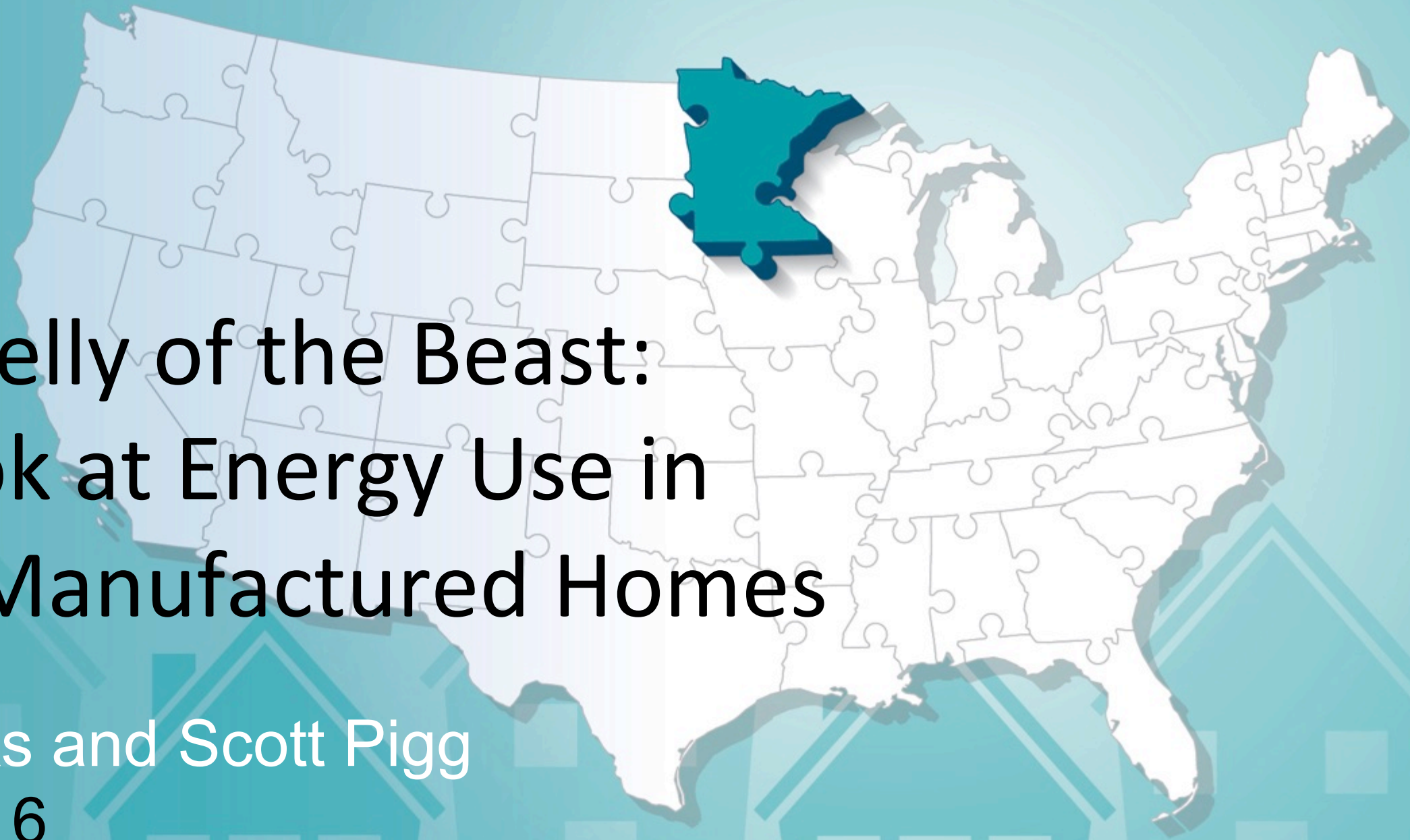


In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

“This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors code/energy** continuing education requirements.”

For additional continuing education approvals, please see your credit tracking card.



# Under the Belly of the Beast: A Closer Look at Energy Use in Minnesota Manufactured Homes

Jeannette LeZaks and Scott Pigg  
February 22, 2016

**SPONSORED BY MINNESOTA DEPARTMENT OF COMMERCE, DIVISION OF ENERGY RESOURCES**



**AREAS OF EXPERTISE**

**Energy efficiency programs**

**Field research**

**Market characterization**

**High performance design**

**Education and training**



# Funding



Conservation Applied Research and Development Program (CARD)

# Who are you?

- A** Builder / remodeler
- B** Home Performance Consultant
- C** Weatherization provider
- D** HVAC contractor / distributor
- E** Utility/government



# Study goals

What are the energy-using characteristics of Minnesota's MHs?

How much energy do MHs use?

What energy-saving opportunities are there?

**MH** = manufactured homes

# Method



What do YOU typically call this kind of home?

A

Trailer

B

Mobile home

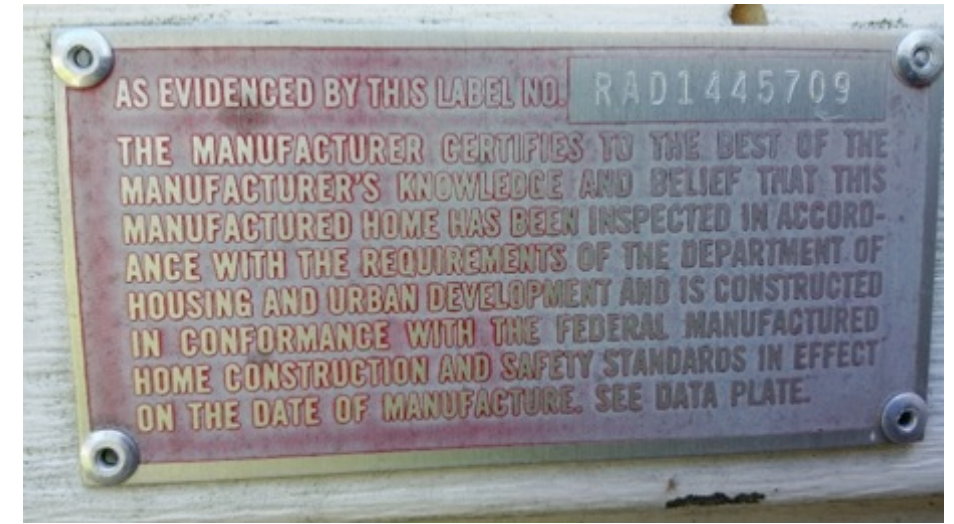
C

Manufactured home





# What is a manufactured home?



# Which is a manufactured home?



POP  
QUIZ!



# Which is a manufactured home?



Is this a manufactured home?

**A** Yes

**B** No

Is this a manufactured home?



- A Yes
- B No

Is this a manufactured home?

**A** Yes

**B** No

Is this a manufactured home?



