

Half a Million Homes & Five Data Sets: A Delicious Retrofit Recipe



Affordable Comfort
San Francisco CA
March 31, 2011

Rachel Scheu
Jessica Spanier
CNT Energy

Session Goal

Explain and demonstrate how large home energy data sets can help accelerate home energy retrofit activity.

- Energy use and housing characteristics of the single family homes in the Chicago metropolitan region
- How these data can be used to provide value to Homeowners, Contractors/Auditors, Program Administrators, Realtors

Qualifier: We understand that every home has unique energy use. These data are not meant to replace analysis at the individual home level. These data are meant to describe a population.

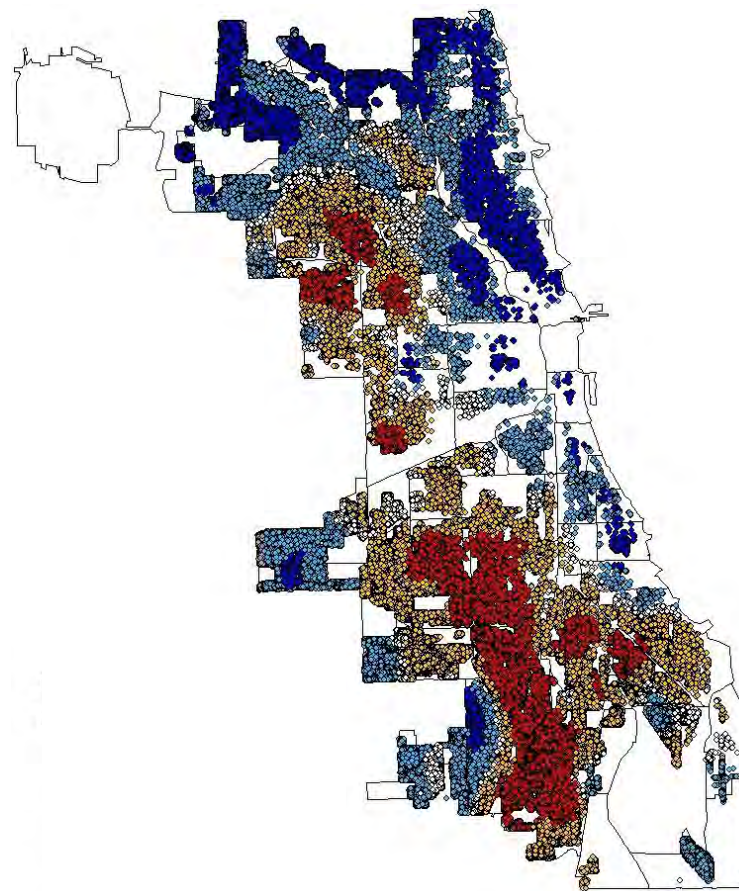
Presentation Contents

- CNT & CNT Energy Approach
- Research Approach and Objectives
- Descriptives of Housing and Energy Use
 - County
 - City
 - Chicago Bungalows
- Operational Energy Use Model
- Why Large Data Sets are Valuable
 - Challenges, Opportunities and Next Steps

Amuse bouche:

Some things that might surprise you

1. Our large data set shows that Chicago homes are twice as energy intensive as the RECs Midwest estimate.
2. Based on a few simple ingredients, our model predicts energy consumption and provides insight into energy efficiency program design
3. We can see EXACTLY where the clusters of high-energy use are.



Center for Neighborhood Technology is a Think-and-Do Tank



Working to promote livable and sustainable communities through more efficient use of resources

- Research
- Advocacy
- Demonstration projects



Received the 2009 MacArthur Award for Creative and Effective Institutions



5 focus areas and 2 non-profit affiliates

- Energy
- Transportation & Community Development
- Geographic Research and Analysis
- Natural Resources
- Climate Change



© CNT Energy 2011



Helping consumers, communities and businesses control energy costs and become more energy efficient

– Energy Planning

- Chicago Climate Action Plan
- Baseline energy analysis for 286 municipalities in the region

– Dynamic Pricing and Smart Grid

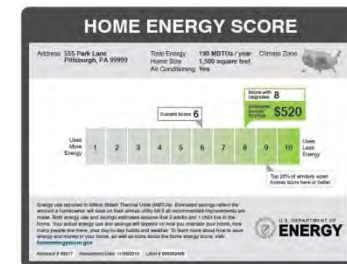
– Energy Efficient Buildings

- Implement retrofit programs
- Chicago Region Initiative for Better Buildings
- US DOE Home Energy Score Pilot
- USGBC LEED Post-occupancy Performance Evaluation
- Building America Team

**energy
savers**

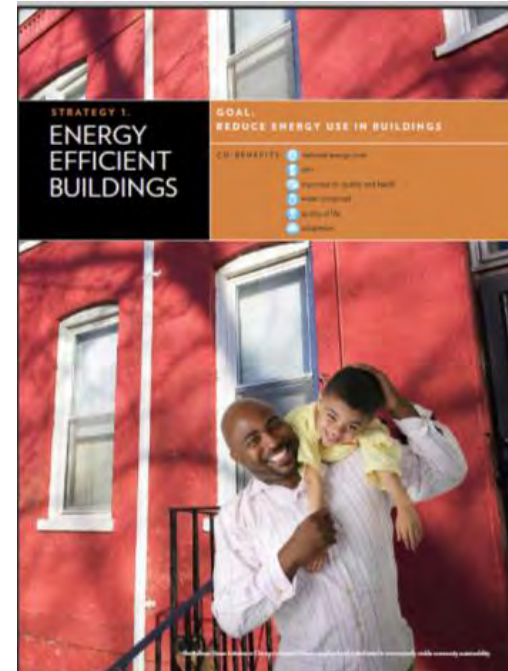
A one-stop energy efficiency shop
for multifamily building owners

Power Smart Pricing
CNTenergy



CCAP – Call to Action

- 80% of building stock in 2020 is already existing.
- Most of region's emissions from energy in buildings
 - Building GHG emissions 6 County region = 61%
 - Building GHG emissions Chicago = 70%
- Ambitious goals:
 - Scale up to 20,000 home retrofits per year!
 - 200,000 single family homes by 2020!



Why Large Data Sets?

- Data used to
 - Inform programs and policy
 - Verify and validate savings
 - Measurement of large scale retrofit impacts
 - Quantify energy efficiency benefits to customers
- Private investment in energy efficiency improvements – accelerate the uptake
 - Access to info, capital, workforce
 - Facilitate the marketplace to value efficiency
- Make housing affordable by reducing energy costs
 - Total Cost of Ownership

Total Cost of Ownership helps consumers make smarter mortgage decisions

Traditional Affordability (PITI)

- Principal
- Interest
- Taxes
- Insurance

Total Cost of Ownership

- PITI+
- Transportation
- Energy
- Maintenance

Which home best suits my family *and* our budget?



Evaluating CNT's Total Cost of Ownership Suite

Addresses lessons learned from foreclosure crisis:

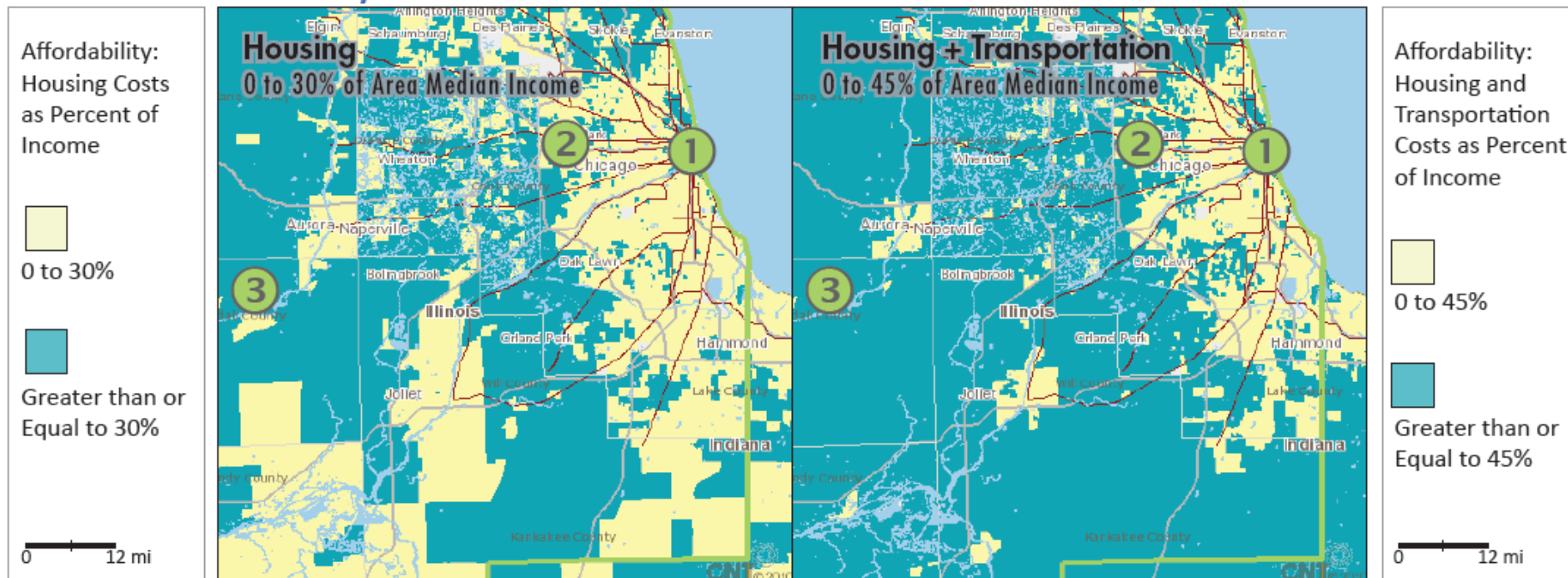
- More to affordability than just the mortgage
- Sustainability and affordability are connected
- REALTORS are home ownership advocates
- REALTORS and homebuyers need access to tools that inform the home-buying decision process

