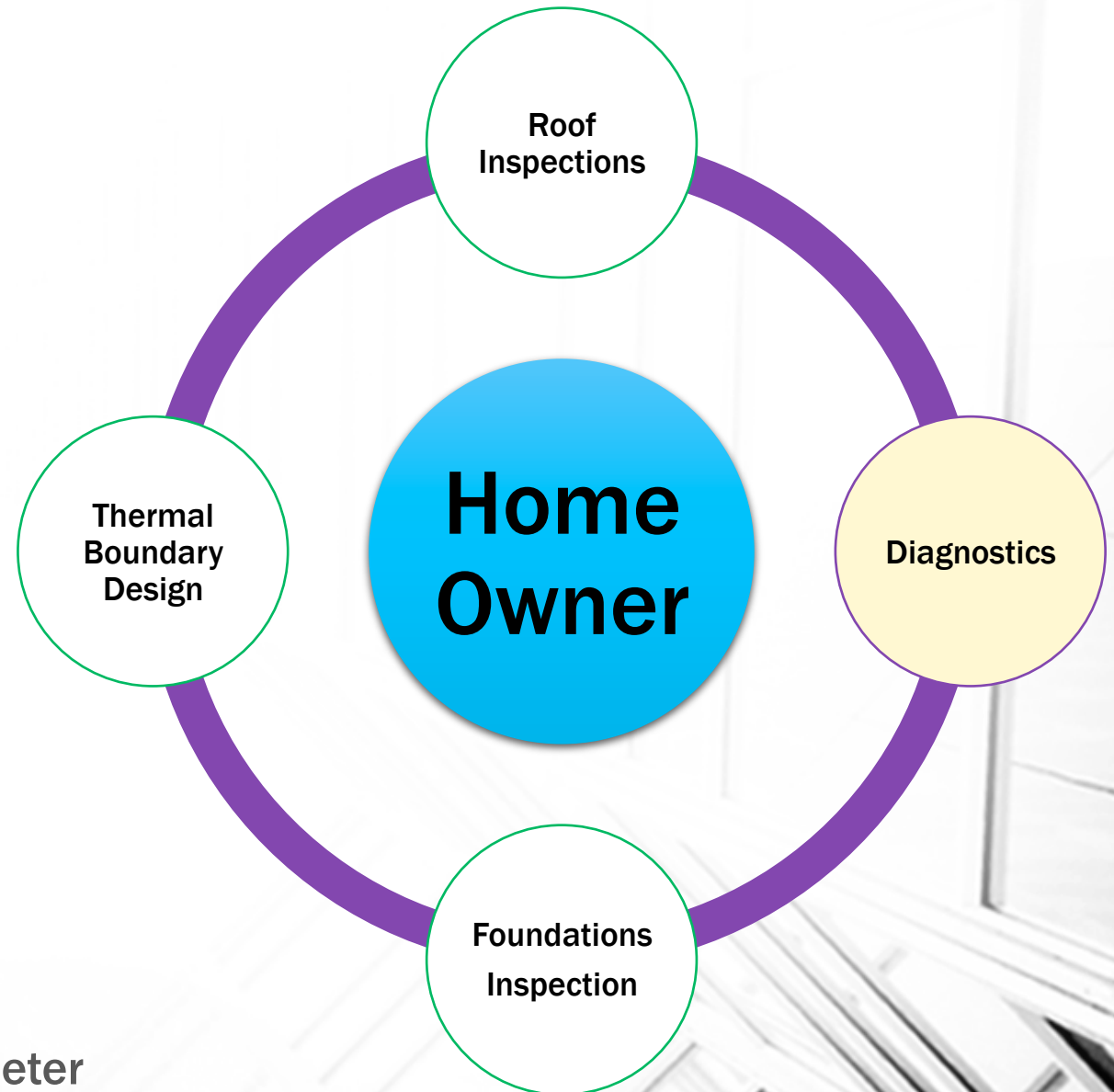
Furnace/ Hot Water Tank/ Exhaust

1. Co Testing/ Efficiency/ Spillage Testing
2. Mobile Home Certified Equipment
3. Worst Cast Draft Testing

Gas Leak Detection/ Co Testing

- Stove, Oven, Dryer, Exposed Gas Line, Gas Meter

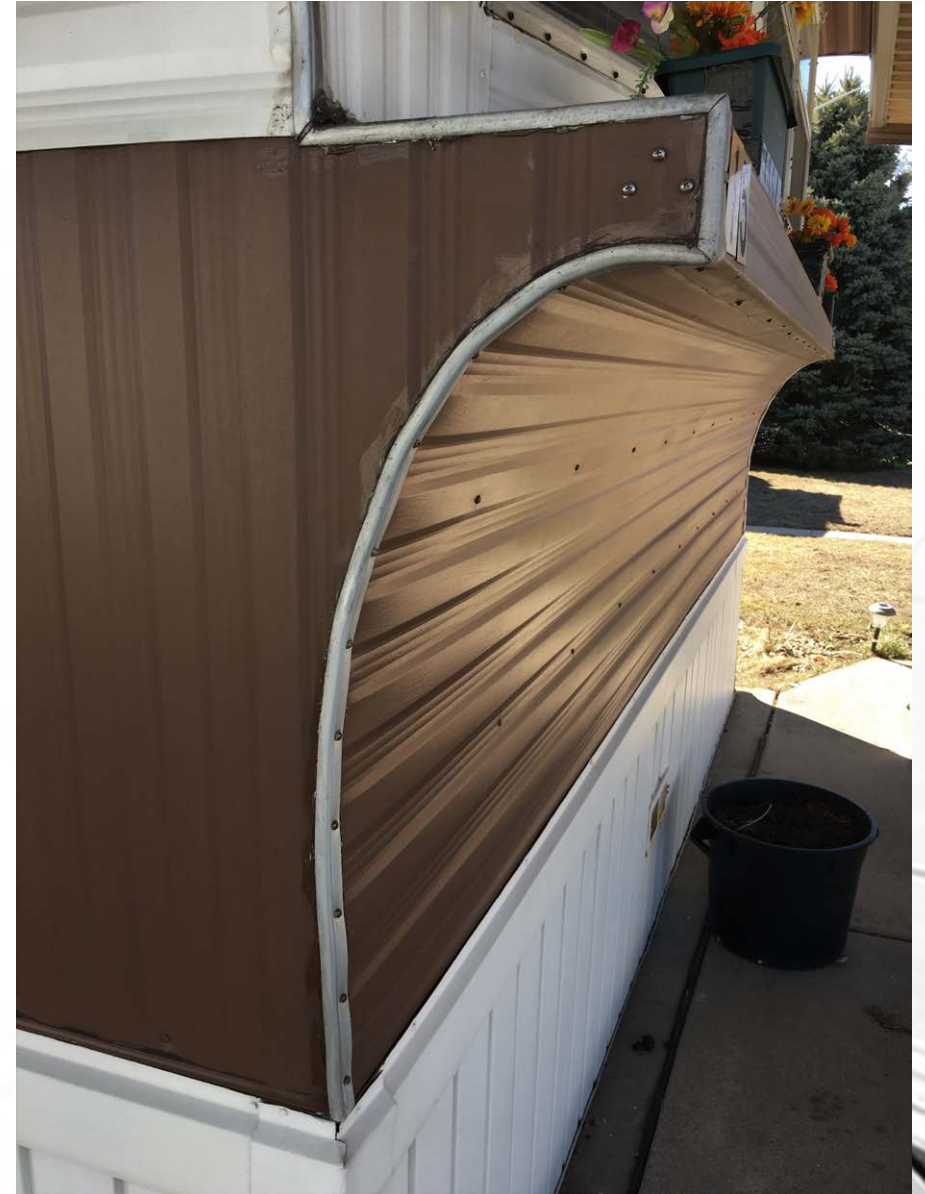
DIAGNOSTICS



Calumet City Illinois Mobile Training with Chris Clay



Sidewall Bay Dense Pack





**ATTIC
OPEN BLOW
FIBERGLASS
INSULATION**

Blower Location

Outside Air Temp.

Inside Air Temp.

Wind Conditions

Ring Used

Vermiculite Present

Blower Door Test

Existing Infiltration Rate CFM 50

Target CFM 50 Intermed. Rate CFM 50

Target Reduction CFM 50 Final Rate CFM 50

Run Target Reduction

ASHRAE 62.2

Save

Cancel

Return



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