**A** Yes

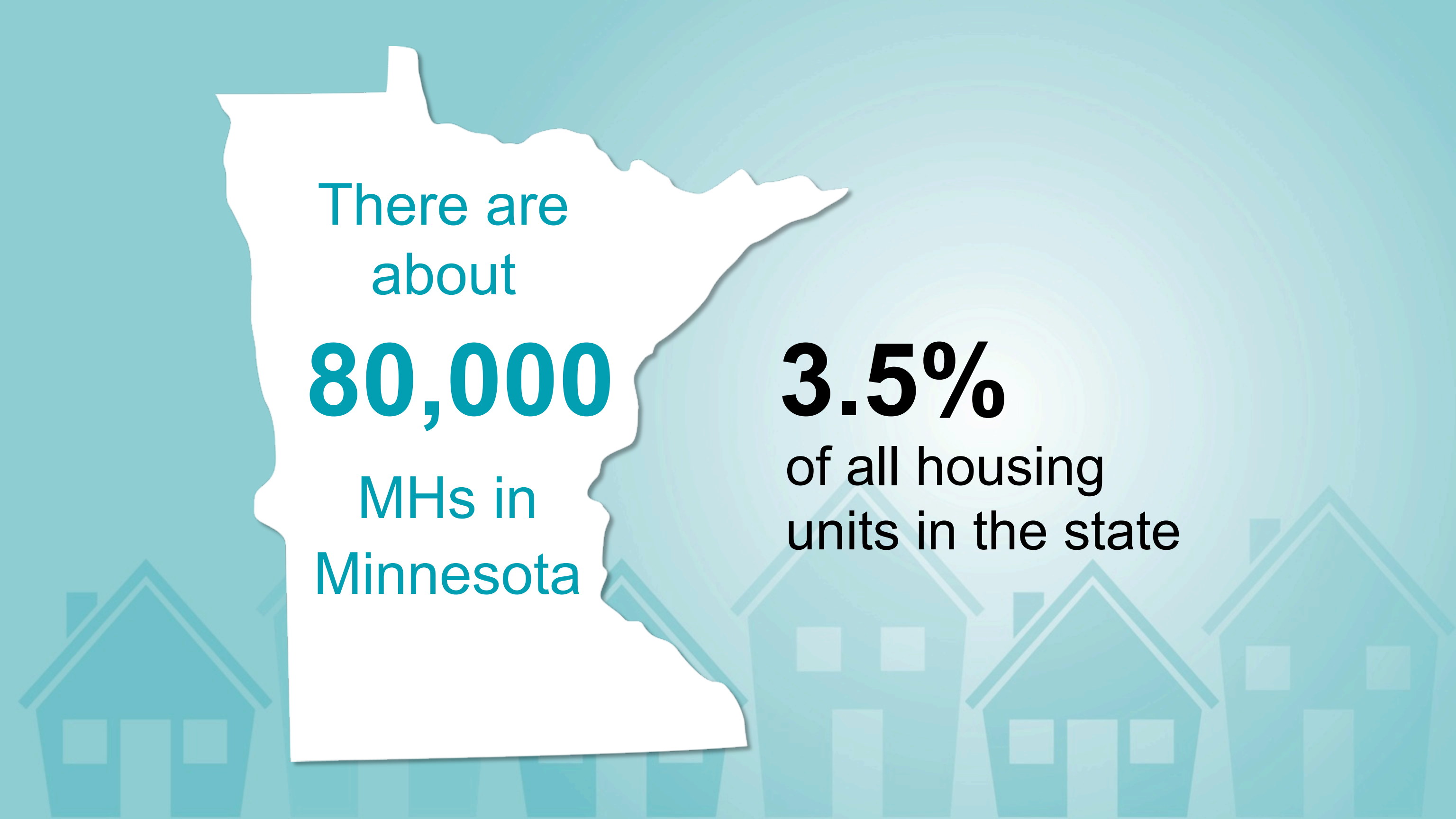
**B** No

# POP QUIZ!

There are  
about  
**???**  
MHs in  
Minnesota

- A** 20,000
- B** 35,000
- C** 80,000
- D** 130,000



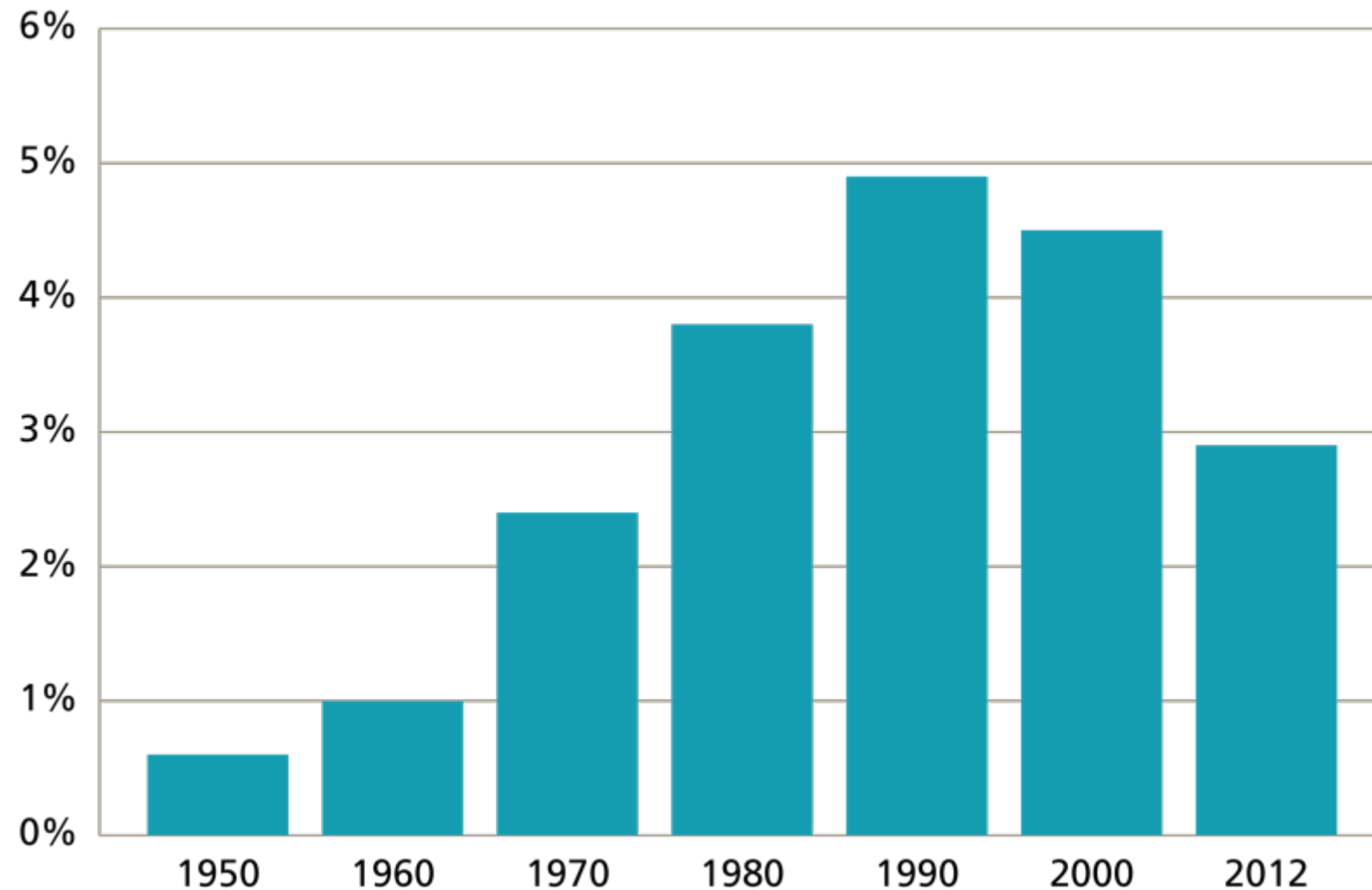


There are  
about  
**80,000**  
MHs in  
Minnesota

**3.5%**  
of all housing  
units in the state

# The MH share of MN housing is shrinking

## MHs as a Percent of all Minnesota Housing



NORTH METRO

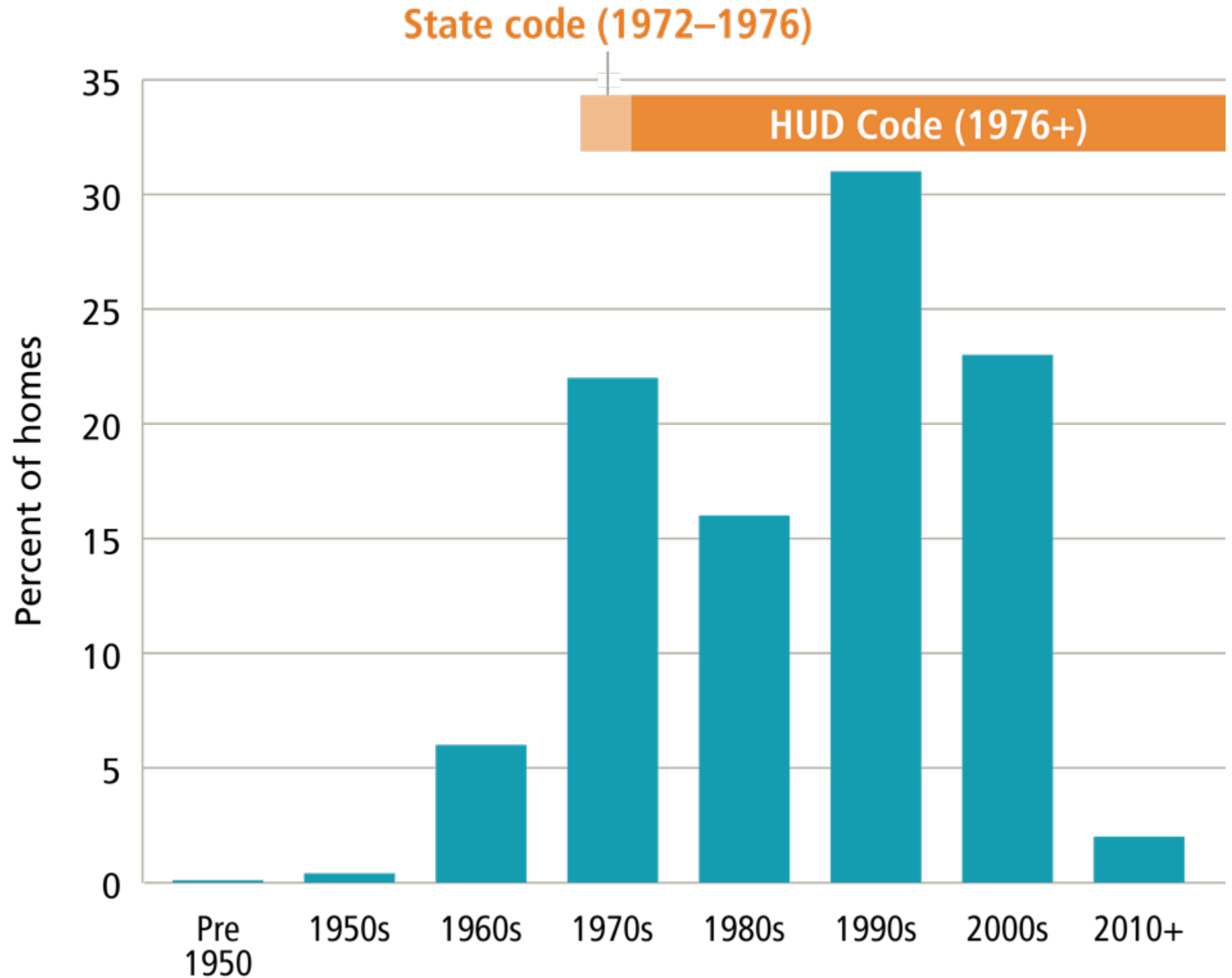
### Met Council pushes to preserve mobile home parks in suburbs

By Shannon Prather Star Tribune | JUNE 25, 2016 — 8:08PM

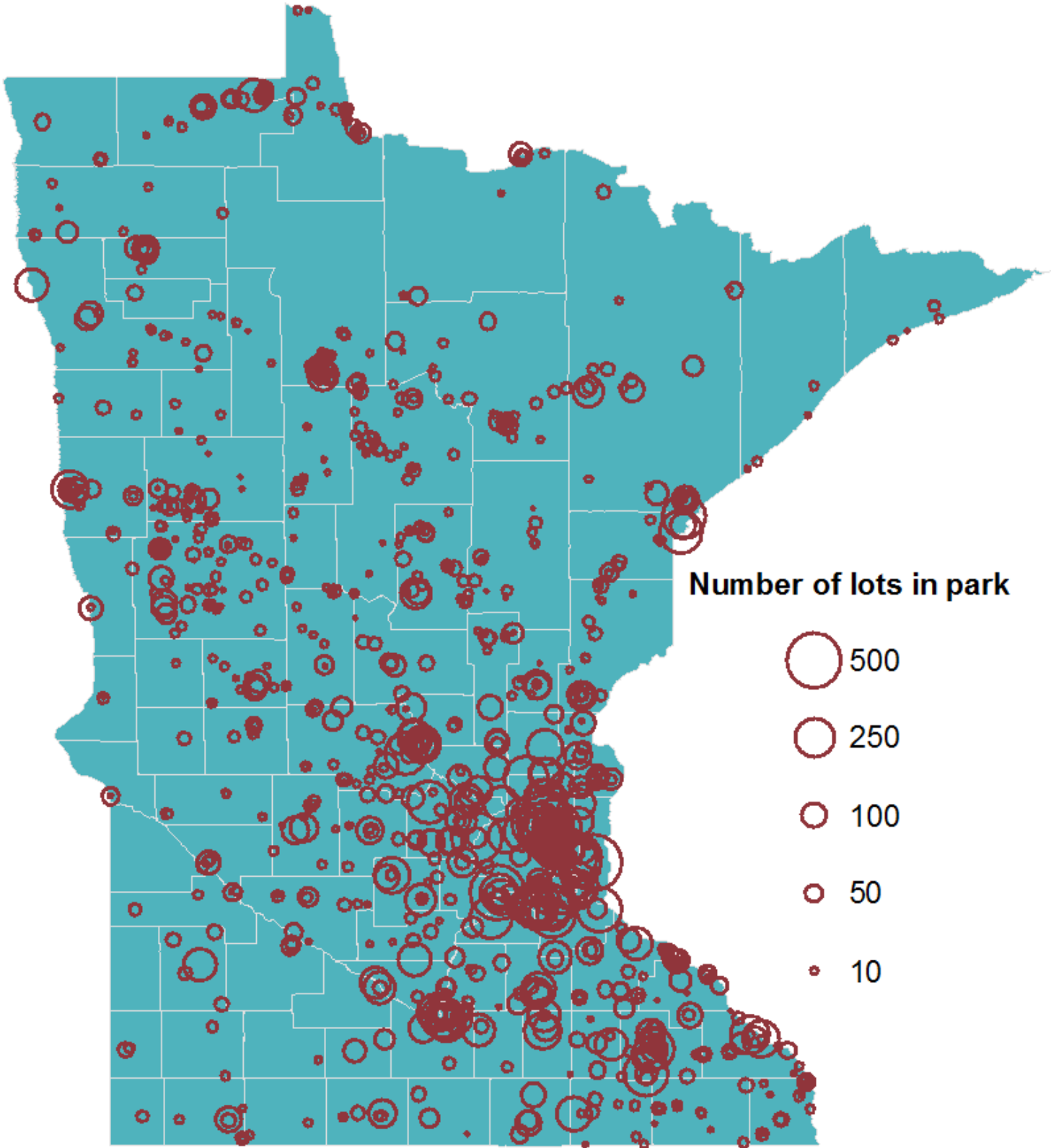
Source: U.S. Census Bureau (does not include MHs with heated additions)

More than 50% built  
in 1990 or later

80% subject to  
federal or state code

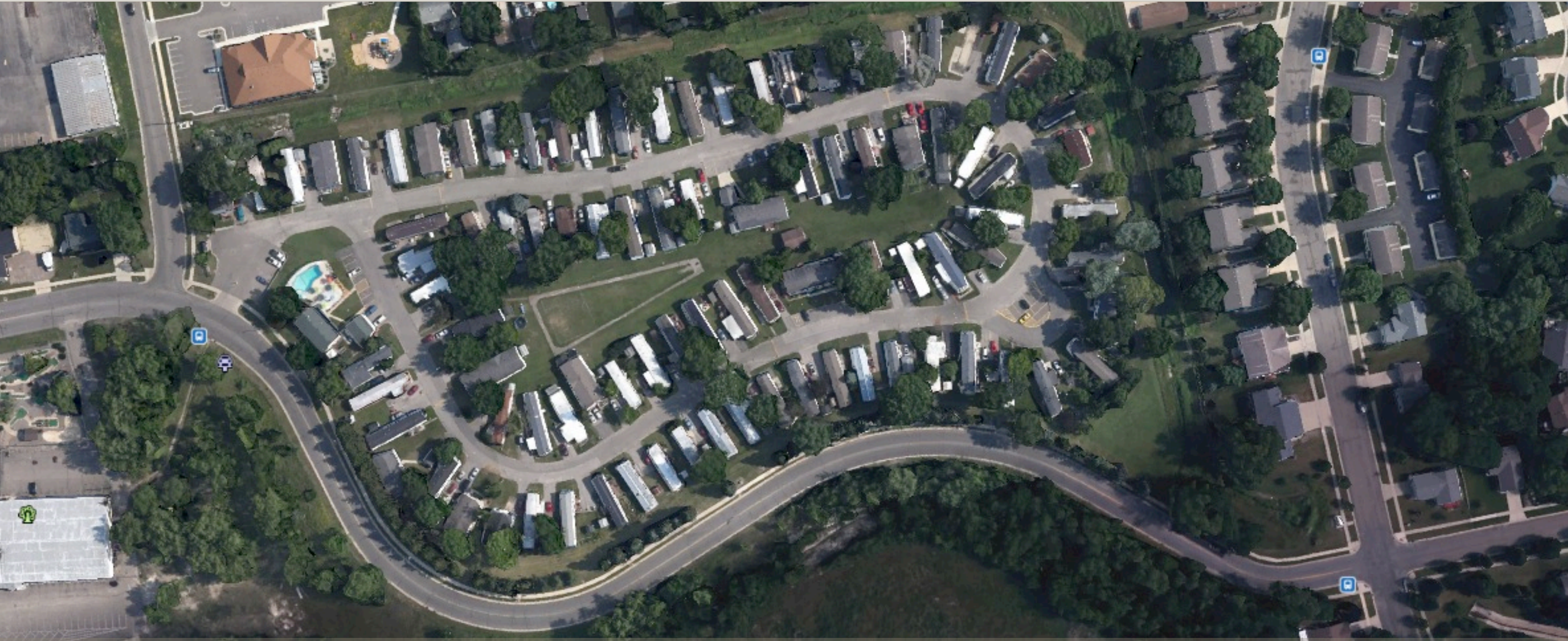



About half of MHs  
are in MH parks



Source: Housing Justice Center

# Homes in parks versus non-park homes



An aerial photograph of a wooded area with a lake and a road. The trees are dense and green. A road runs along the top and right sides of the image. A lake is visible in the lower right quadrant. A speech bubble is overlaid on the right side of the image, containing the text "Can you find the manufactured home?". A cartoon hand wearing a red and white striped sleeve is pointing towards the speech bubble.