Center for Neighborhood Technology

H+T: Housing and Transportation Index



Two Views of Affordability



<http://htaindex.org>

<http://abogo.org>

Research Approach and Objectives

Research Objectives

- To provide description of housing stock and energy use characteristics in Chicago region
- To produce operational energy use model
 - Can we use available data to find homes with high EUI
 - Benchmark homes in the Chicago region

Geography/Scope – Cook County

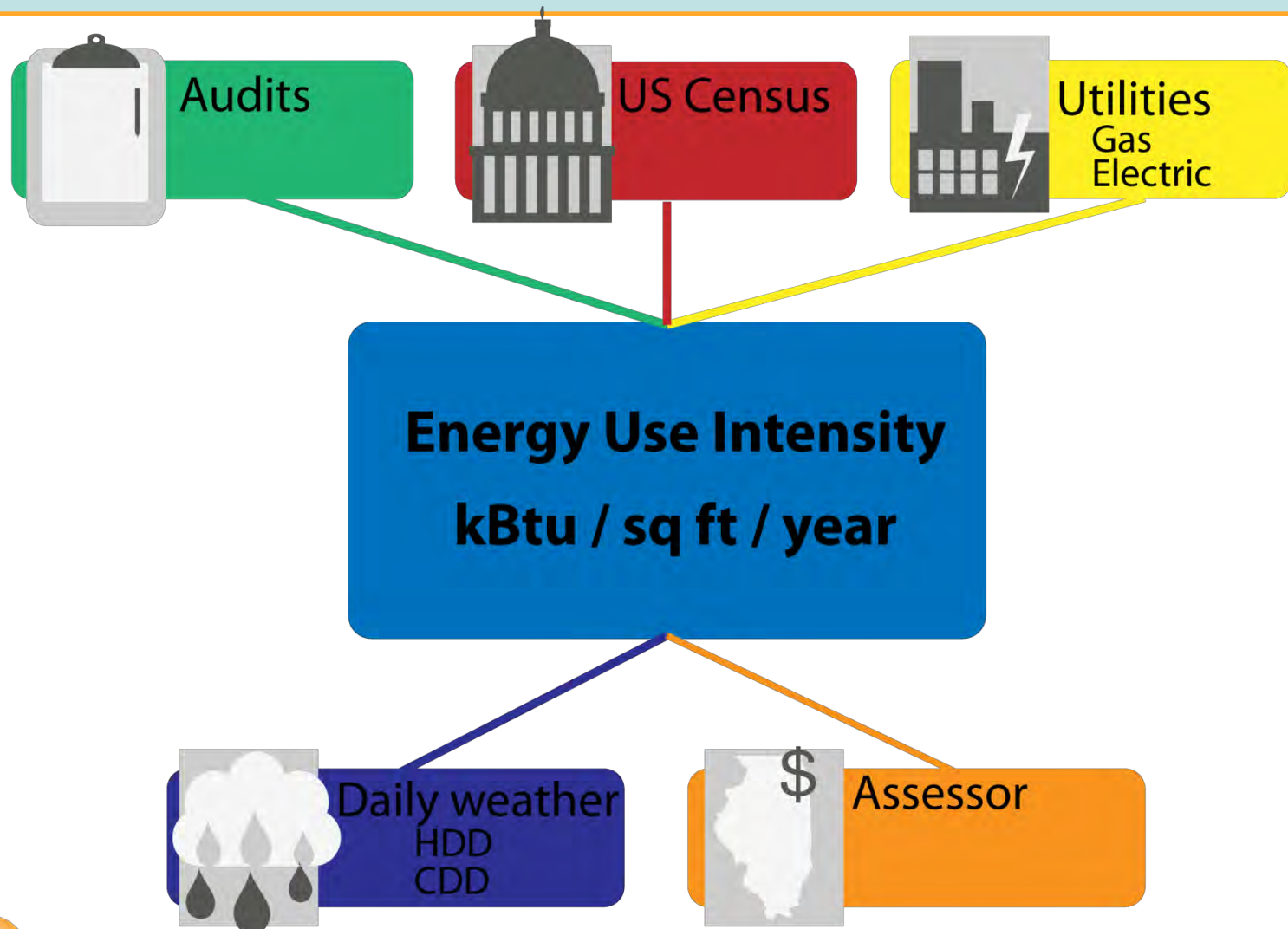
Cook County Single Family Housing & Demographics	
Size	1635 square miles
Households	Nearly 2 million
Single family Homes (n)	Nearly 1.1 million
Size of homes (median)	1,629 square feet
Year built (median)	1956
Construction type	Masonry 38% Frame 58% Other 4%
Household annual income (median)	\$59,903
Heating Systems	85% gas forced air, 15% hot water/steam
Central Air Conditioning penetration	40%

Geography/Scope – Chicago

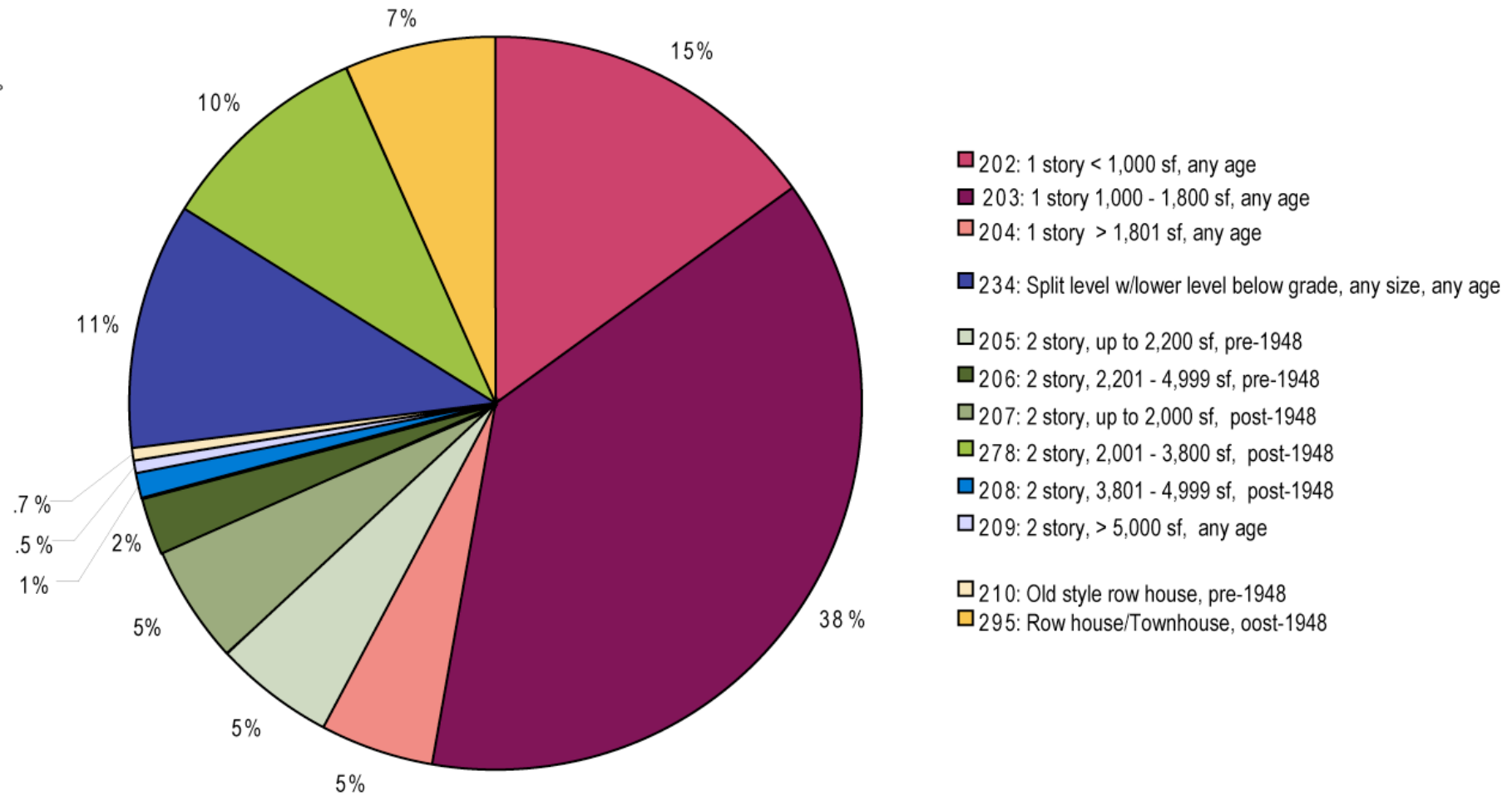


Chicago Single Family Housing & Demographics	
Size	234 square miles
Households	Nearly 1.1 million
Single family Homes (n)	Nearly 437,000
Size of homes (median)	1,440 square feet
Year built (median)	1926
Construction type	Masonry 58% Frame 38% Other 4%
Household annual income (median)	\$46,781
Heating Systems	75% gas forced air, 25% hot water/steam
Central Air Conditioning penetration	25%

Data sets



Cook County Single Family Housing and the Common Architectural Styles Represented within Tax Assessor Classifications



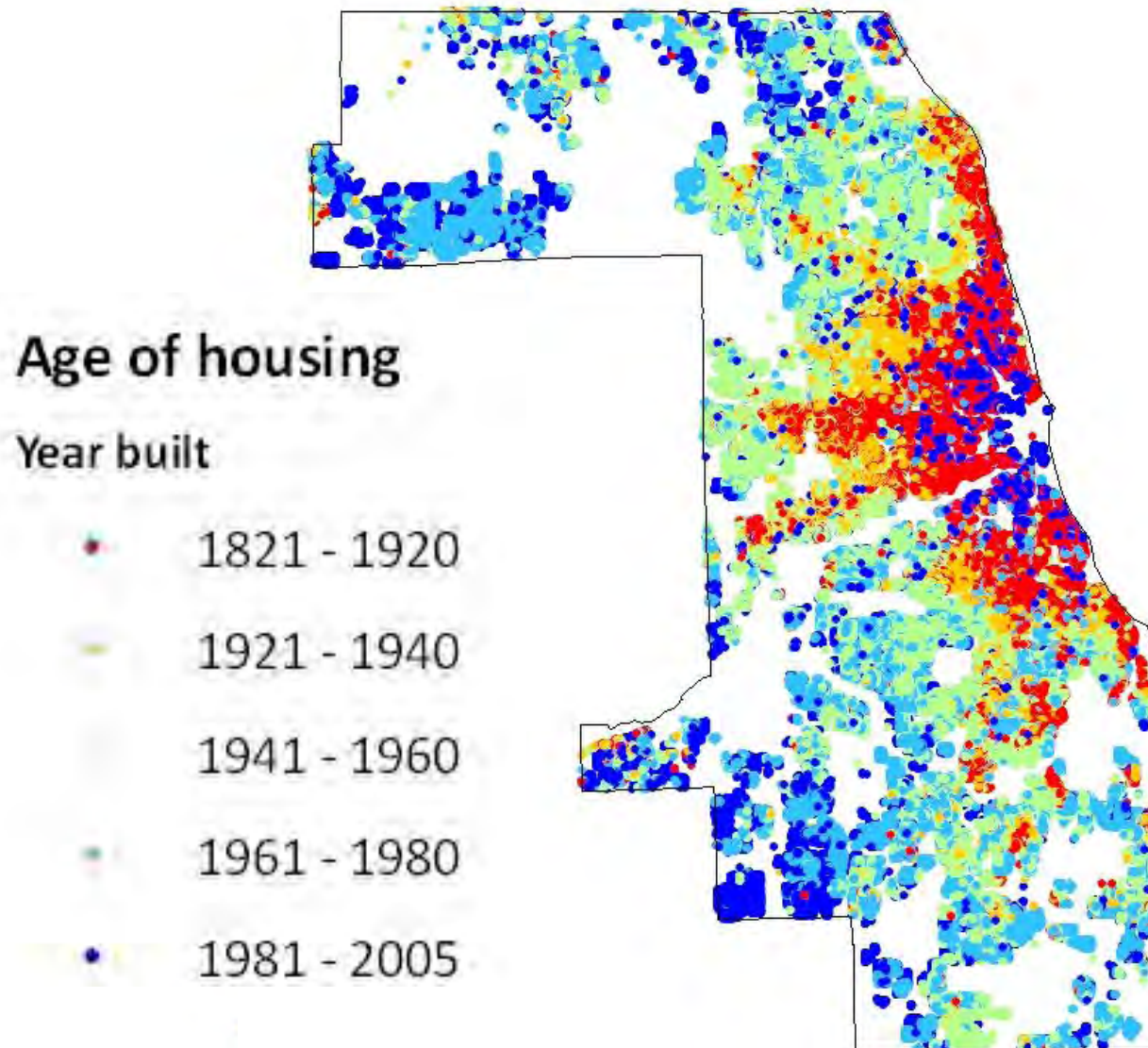
Why this data set is unique

Characteristic	2005 RECS, National	2005 RECS, East North Central	CNT Energy
# Homes	3,102	486	440,204
kWh	10,757	9,685	9,273
therms	706	934	1,306
kBtu - electric	36,703	33,045	31,639
kBtu - gas	70,589	93,353	130,600
Square feet	1,889	2,132	1,254
Year built	Before 1940	Before 1940	1957
EUI	57	59	129

Housing stock and energy use in the region



Cook County housing stock is old.



Cook County homes are energy intensive

Median EUI – 129

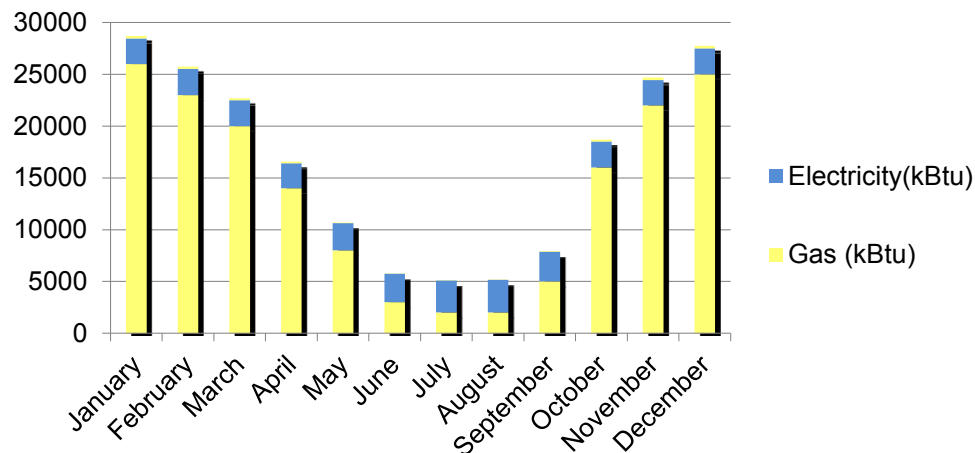
25th percentile EUI –99

75th percentile EUI –157

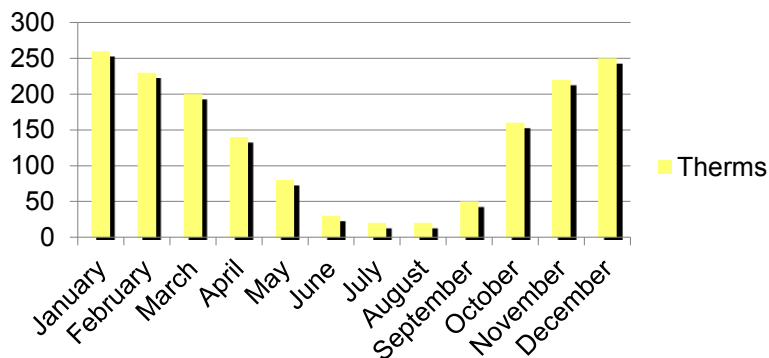
444,204 homes

These homes are gas-intensive

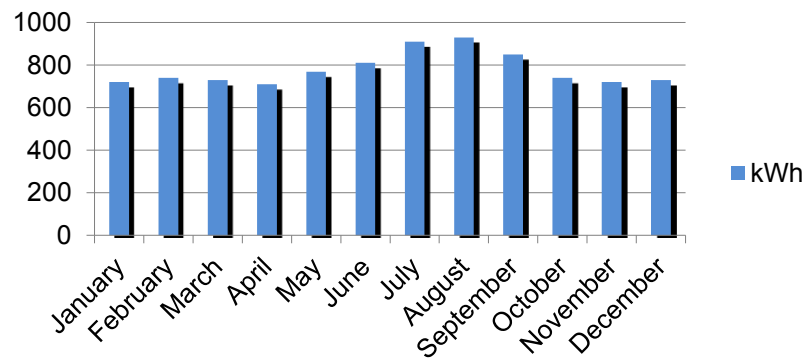
Energy Use (kBtu)