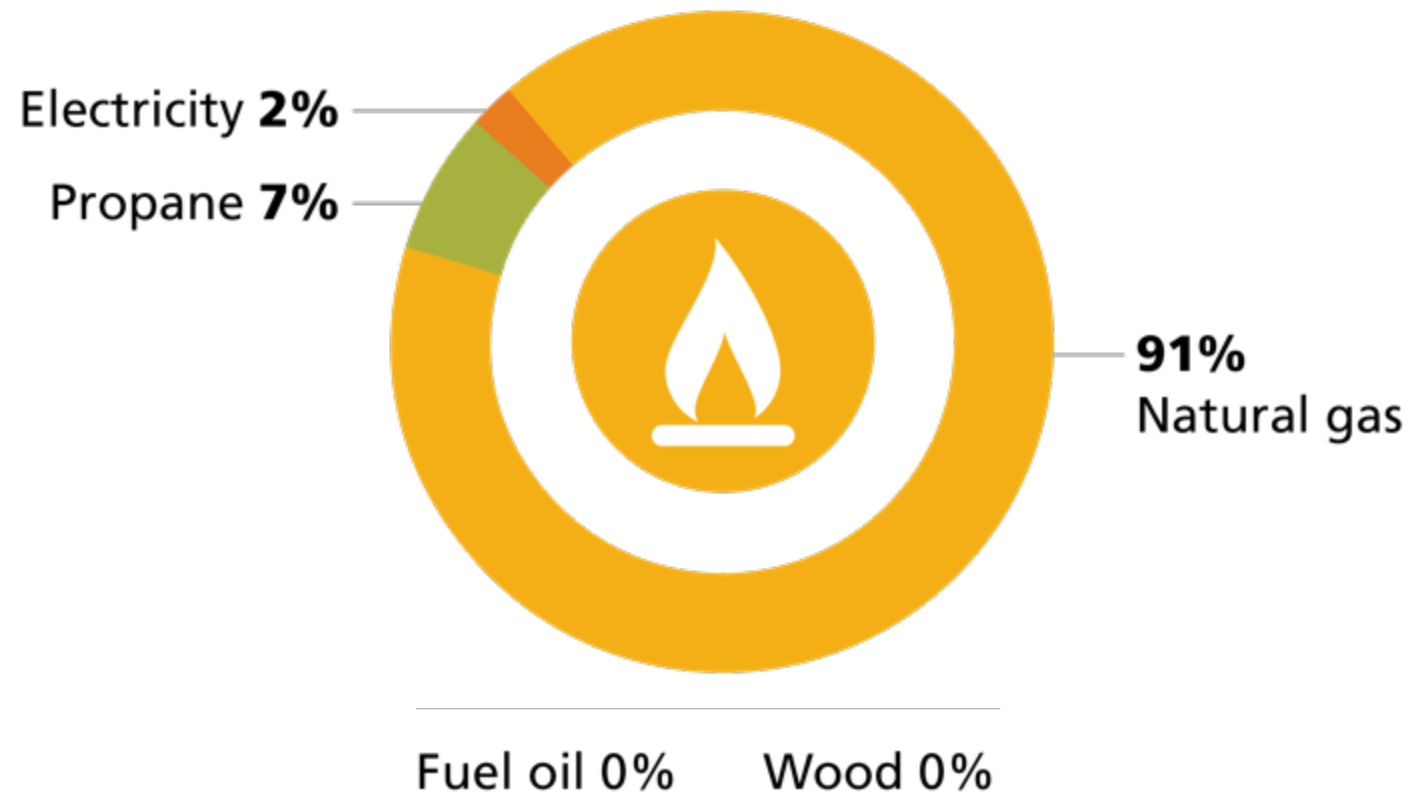
Can you find  
the manufactured  
home?

Can you find  
the manufactured  
home?



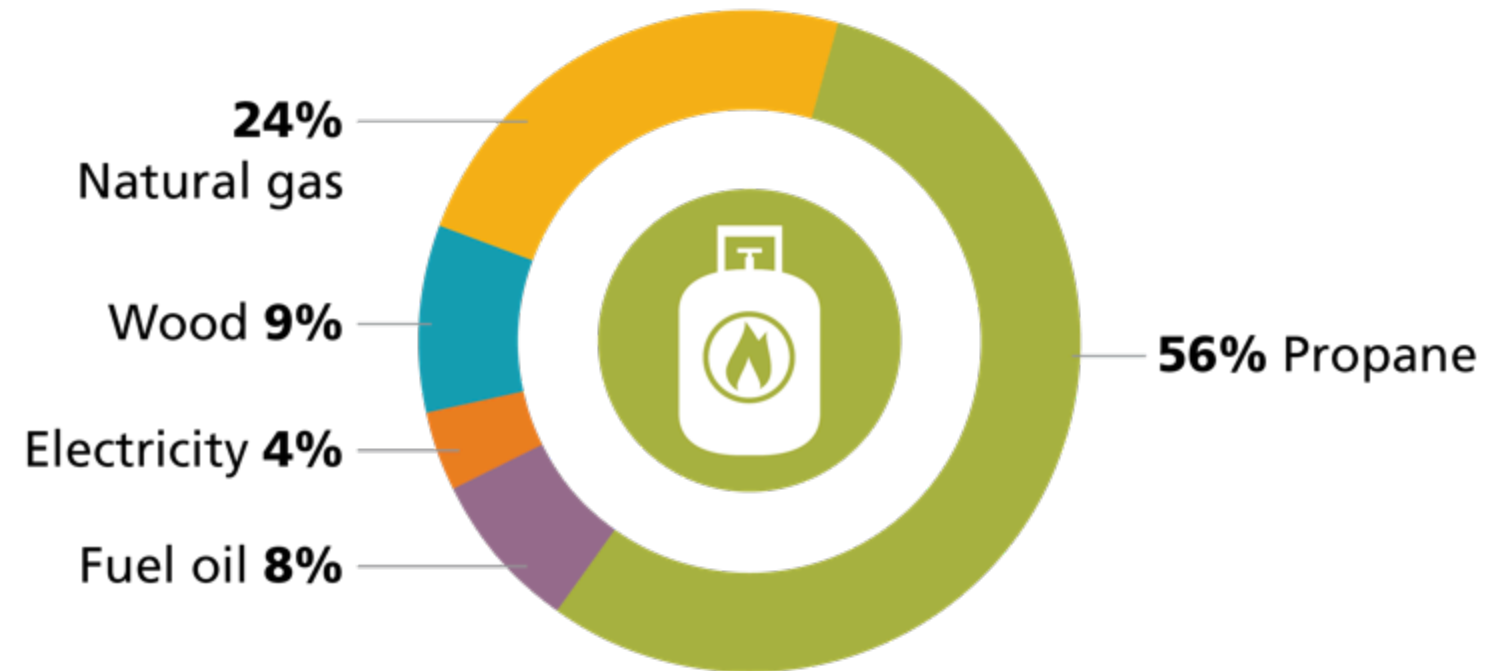
Park homes mostly heat with natural gas.

Park MHs



Many non-park homes heat with propane.

Non-park MHs





# CASE STUDY #1





## CASE STUDY #2

# CASE STUDY #3



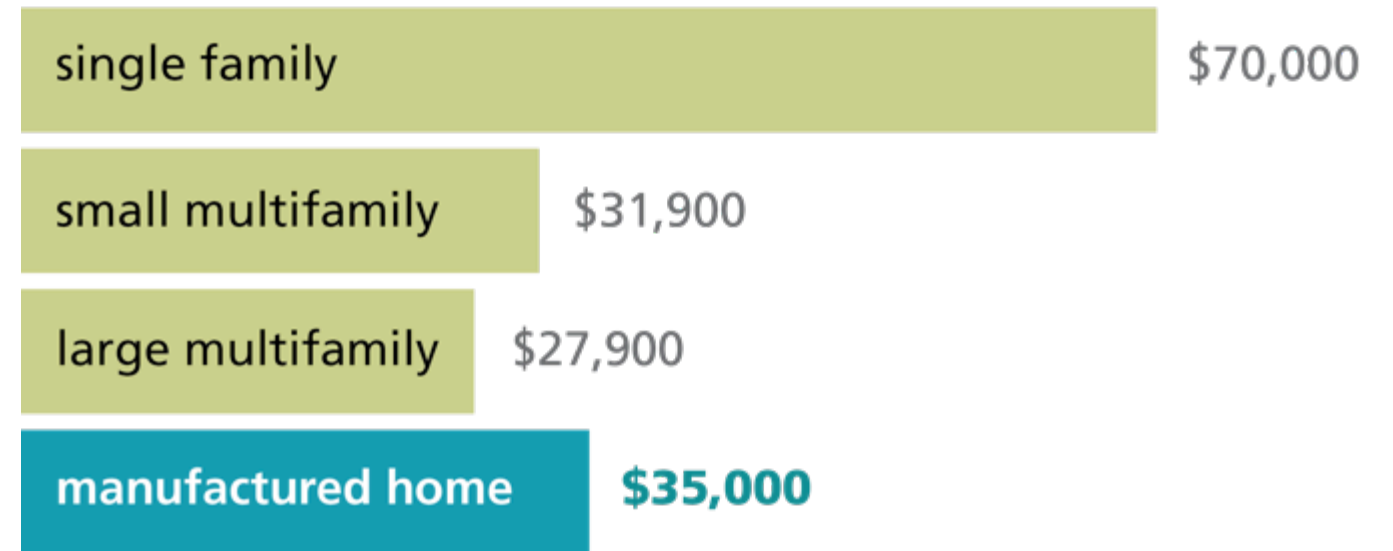
# CASE STUDY #4



MH households resemble apartment dwellers in terms of income and poverty...