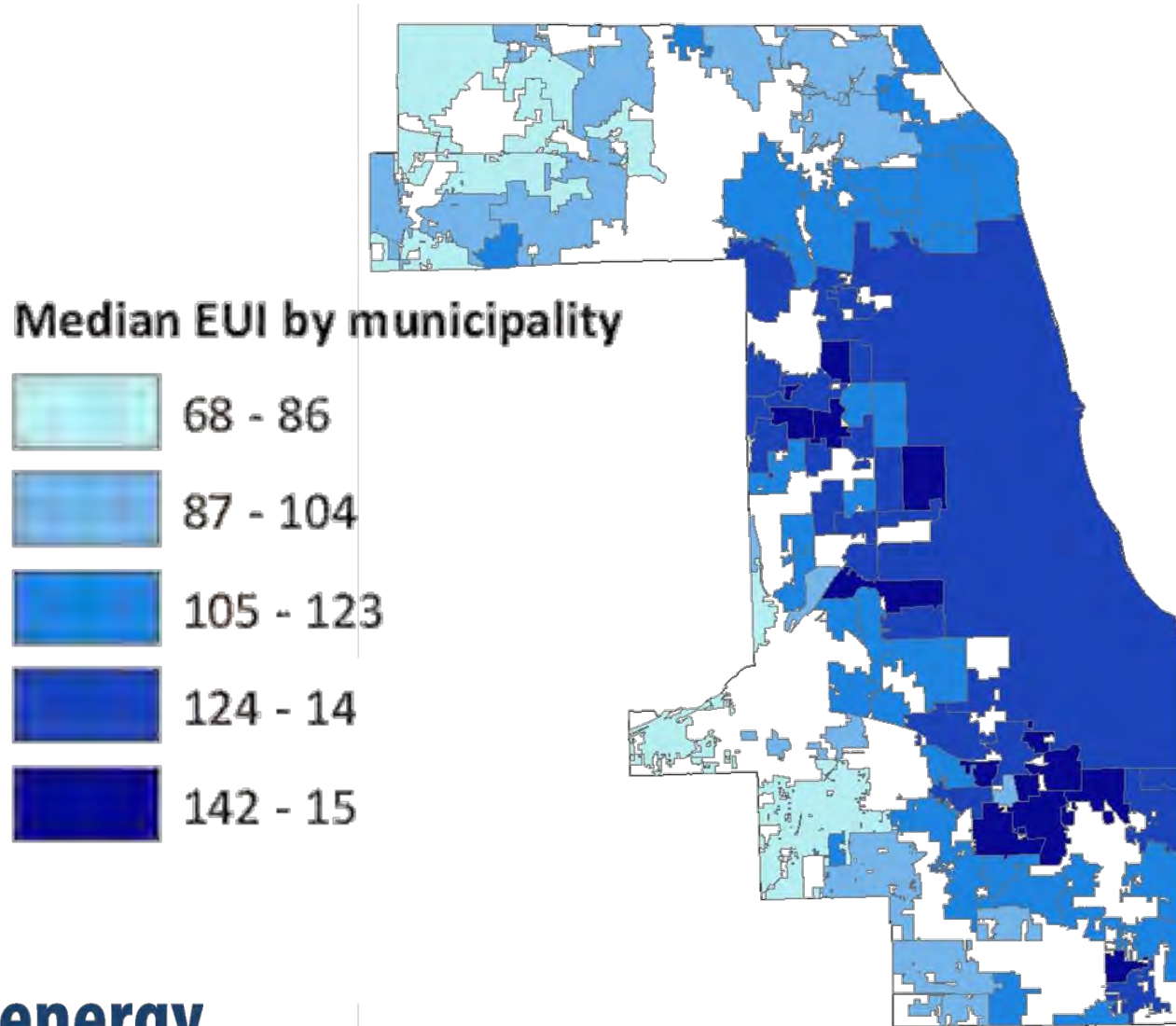
Therms



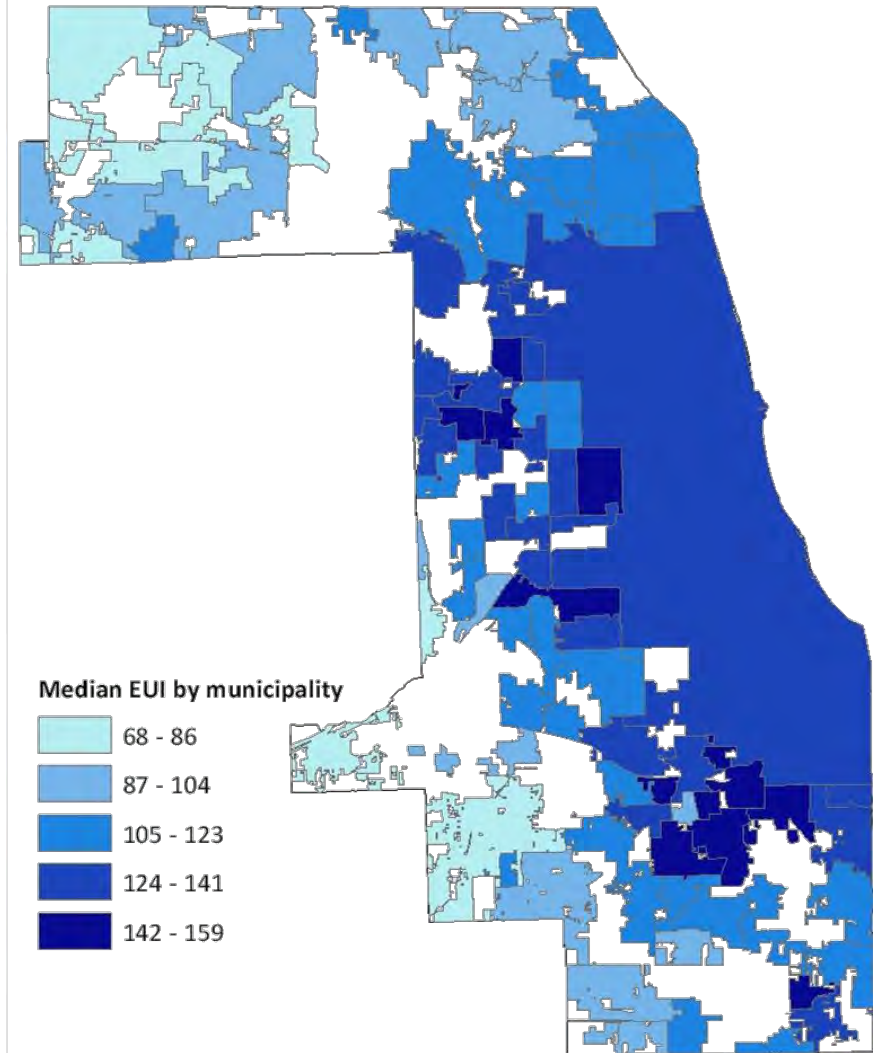
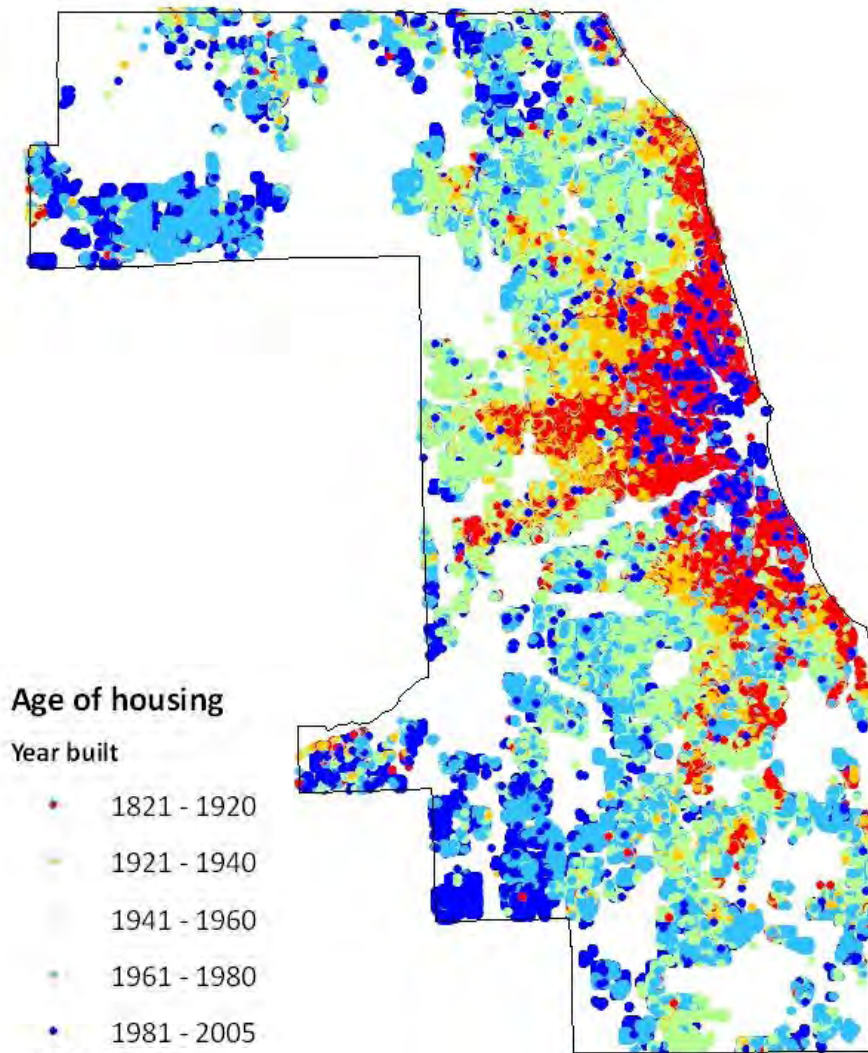
kWh



The suburbs surrounding Chicago have the highest median EUI.

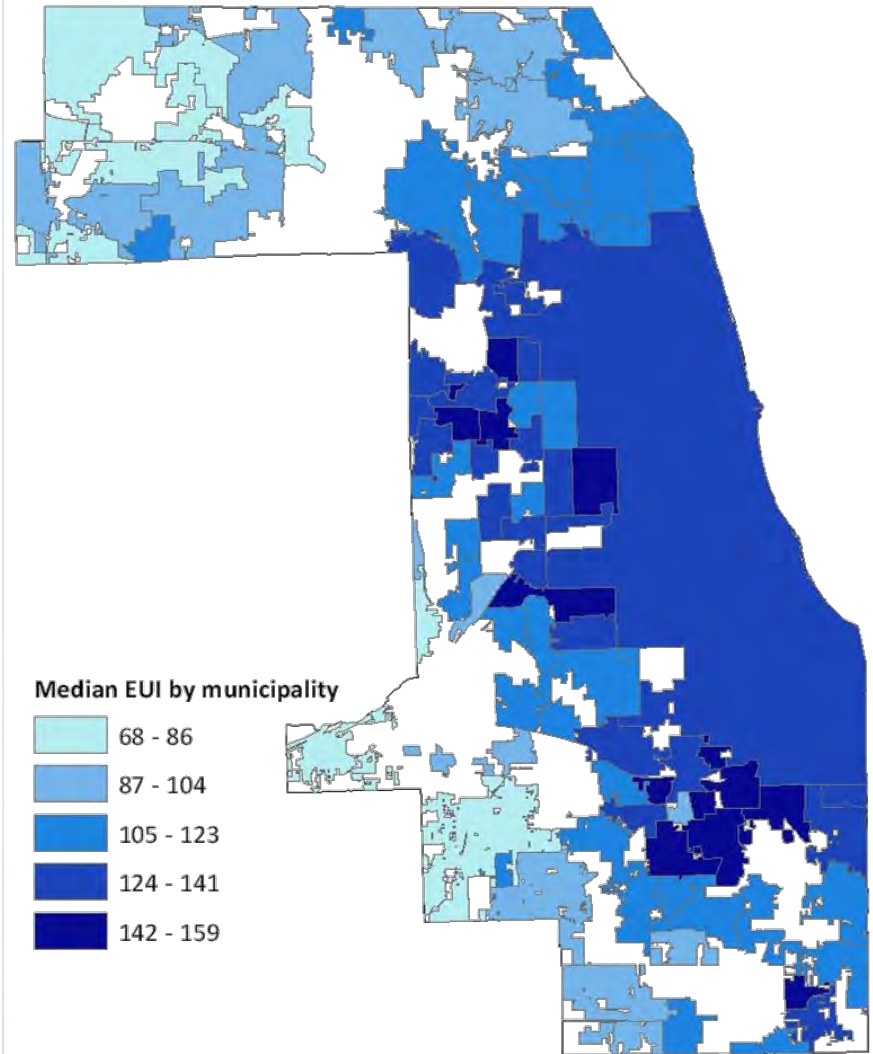
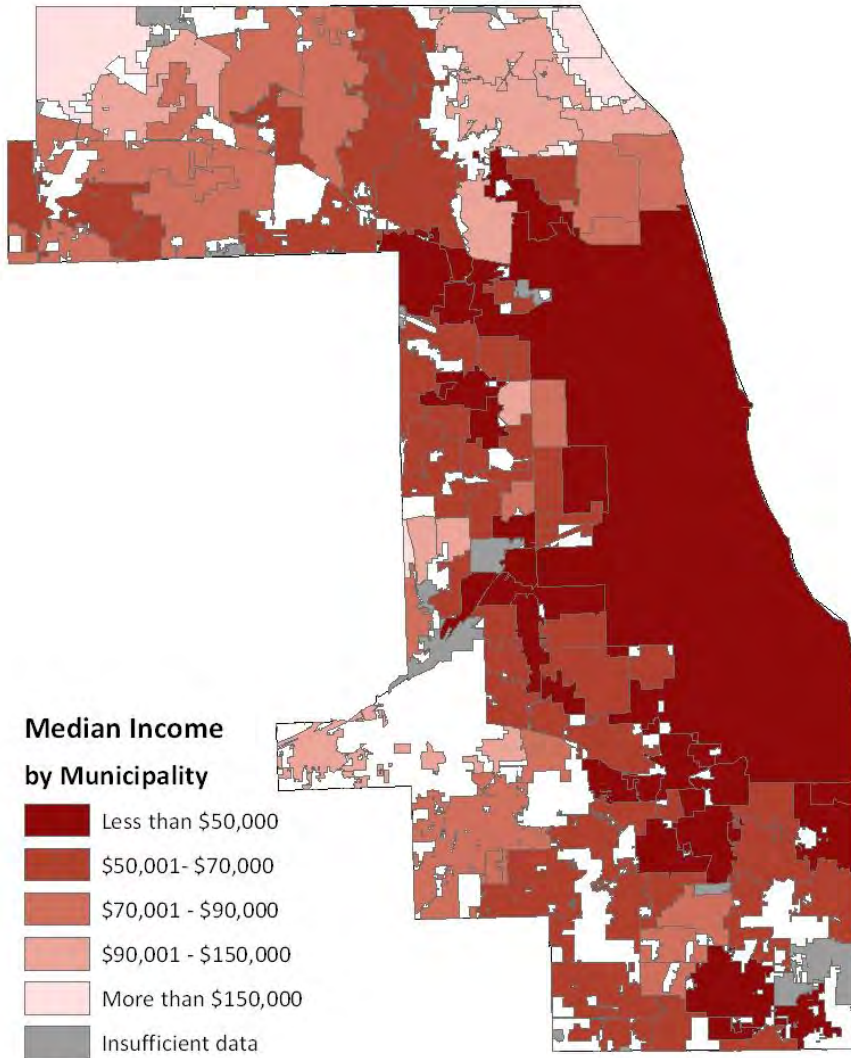


Areas of older housing have higher EUIs.



© CNT Energy 2011

Lower-income areas have higher EUIs.

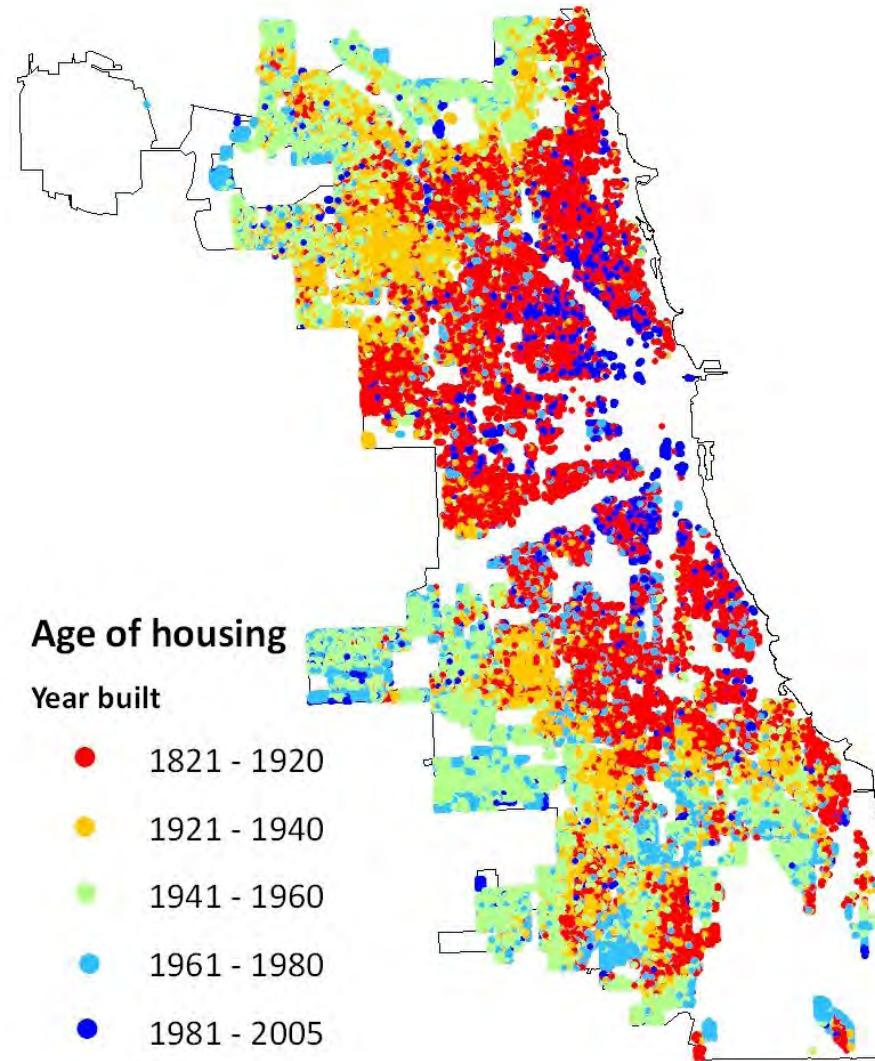


© CNT Energy 2011

Chicago



Chicago homes are old.



© CNT Energy 2011

Chicago Homes are Primarily Frame and Brick Construction



1



The Golden Chance for a Delightful Home in Town

368 RESIDENCE LOTS

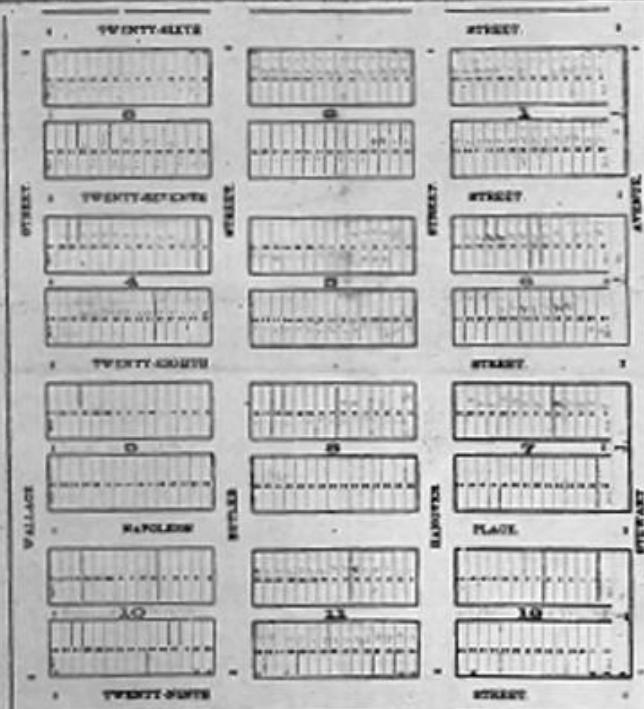
To be sold at Auction by WM. A. BUTTERS & CO., on

Thursday, July 9th, 1868

At two o'clock, P. M.

Sale to be made on the Ground.

JUDGE DAVIS' SUBDIVISION.



Of the North Half of the East Half of the Southwest Quarter, Section 28, Town 39, Range 14 East.

WORKINGMEN!

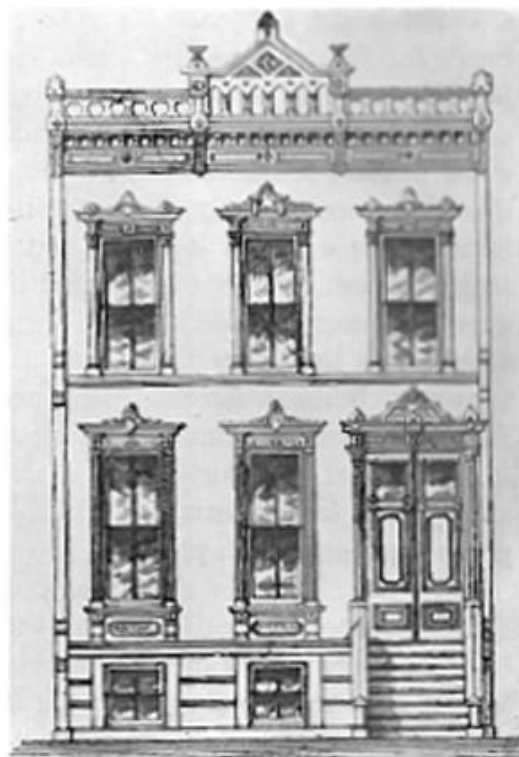
Now is your chance to buy a beautiful Residence Lot on easy terms. The "old time terms" of one quarter down, balance in one, two and three years, with interest at six per cent, and have your residence almost in the heart of the city. This property fronts North on 24th Street, South on Superior Avenue, South on 20th Street, and West on Wallace Street. They are the only lots for sale upon such liberal terms of payment in the city. The title is perfect. Full warranties from Judge Davis. An abstract of title furnished to every purchaser. Do not fail to go and see the lots, and attend the sale, as every lot will be sold without reserve.