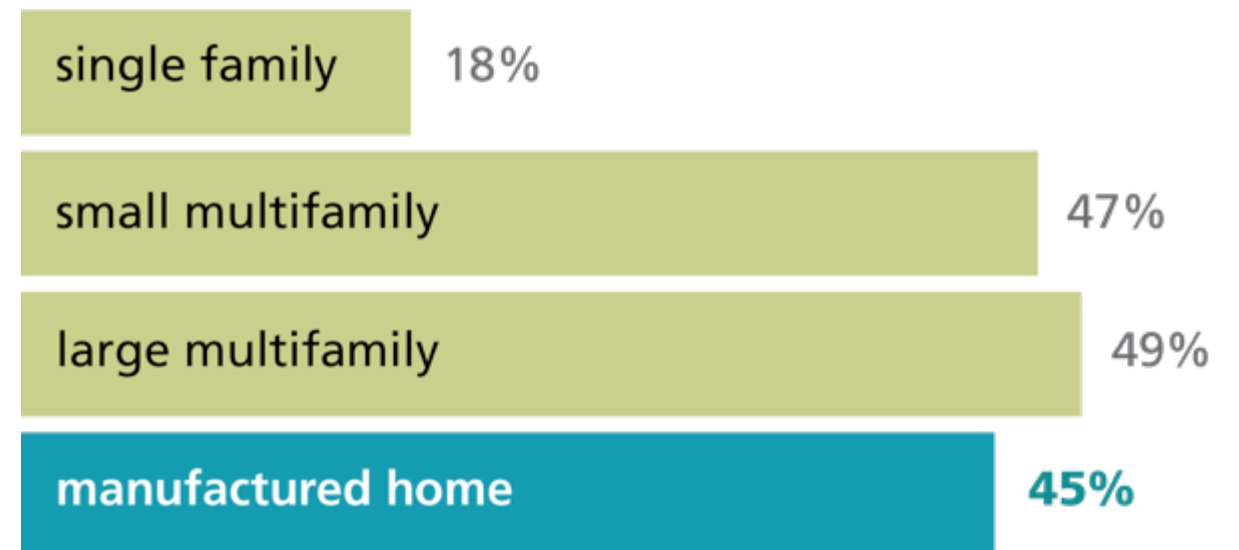
(Census data)

### Median income



### Low income

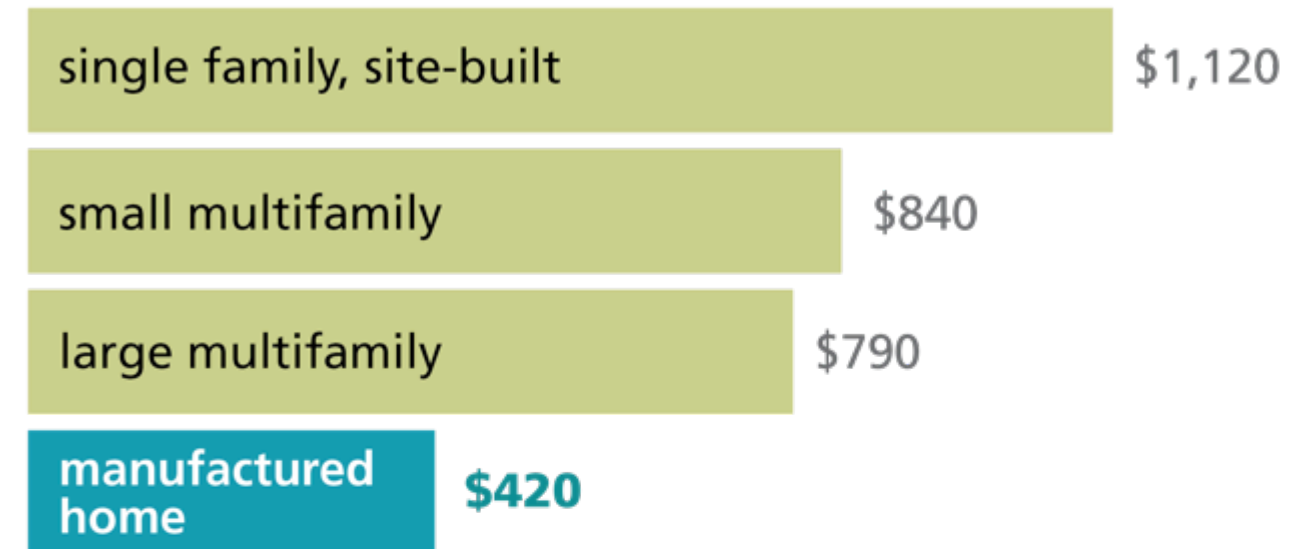
Note: At or below the 200% of Federal Poverty guideline



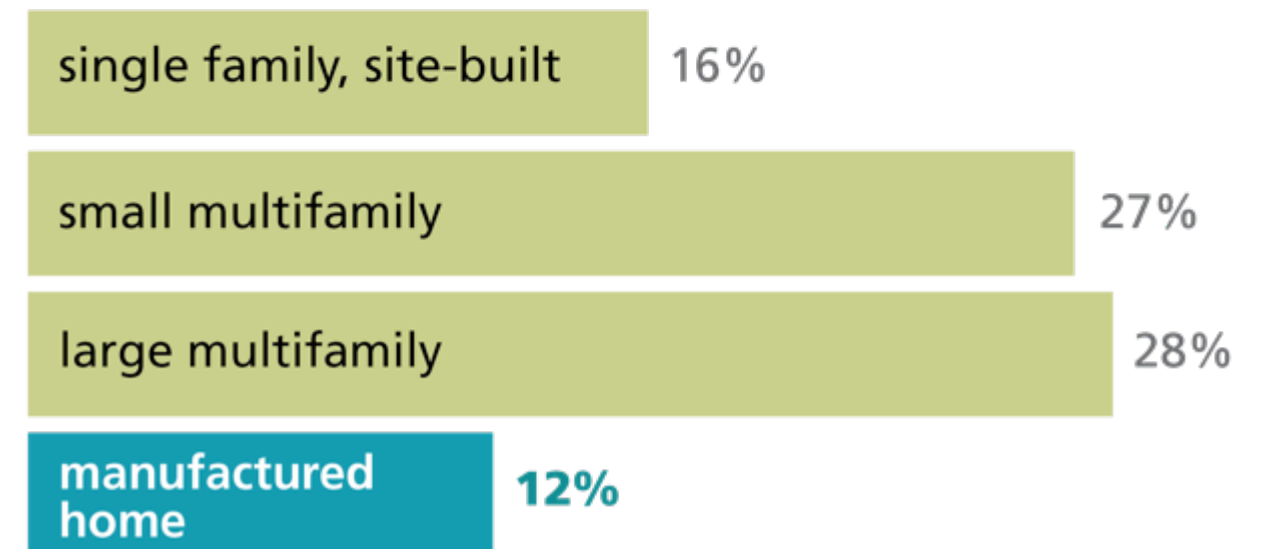
...but have lower housing costs

(Census data)

### Monthly housing costs



### Percent of income



# POP QUIZ!

## What's the average annual utility cost?

**A** \$950

**B** \$1,500

**C** \$2,000

**D** \$2,900

	Percent of household	Annual total energy costs*
Heating fuel	59%	
Natural gas	39%	\$1,860
Electricity	2%	\$2,930
Propane	30%	\$2,330
Fuel oil	4%	\$2,280
Wood	7%	\$1,930
Weighted average	100%	\$2,050

\*Includes heating fuel, electricity and utility monthly fixed charges.



# POP QUIZ!

## What's the average annual utility cost?

Heating fuel	Percent of households	Annual total energy costs*
Natural gas	55%	\$1,860
Electricity	3%	\$2,930
Propane	30%	\$2,330
Fuel oil	4%	\$2,280
Wood	7%	\$1,930
Weighted average	100%	\$2,050

**C** \$2,000

\*Includes heating fuel, electricity and utility monthly fixed charges.

## Energy costs

Heating fuel	Percent of homes (survey)	Annual total energy costs*
Natural gas	59%	\$1,860
Electricity	3%	\$2,930
Propane	30%	\$2,330
Fuel oil	4%	\$2,280
Wood	4%	\$1,930
<b>Weighted average</b>	<b>100%</b>	<b>\$2,050</b>

\*Includes heating fuel, electricity and utility monthly fixed charges.

# POP QUIZ!

What's the biggest energy savings opportunity (\$/home)?

- A** Lighting upgrades
- B** Duct sealing
- C** Portable space heater
- D** Winter thermostat setback

# POP QUIZ!

What's the biggest energy saving's opportunity (\$/home)?

**A**

Lighting upgrades

RETROFIT OPPORTUNITIES (\$231/home)

BEHAVIORAL OPPORTUNITIES (\$166/home)

BEHAVIORAL OPPORTUNITIES (\$166/home)

Other retrofit opportunities

\$87

Other upgrade opportunities

\$43

Portable space heater

\$81

Plumbing heat tape

\$28

Winter thermostat setback

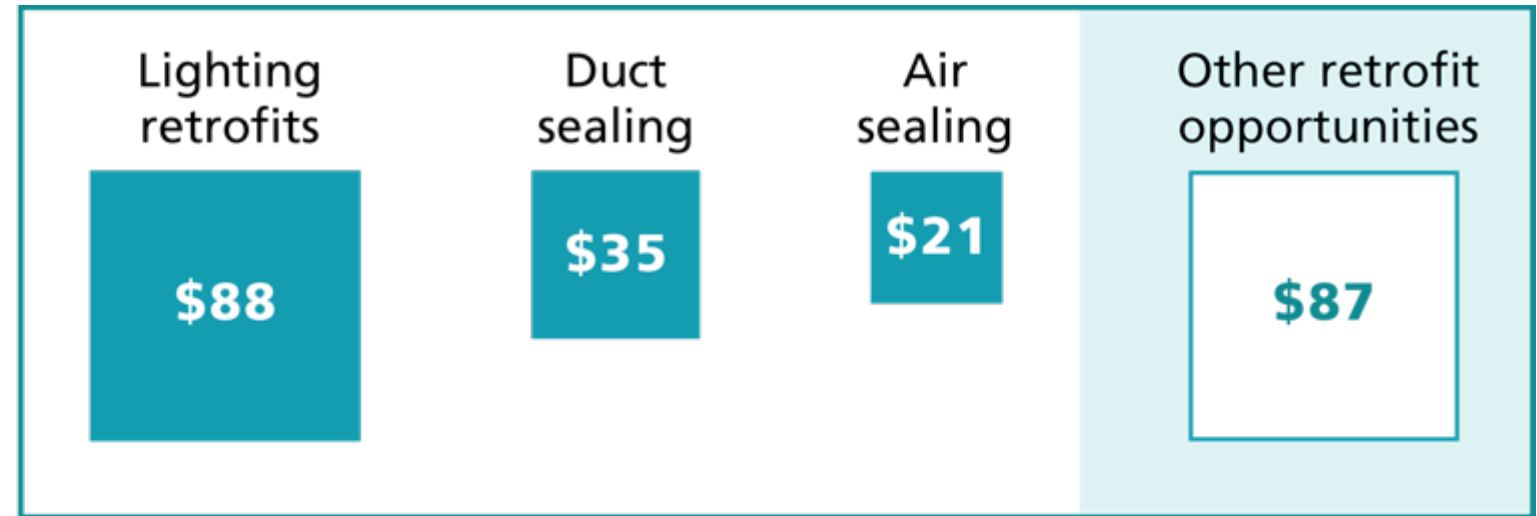
\$22

Other behavioral opportunities

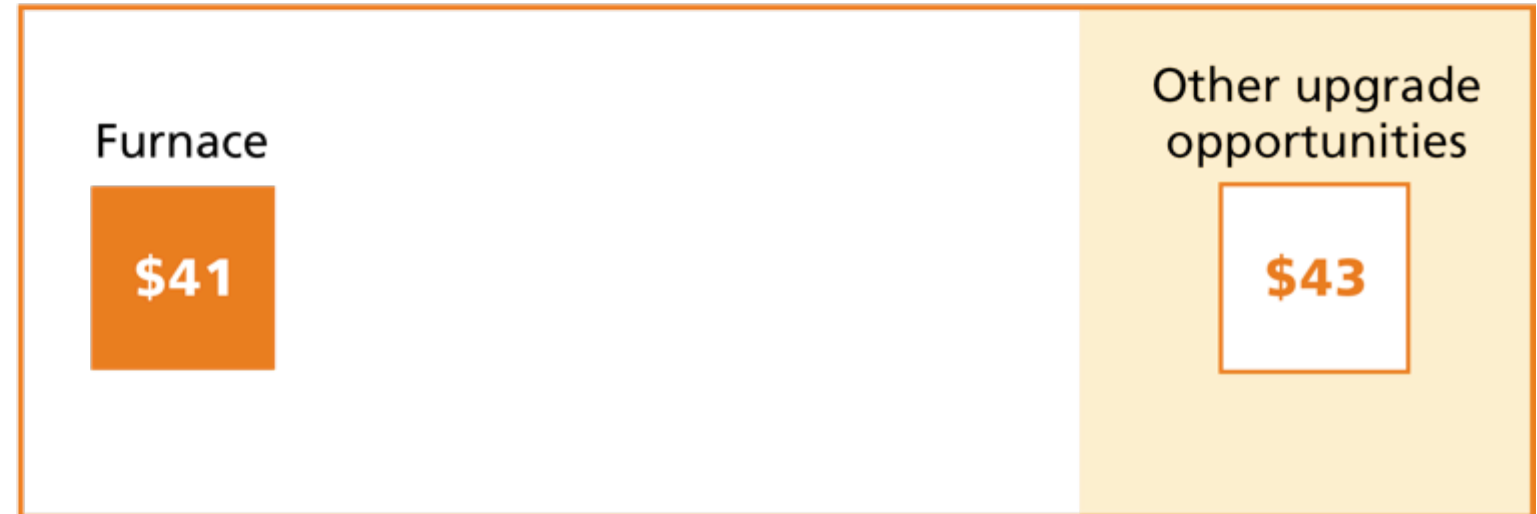
\$35

# Energy saving opportunities (\$480 per home)

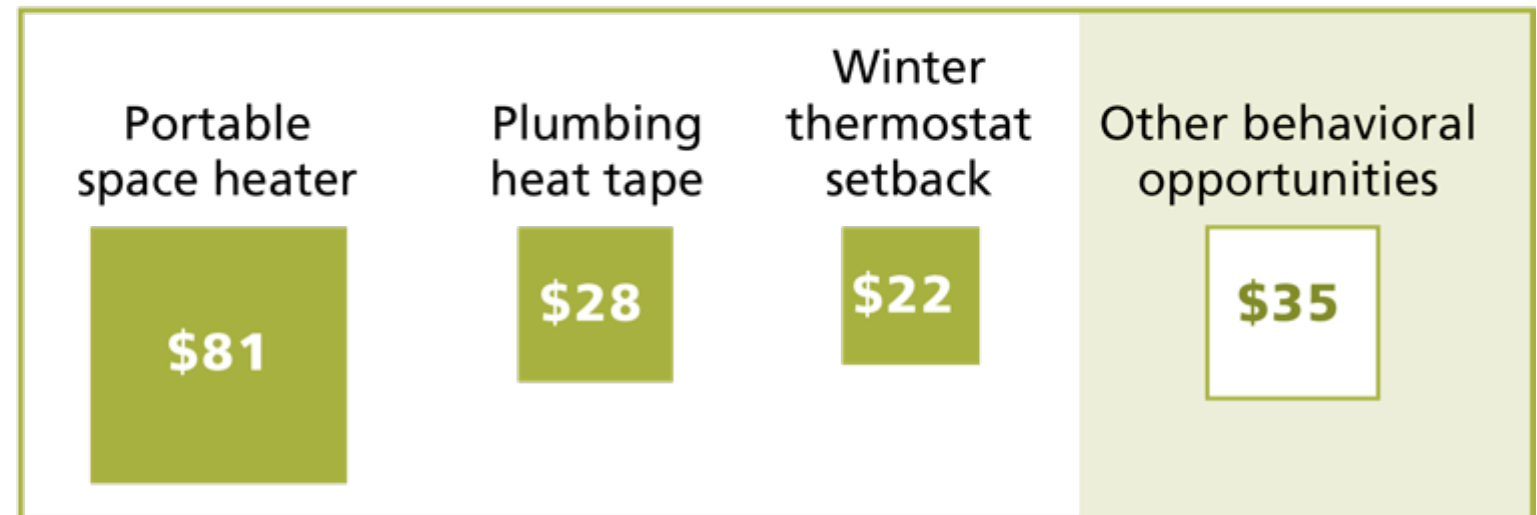
## RETROFIT OPPORTUNITIES (\$231/home)



## UPGRADE OPPORTUNITIES (\$84/home)



## BEHAVIORAL OPPORTUNITIES (\$166/home)



# Opportunities by interest and ability of homeowner

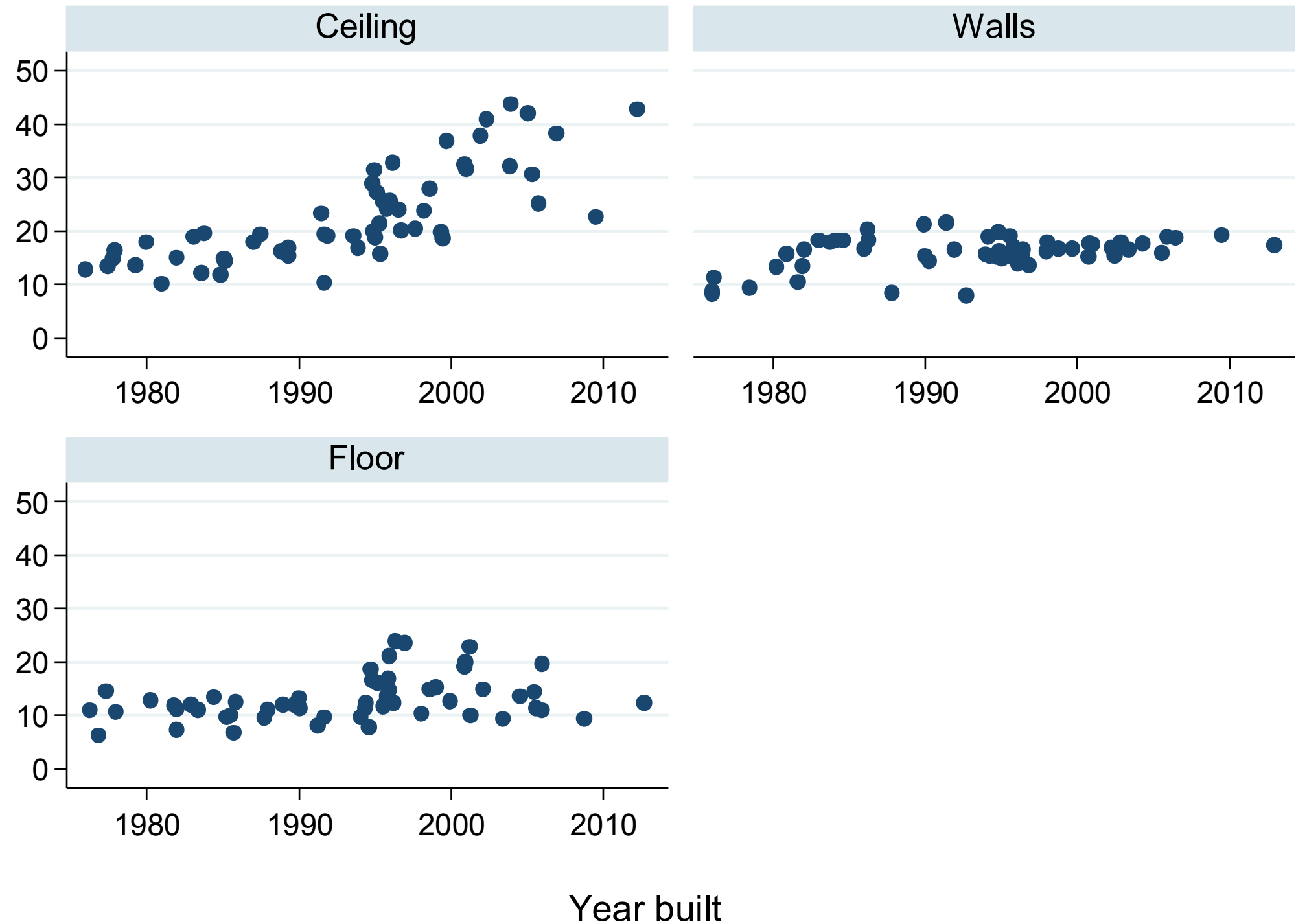
		ABILITY			
		Low	Medium	High	Total
WILLINGNESS	Not willing	1%	<1%	0%	1%
	Somewhat willing	18%	11%	<1%	30%
	Willing	20%	14%	9%	42%
	Very willing	3%	5%	19%	27%
	<b>Total</b>	<b>42%</b>	<b>30%</b>	<b>28%</b>	<b>100%</b>

# Opportunities by interest and ability of homeowner

		ABILITY			
		Low	Medium	High	Total
WILLINGNESS	Not willing	1%	<1%	0%	1%
	Somewhat willing	18%	11%	<1%	30%
	Willing	20%	14%	9%	42%
	Very willing	3%	5%	19%	27%
	<b>Total</b>	<b>42%</b>	<b>30%</b>	<b>28%</b>	<b>100%</b>

47%

# Nominal Insulation levels



\*inverse of listed U-value



# Minnesota Administrative Rule 1350.3800

## **1350.3800 CONSTRUCTION ALTERATIONS.**

Subpart 1. **Effect on seal or label.** Any alteration of the construction, plumbing, heating, cooling, fuel-burning system, electrical equipment, installation, or fire safety in a manufactured home that bears a seal or label, prior to receiving review and approval, and prior to obtaining permits, which include necessary inspections, shall void the approval, and the seal or label shall be returned to the commissioner.

Subp. 2. **Acts not constituting alterations.** The following shall not constitute an alteration: repairs with approved components or parts; conversion of listed fuel-burning appliances in accordance with the terms of their listing; adjustment and maintenance of equipment; or replacement of equipment in kind.

Subp. 3. **Application.** Any person proposing an alteration to a manufactured home bearing a seal or label shall make application for review and approval of the alteration to the commissioner or to the local authority having jurisdiction on the form issued by the commissioner.

Subp. 4. **Inspection.** Upon completion of the alteration, the applicant shall request the commissioner or the local authority having jurisdiction to make an inspection pursuant to part [1350.2100](#) to determine code compliance of the approved alteration.

Subp. 5. **Replacement construction seal.** If approvals and inspections for alterations were not obtained, and the home's construction seal or label is removed by the commissioner, or the commissioner ordered removal by the local authority having jurisdiction, then the applicant may apply for a replacement construction seal upon inspection and approval of the alteration. Replacement construction seals shall require submission of an application in accordance with part [1350.0500](#), subpart 2.

# Minnesota Administrative Rule 1350.3800

## 1350.3800 CONSTRUCTION ALTERATIONS.

Subpart 1. **Effect on seal or label.** Any alteration of the construction, plumbing, heating, cooling, fuel-burning system, electrical equipment, installation, or fire safety in a manufactured home that bears a seal or

***Subpart 1. Effect on seal or label.*** Any alteration of the construction, plumbing, heating, cooling, fuel-burning system, electrical equipment, installation, or fire safety in a manufactured home that bears a seal or label, prior to receiving review and approval, and prior to obtaining permits, which include necessary inspections, shall void the approval, and the seal or label shall be returned to the commissioner.

inspection and approval of the alteration. Replacement construction seals shall require submission of an application in accordance with part [1350.0500](#), subpart 2.