TO FIND THE LOTS—Take the Archer Avenue Cars to Superior Street, only two squares South of Archer Avenue, or the State Street Cars to 24th Street, only five minutes walk West from State Street.

BEFORE PURCHASING—As every lot is to be sold, a deposit of \$25 Dollars will be required to be paid at the time of the purchase. For further particulars call on

WM. A. BUTTERS & CO., Auctioneers,

44 and 46 Randolph Street.



3. Detail of a Plan for a Block of Thirty-Two Frame Houses Built on North LaSalle Street, 1869

Balloon frame construction, whether it had elaborate ornamentation or not, was the most common way builders found to meet the demand for new housing. This rendering shows the facade detail of one of thirty-two houses erected at one time. The builders boasted that "the partition between the houses are all double, with a four inch space between the studs that will enable the proprietors to remove them. . . in case of fire." A stream of water could then be directed into the space.

(Courtesy Chicago Historical Society.)


Frame and Brick Construction Homes

Market Segmentation and Location

HOMES

Lake View

JUST NORTH OF THE CITY LIMITS!



PASSENGER
TRAINS
ALL SEASONS, FOR THE
WINTER SEASON 1897-98
Ask Ticket Agent
Kingsport, Dublin
L.R. 104 18221


— THE —


NEW RAILROAD!

WELLINGTON STREET.

TO RAIL, BELT & LEVY. PRICES, \$400 TO \$450. CARROLL STREET, ONE EASY MILE.

STREET.





STREET.
PRICES \$400 TO \$450.
STREET.
PRICES \$400 TO \$450.

Go and see the HOUSES being built.

OUTSIDE FIRE LIMITS!

You Can Build Wooden Houses!

NO CITY TAXES!

GEORGE STREET.
WELLINGTON STREET.
HERNDON STREET.

SOUTHPORT AVENUE.

GO AND SEE THEM.


TAKE THE LINCOLN AVE. STREET CARS

Only 3 Blocks from present terminus of Street Cars. One of the most pleasant rides in the city, passing in front of Lincoln Park & along a finely shaded avenue, and away from the streets leading to the country.

S. E. GROSS & CO.,

Sole Agents for the NEW STREET CARS in the City.

HERNDON STREET.



Handsomest Brick Cottages in Chicago

Price, Only \$1650 to \$1800 each.
EXTRAORDINARY EASY PAYMENTS.
 Very Small Cash Payments—**BALANCE IS MONTHLY!** MAKE ALL PAYMENTS TO 447 A BOND ST. CHICAGO
 NEAR COR. DIVISION ST. BOULEVARD & WESTERN AVE.
 SIX ROOM COTTAGES WITH LAKE WATER. GO AND SEE THEM.

See the Height.

Second Story 8 Feet High.

First Story. 10 Ft. High.

Basement 3 FL. ABOVE GROUND

LOOK AT THE ROOMS.

FIRST STORY.

- 1 Vestibule.
- 1 Parlor.
- 2 Bedrooms.
- 2 Closets.
- 1 Kitchen.
- 1 Pantry.

Second Story.

- 2 Large Rooms





Siehe Höhe

Zweiter Stock 8 Fuß hoch.

Erster Stock 10 Fuß hoch.

Basement 3 Fuß über der Erde.

Siehe Zimmer an!

1 Gang.
 1 Border-Zimmer.
 2 Bett-Zimmer.
 2 Kleine Zimmer.
 1 Küche.
 1 Kleines Verschluß Zimmer.

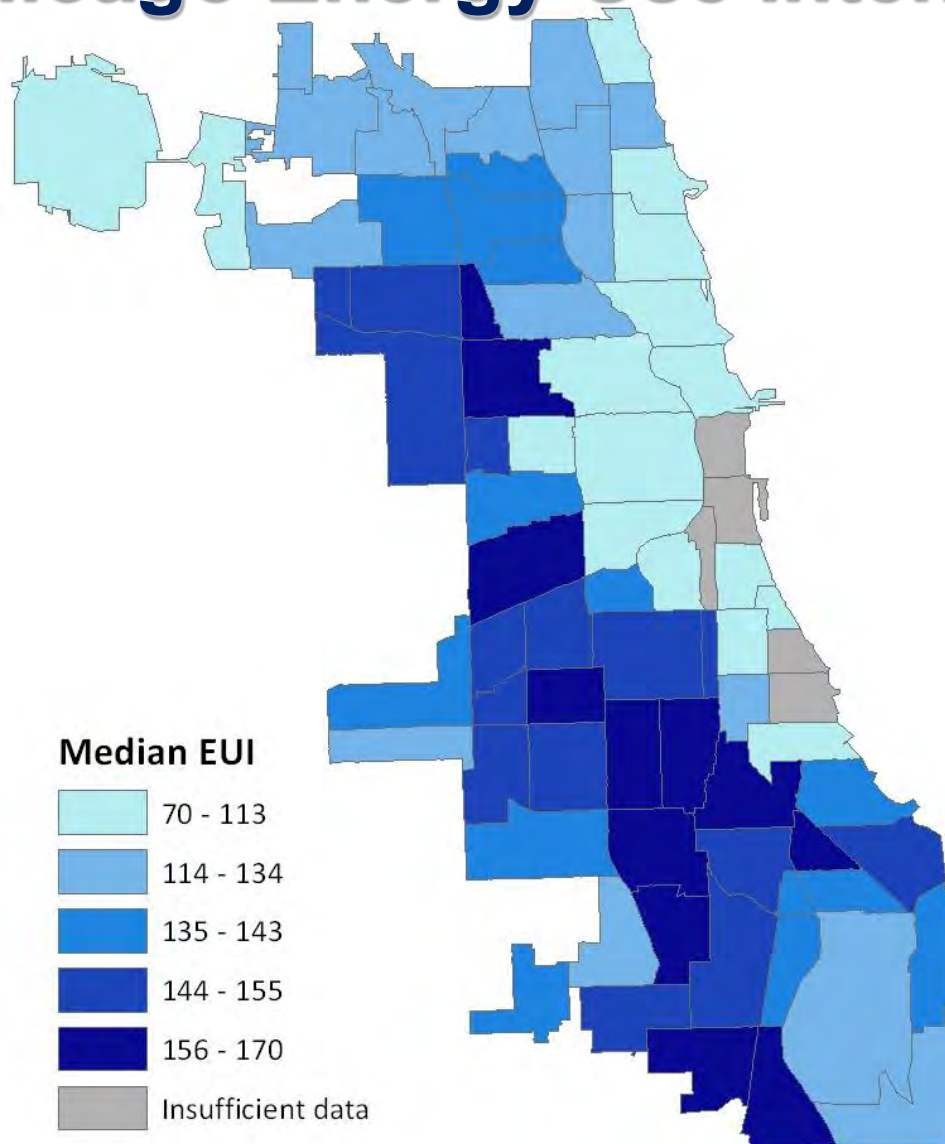
Zweiter Stock.
 2 Große Zimmer.

S. E. GROSS & CO.,
 105 CLARK STREET, CORNER OF MADISON STREET.
 Particular Notice: We in Chicago sell, lease, build, rent and manage houses. It is open every day—Work days and Sundays—and our agents sell and lease houses. Take to Chicago, Illinois, from our headquarters.