# Minnesota Administrative Rule 1350.3800

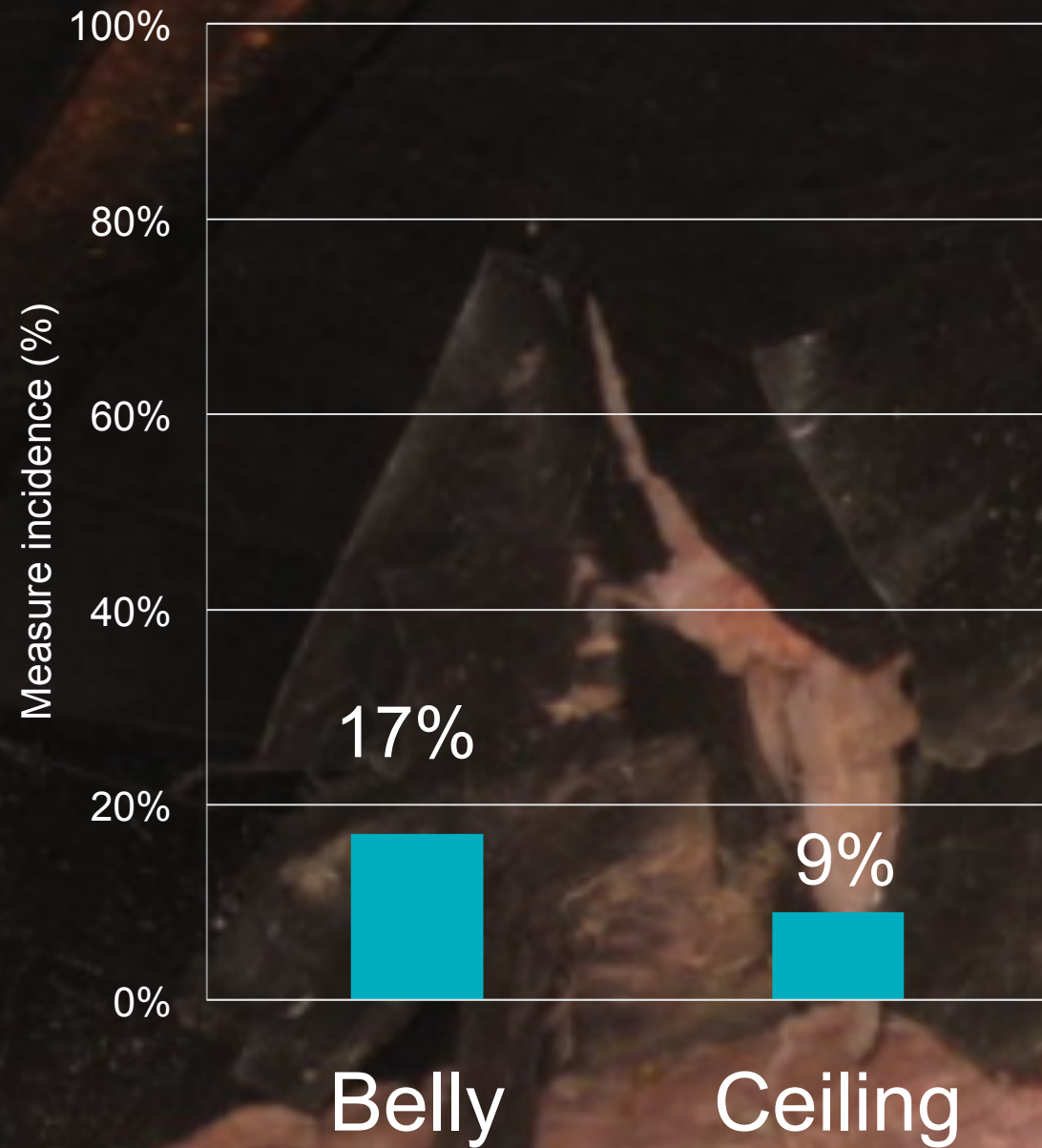
## 1350.3800 CONSTRUCTION ALTERATIONS.

Subpart 1. **Effect on seal or label.** Any alteration of the construction, plumbing, heating, cooling, fuel-burning system, electrical equipment, installation, or fire safety in a manufactured home that bears a seal or label, prior to receiving review and approval, and prior to obtaining permits, which include necessary inspections, shall void the approval, and the seal or label shall be returned to the commissioner.

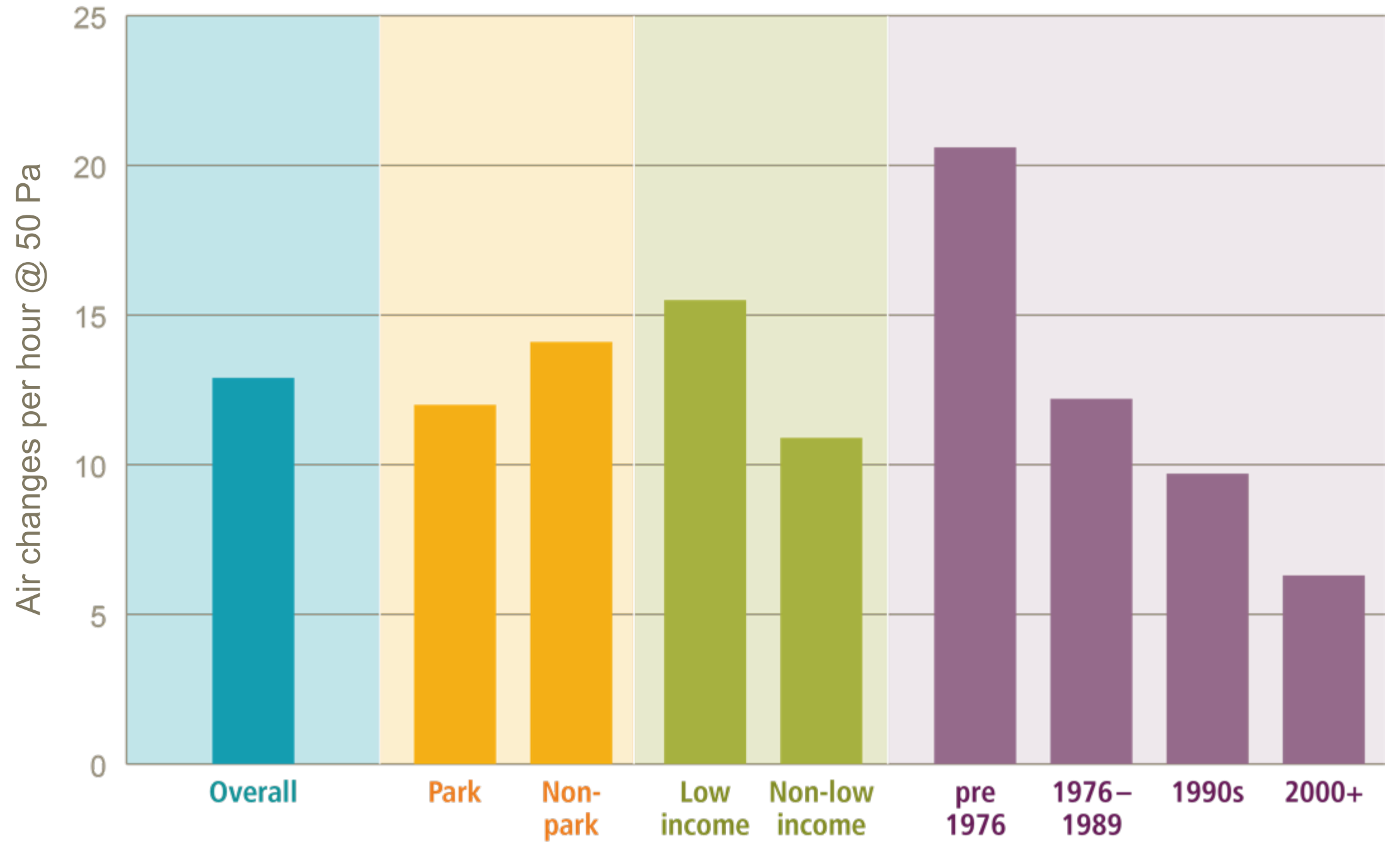
***Subp. 3. Application.*** Any person proposing an alteration to a manufactured home bearing a seal or label shall make application for review and approval of the alteration to the commissioner or to the local authority having jurisdiction on the form issued by the commissioner.

Subp. 5. **Replacement construction seal.** If approvals and inspections for alterations were not obtained, and the home's construction seal or label is removed by the commissioner, or the commissioner ordered removal by the local authority having jurisdiction, then the applicant may apply for a replacement construction seal upon inspection and approval of the alteration. Replacement construction seals shall require submission of an application in accordance with part [1350.0500](#), subpart 2.