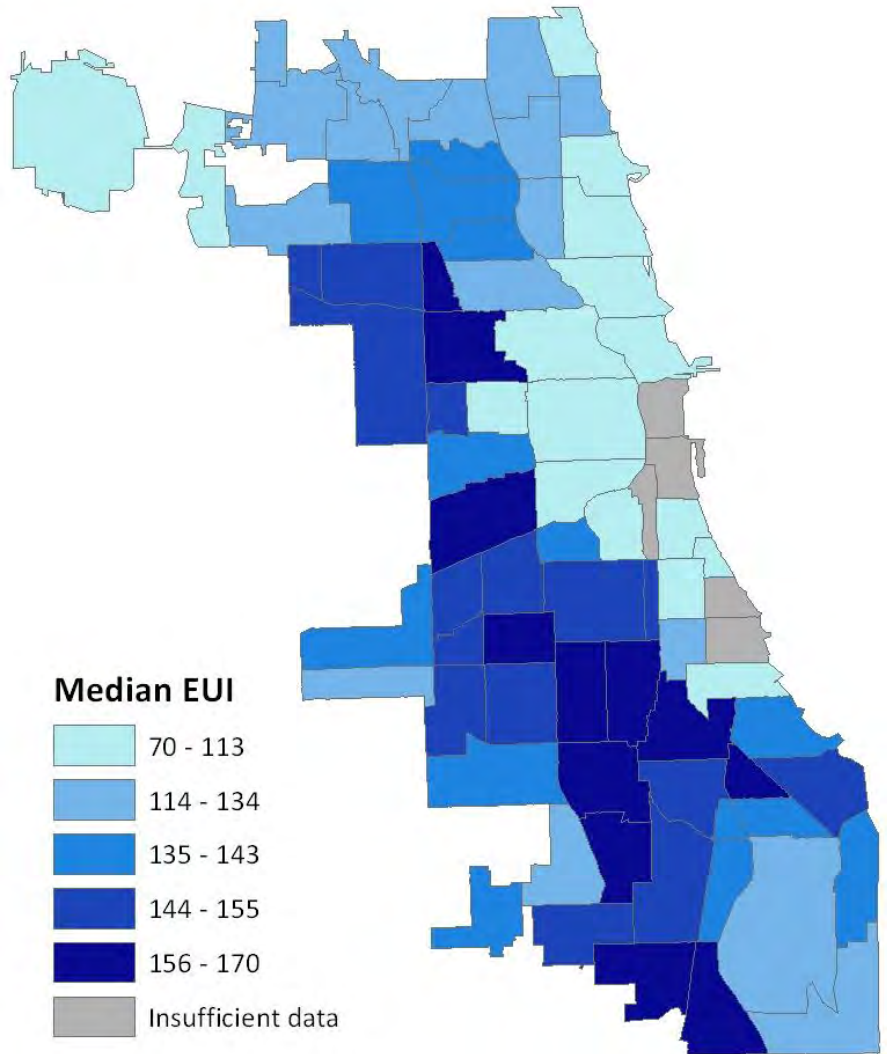
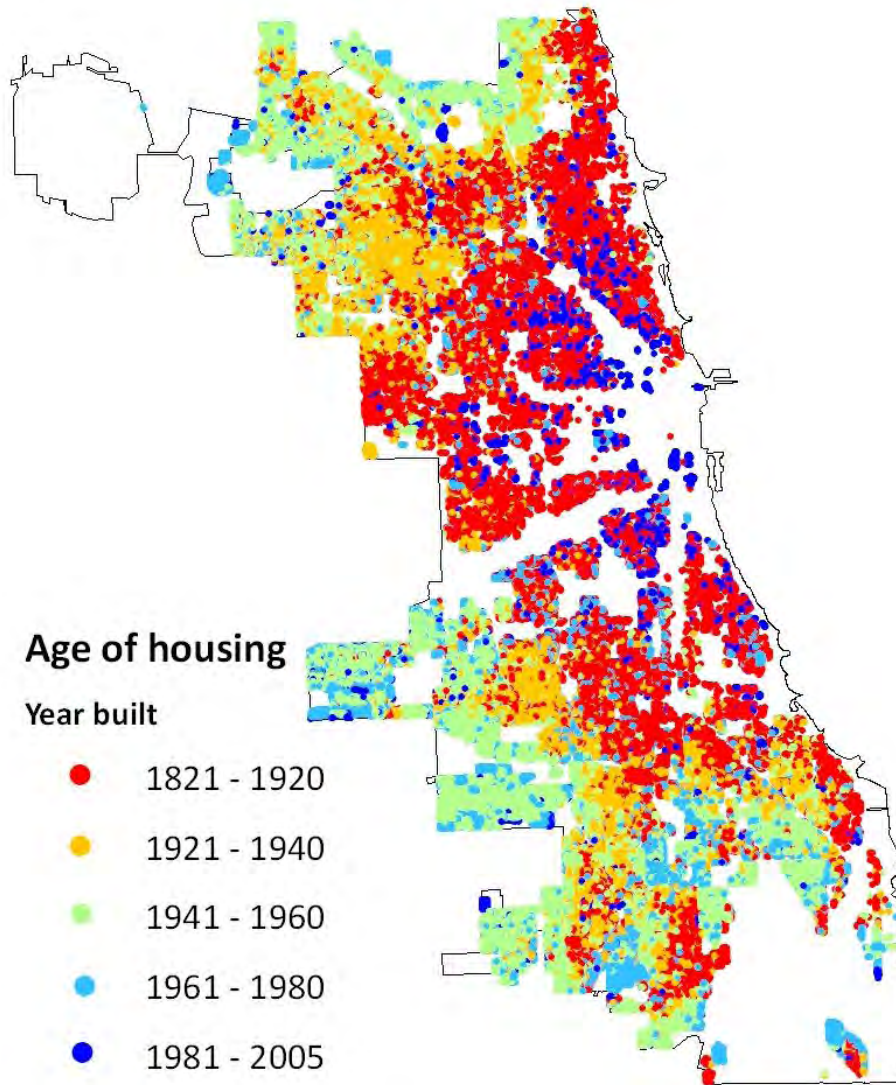
Chicago homes are more energy intensive

	Cook County	Chicago
Median	129	141
25th percentile	99	112
75th percentile	157	175
N	444,204	206,681

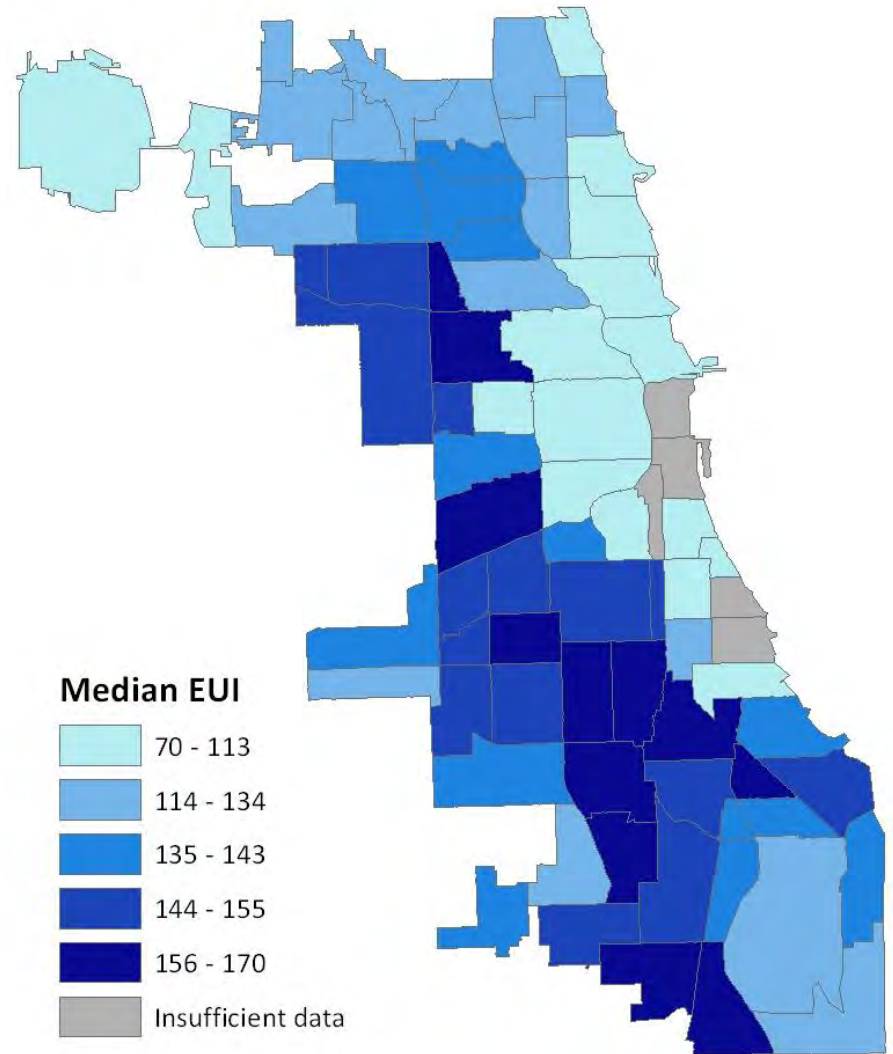
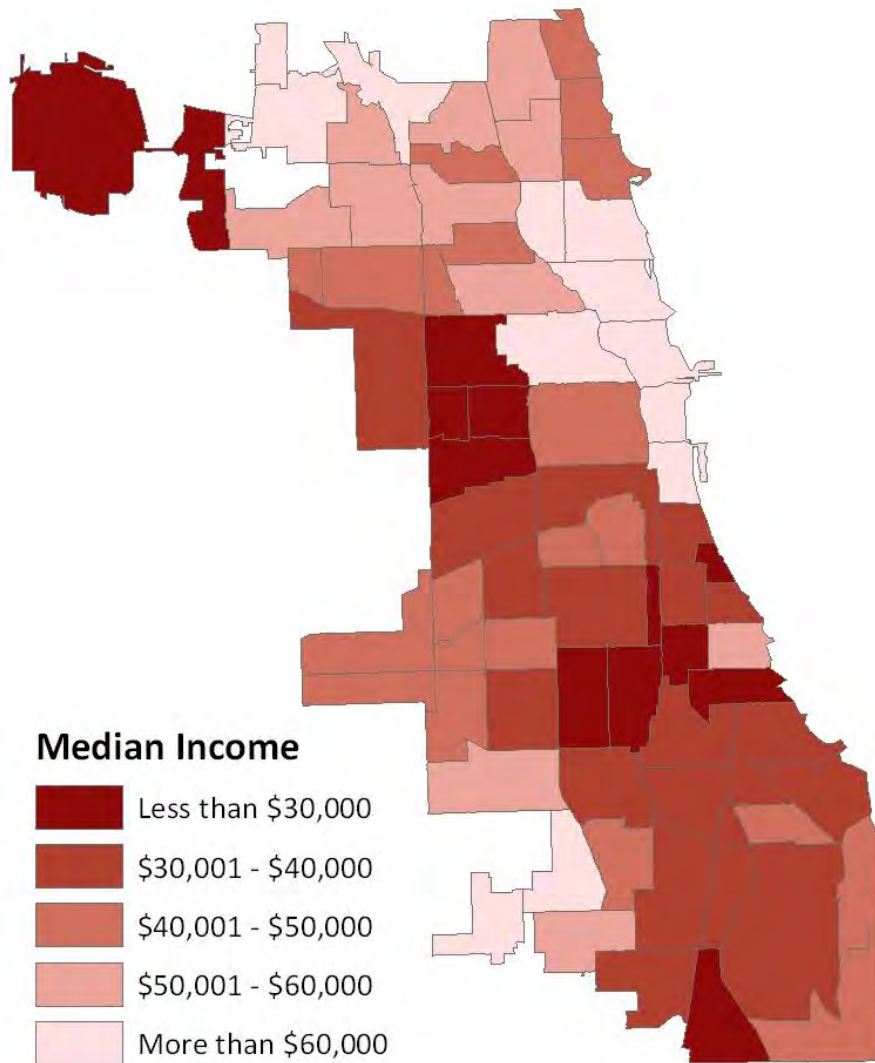
Chicago Energy Use Intensity