# Insulation is limited in MN to restoring to original condition



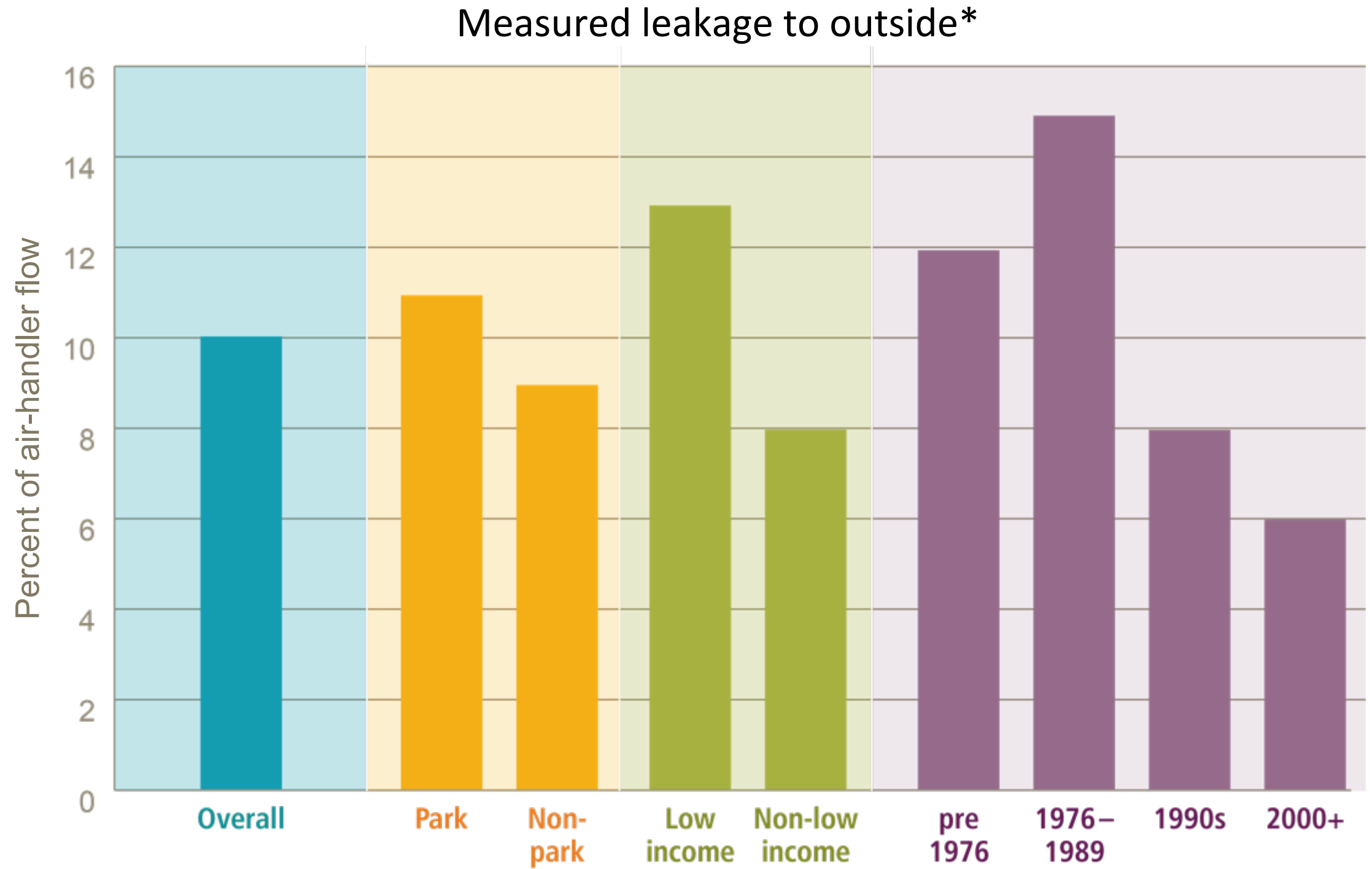
# Air leakage



Some homes that we visited had already been air sealed by WAP



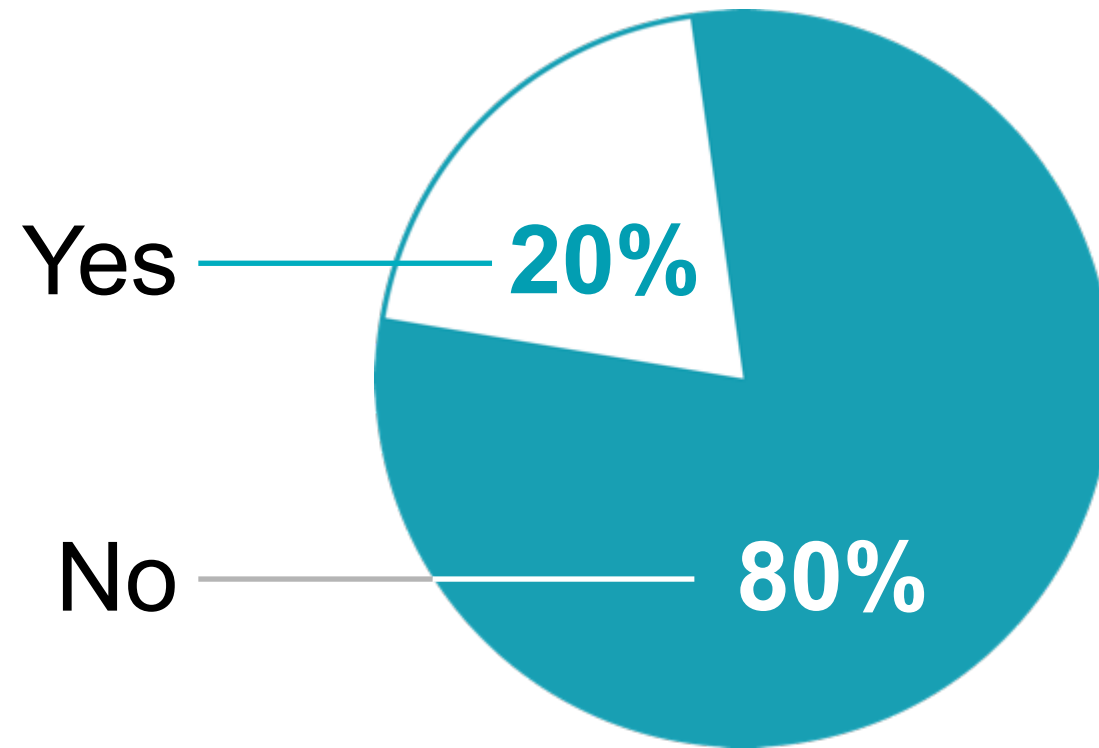
# Duct leakage



\*from duct pressurization testing at 25 Pascals

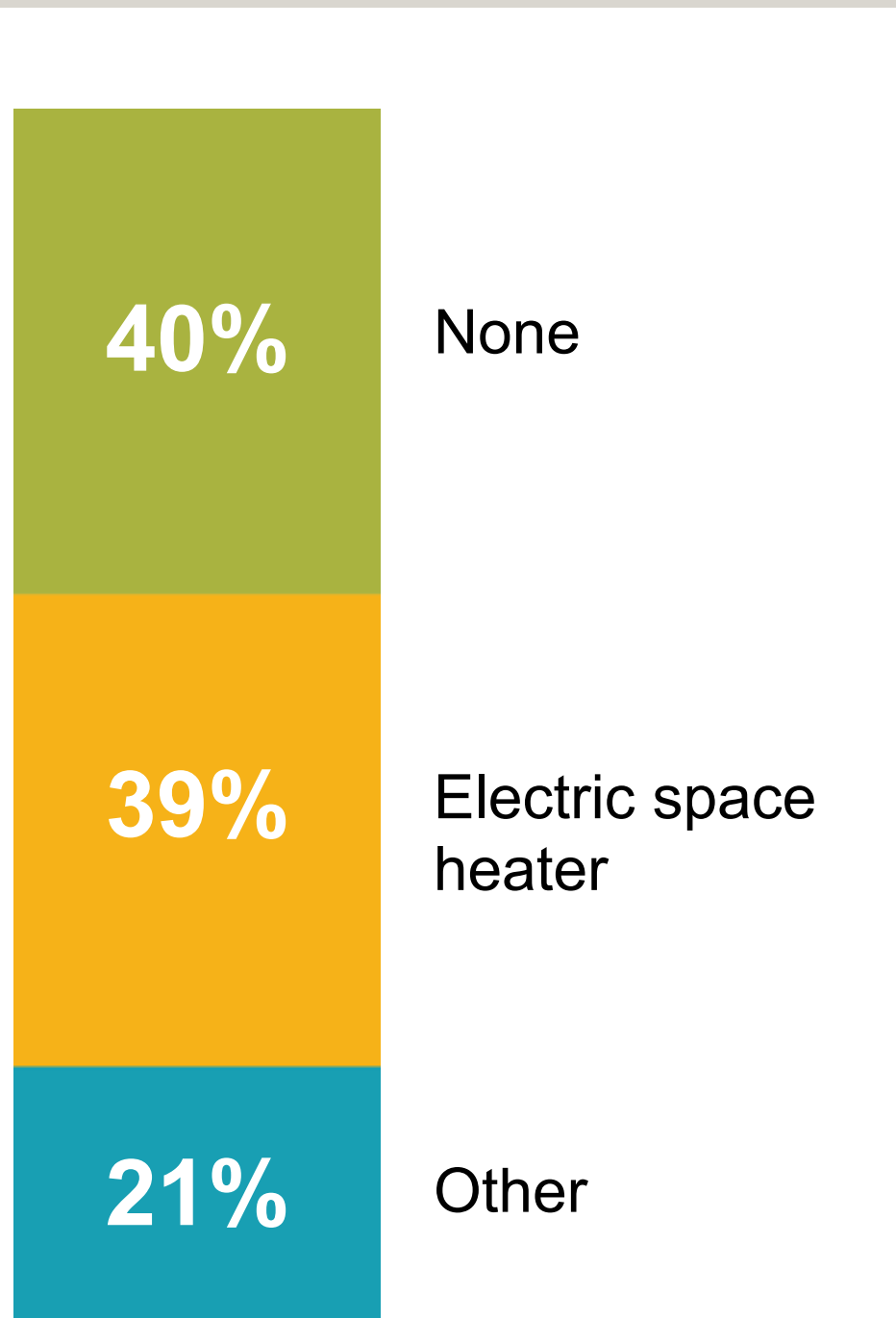
# Furnaces

## Condensing furnace?

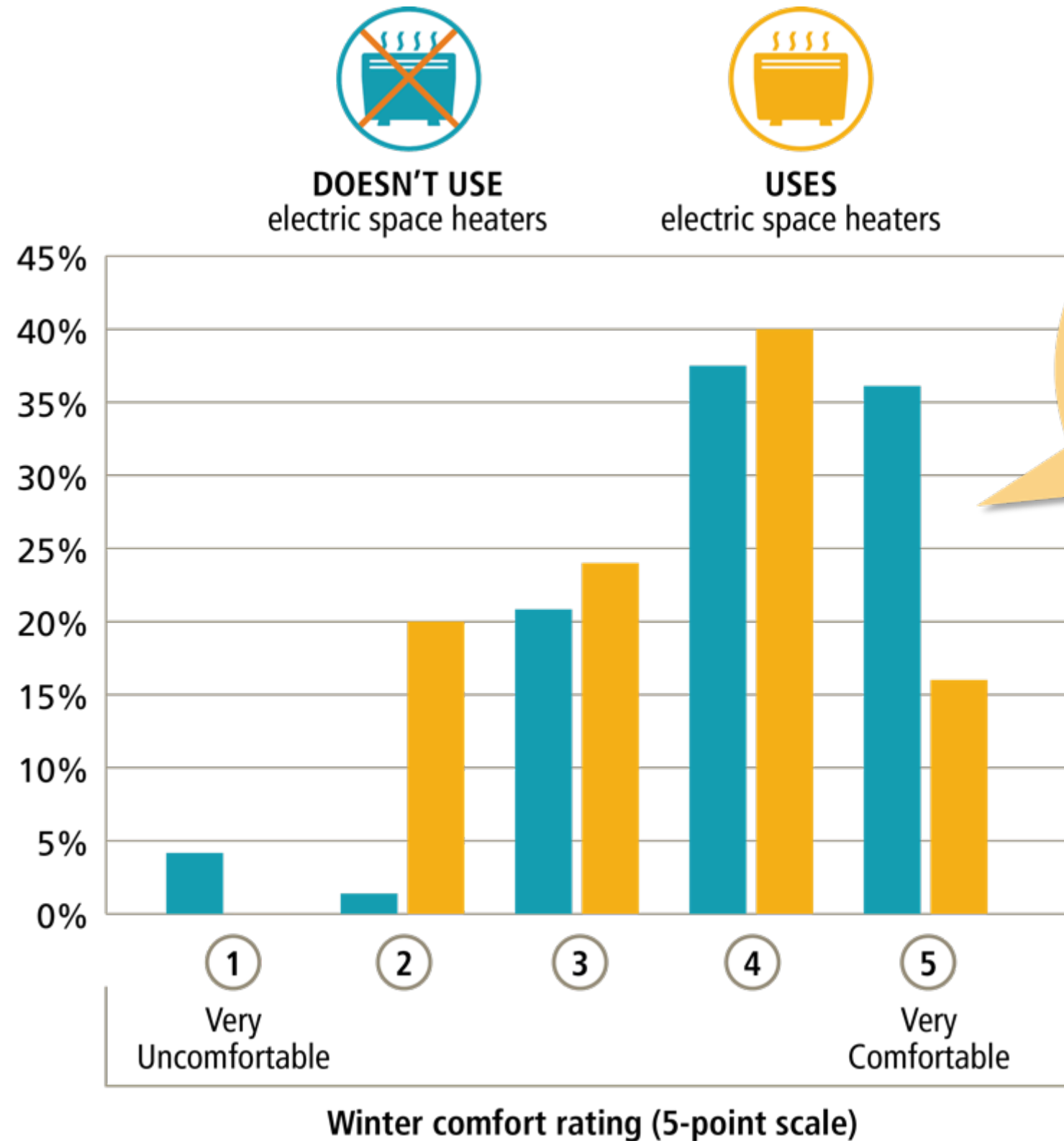




# Supplemental heating systems



# Space heaters and comfort



People who use space heaters are less likely to say they're very comfortable (5) and more likely to say they're somewhat uncomfortable (2)...

**10%**  
None

**66%**  
Central

**24%**  
Room

## Cooling



# Water heating



**61%**  
Electric



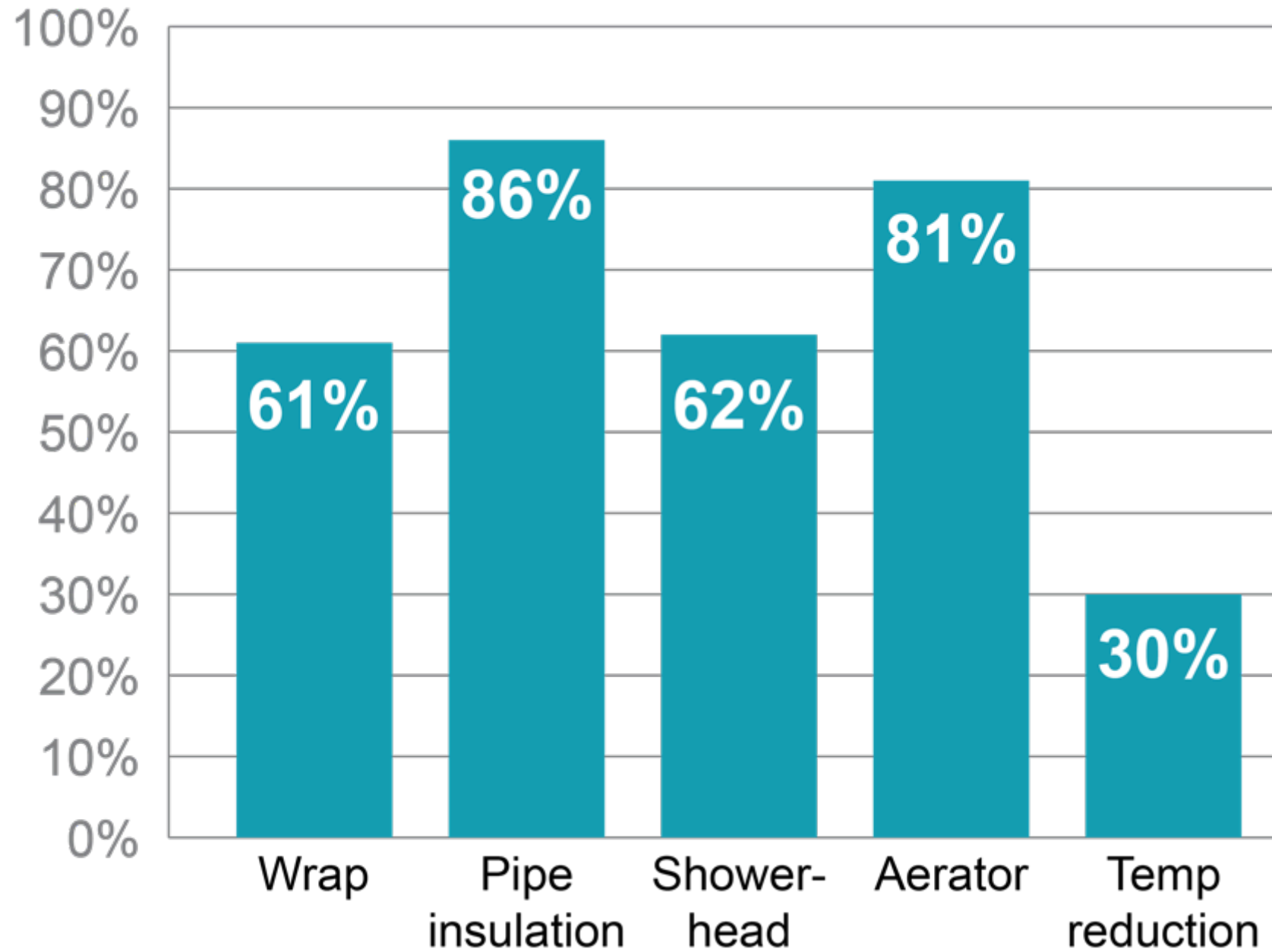
**28%**  
Natural gas



**10%**  
Propane



# Hot-water-savings measure incidence



What's the percentage of incandescent lighting in manufactured homes?

POP QUIZ!

- A** 25%
- B** 55%
- C** 85%
- D** 95%

84%

9%

6%

2%

12/01

Incandescent

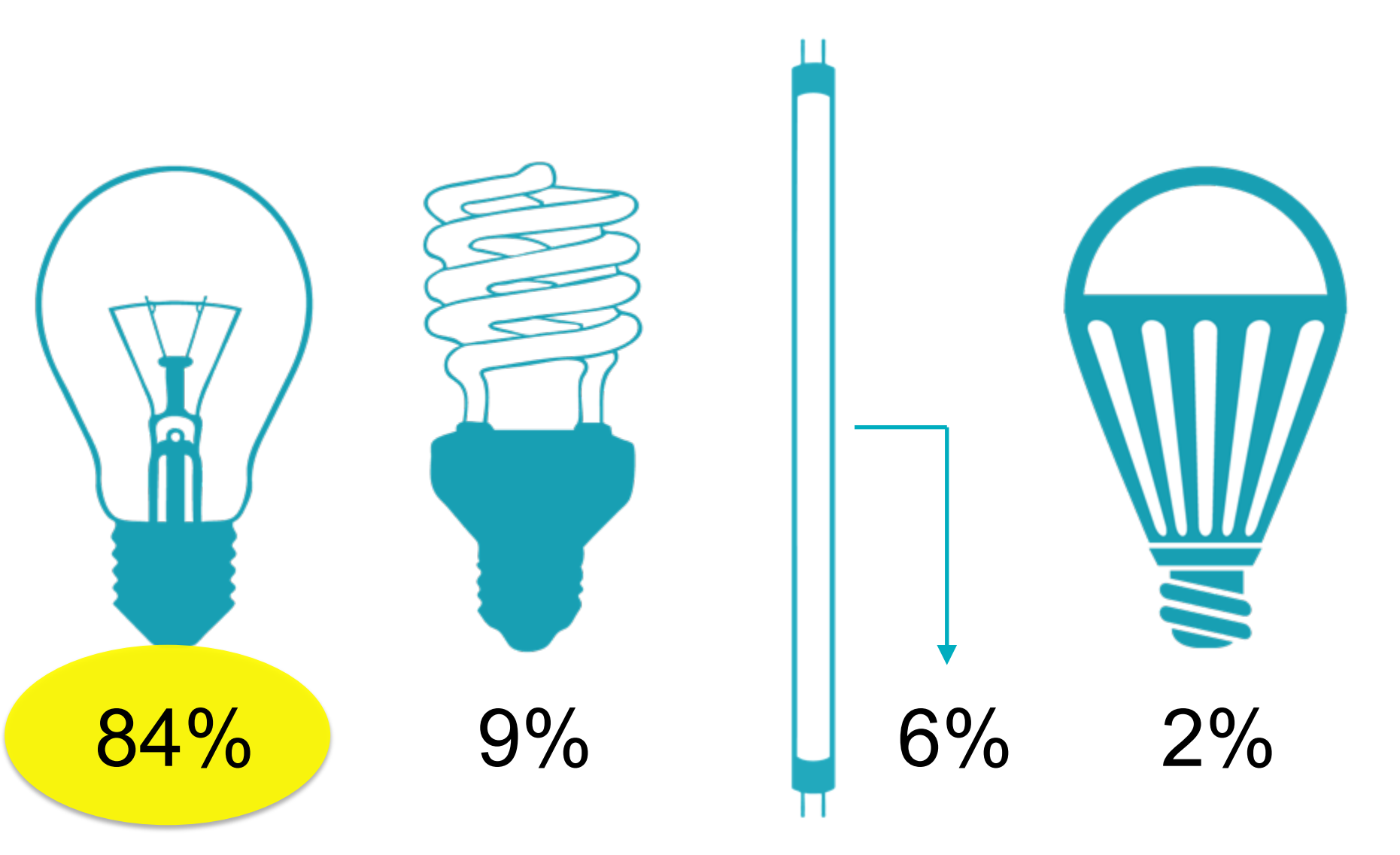
CFL

Linear  
fluorescent

LED

# Lighting

## Estimated percent of lighting energy use



Incandescent

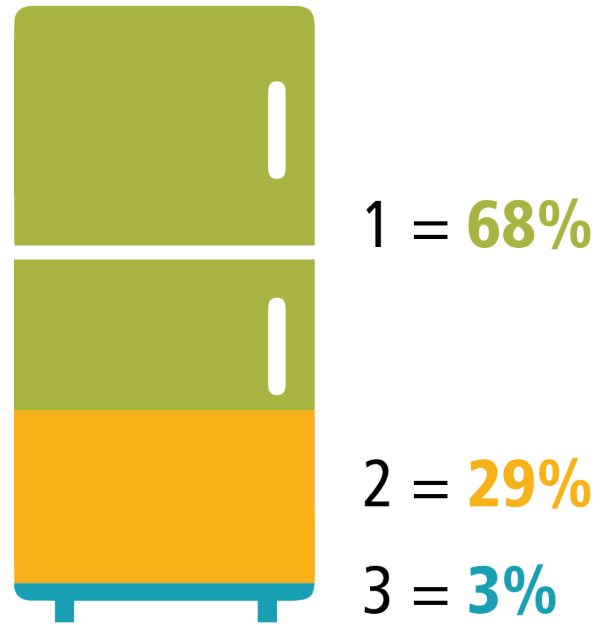
CFL

Linear  
fluorescent

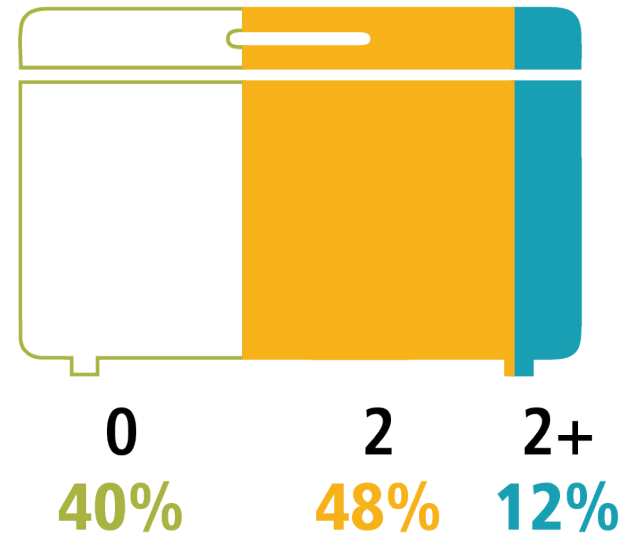
LED

# Refrigerators and freezers

### Number of refrigerators

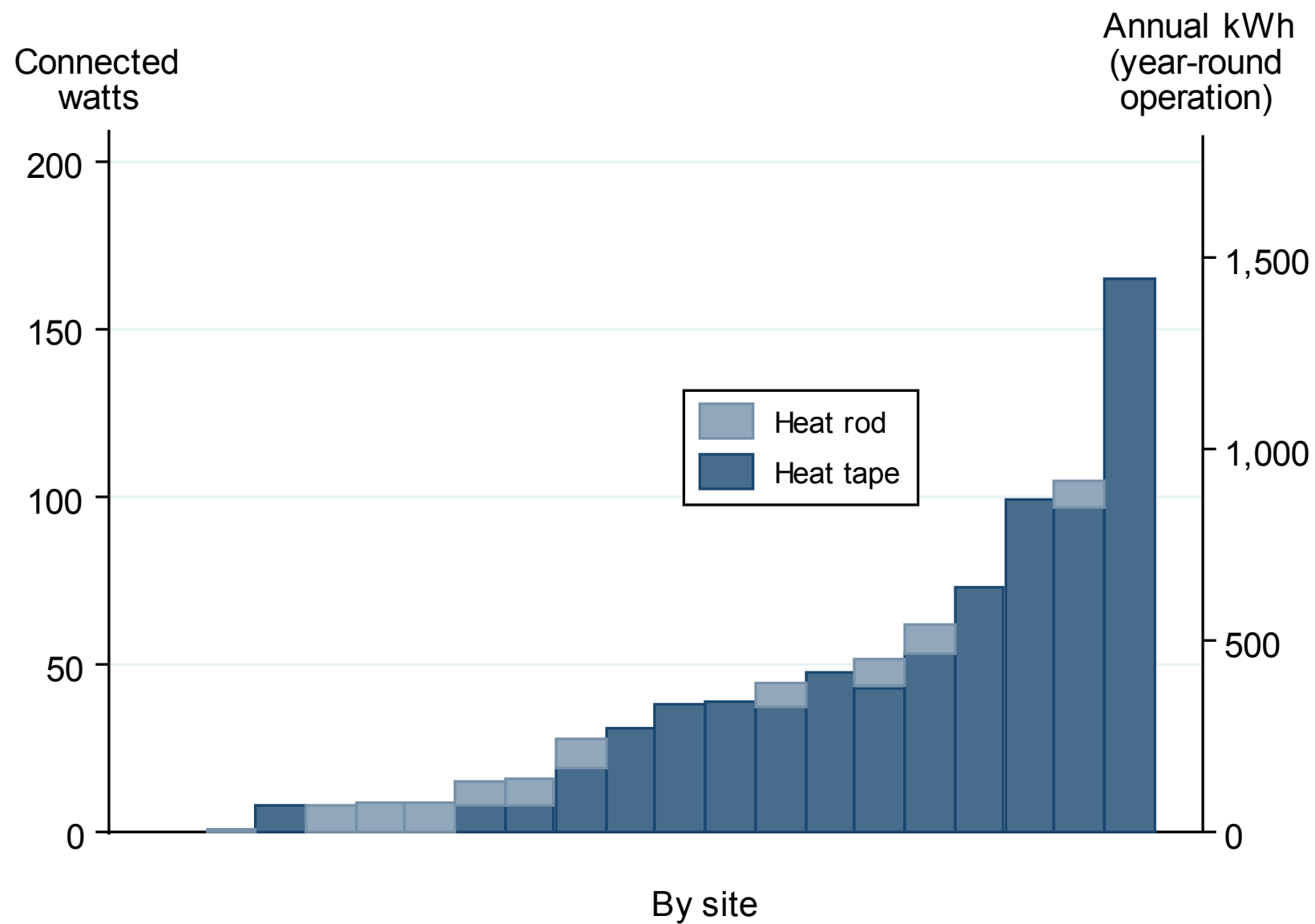


### Number of freezers





# Plumbing heat tape



Repair  
issues



# Recommendations

- 1 Utilities should **work closely with the Minnesota Weatherization Assistance Program**
- 2 Engage with WAP by **helping identify the many manufactured homes on private property** for targeting low-income services
- 3 Manufactured-homes parks provide an **opportunity for “blitz”** type programs specifically targeting this housing
- 4 Utilities and the State could coordinate on ways to address the significant use of **electric space heaters**
- 5 Utilities could expand the scope of their existing residential new construction programs to provide incentives for the purchase and installation of an **ENERGY STAR manufactured home**

For the fun of it...

# *Atlantic*<sup>®</sup> *Manufactured Homes*



*Built Better From the Inside Out™*



**CHAMPION**  
HOME BUILDERS CO.

For the fun of it...



# Thank you

Scott Pigg

[SPigg@Seventhwave.org](mailto:SPigg@Seventhwave.org)

608.210.7138

Jeannette LeZaks

[JLeZaks@Seventhwave.org](mailto:JLeZaks@Seventhwave.org)

608.210.7156

Full report can be found here:

<http://www.seventhwave.org/manufactured-homes-study>





I love my udders

This kitchen of two choices (take it slow)

COW COLLECT

Welcome!

PRIMA