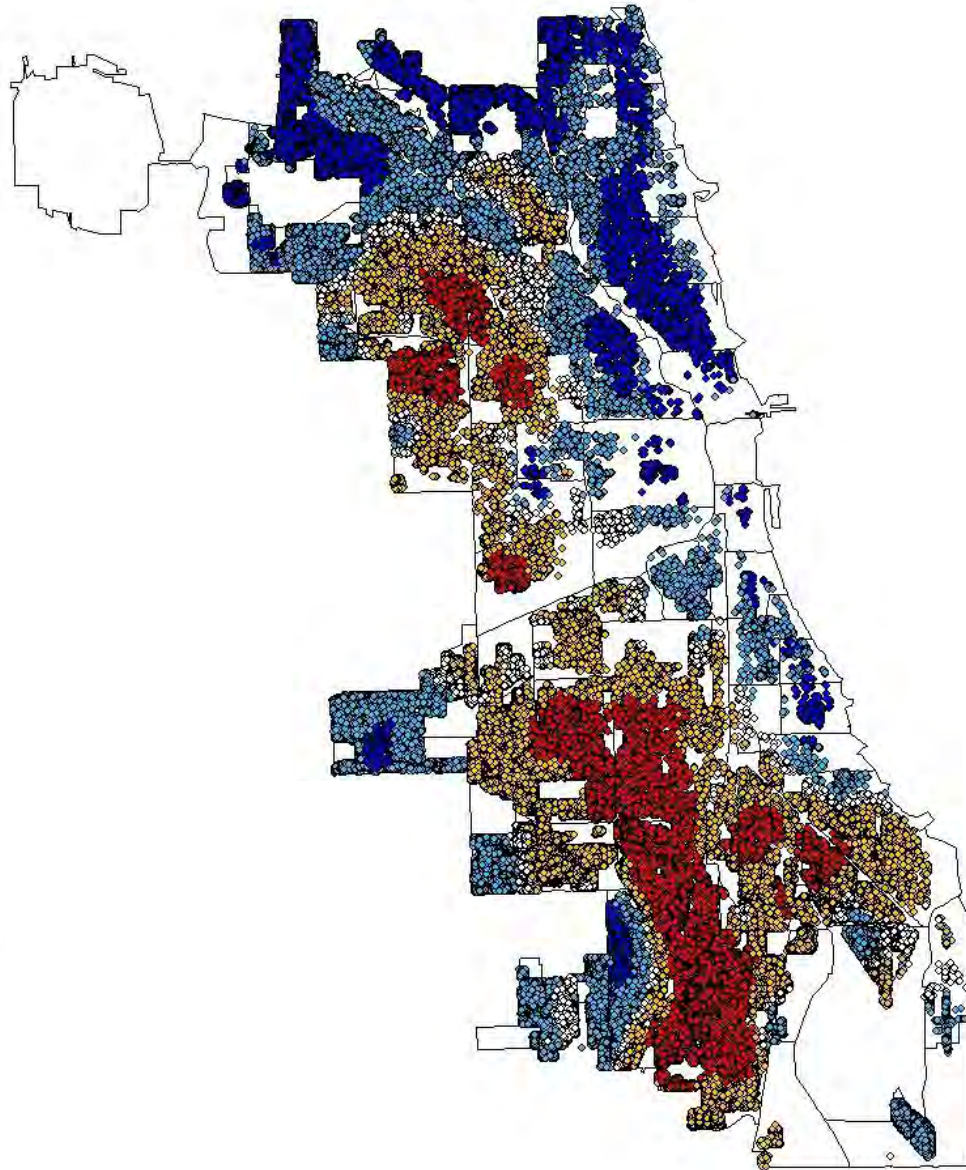
Areas of older housing have higher EUIs.



Lower-income neighborhoods have higher EUIs.



Chicago Hot Spot Analysis

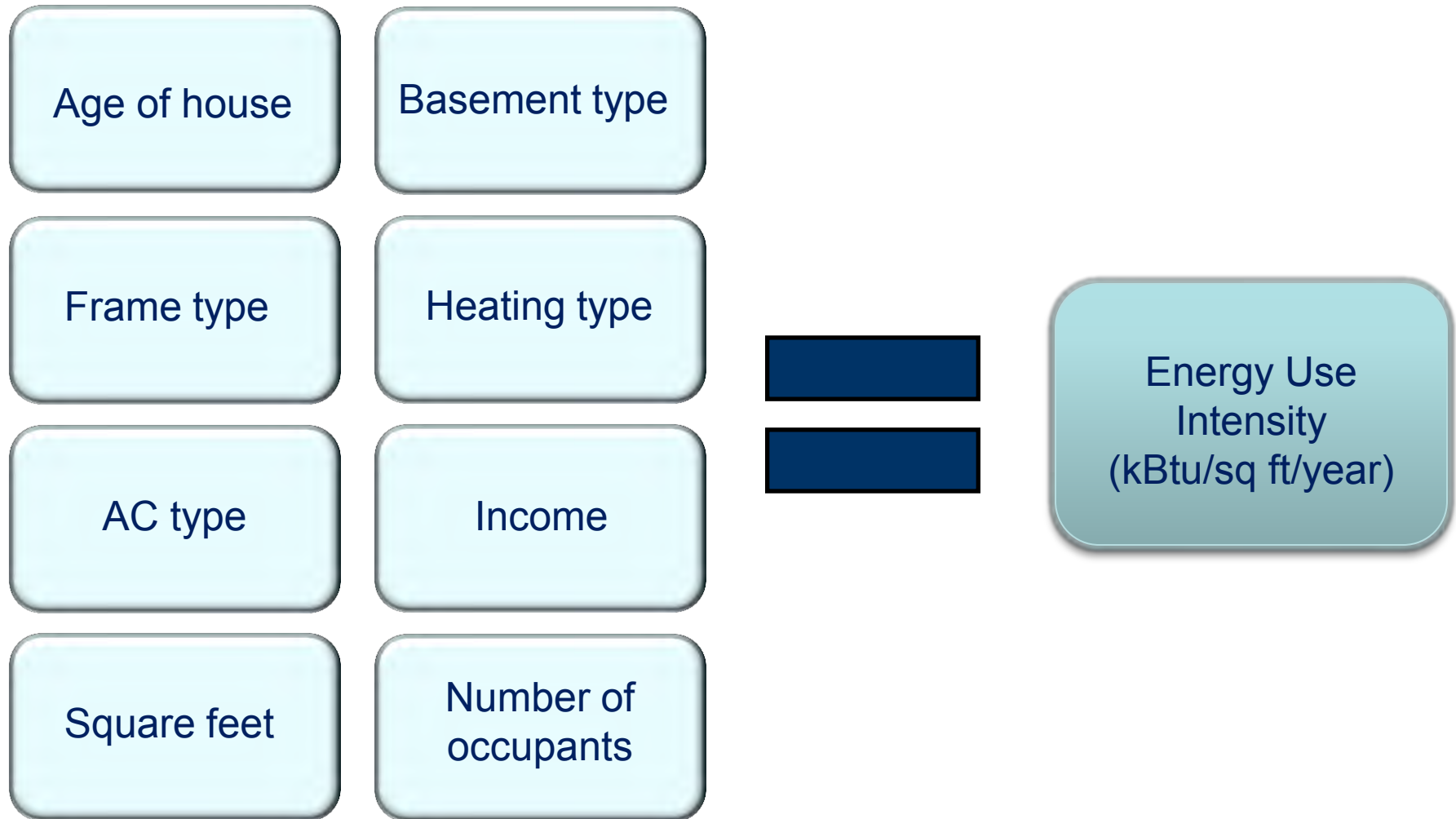


Large Data Sets

- Common mindset of data development - “all homes are unique”
- Aggregating small numbers of homes doesn't get to the same point that a large data set does
 - Avoid the outliers
- Measurement of large scale retrofit impacts

Operational Energy Use Model

Model - Inputs



Model - Inputs

Dependent variable = Energy Use Intensity (EUI)

- Weather normalized

8 independent variables

- Age of home
- Square feet
- Frame type
- Basement type
- Heating type
- AC type
- Income
- Number of occupants

Doesn't include behavior and “stuff”

Model - results

Variable	Sign of coefficient
Square feet	Negative
Brick	Positive
Basement type	Positive
Heating type	Negative
AC type	Positive
Number of occupants	Positive
Income (thousands)	Negative
Age of house	Positive

Model - results

- Model results are highly significant
- Allows us to explain variability in EUI based on 8 structural variables
- Can be improved over time – doesn't control for individual characteristics of homes
- R-squared – .43
 - ~43% of the variation in EUI is explained by this model
 - Remember – the model doesn't include behavior

Model result – frame cottage

Frame cottage

- 1500 sq ft
- Frame construction
- Unfinished basement
- Furnace
- Window AC
- Built in 1893
- 4 occupants
- Income ~\$50,000

EUI = 135



Model result - bungalow

Bungalow

- 1200 sq ft
- Brick
- Unfinished basement
- Boiler
- Window AC
- Built in 1920
- 4 occupants
- Income ~\$50,000

EUI = 162



Historic Chicago Bungalow



Credit: www.historicchicagobungalow.info

Vernacular Architecture: Chicago Bungalow

- Ubiquitous. Over 80,000 bungalows built in the region between 1910-~1940
- Represents nearly 1/3 of single family housing stock in Chicago
- Influenced by Arts and Crafts movement emphasizing simplicity and craftsmanship
- Six historic Chicago Bungalow Districts that are on the National Register of Historic Places



WHAT IS A HISTORIC CHICAGO BUNGALOW?

TEN DEFINING CHARACTERISTICS



FLOWER BOXES, VURNS & OTHER
"NATURAL" OR BUILT-IN ELEMENTS

INTRICATE WOOD-, MASON -,
AND/OR METAL-WORK

GENEROUS WINDOWS,
OFTEN LEADED - OR STAINED-GLASS

RECTANGULAR SHAPE,
BUILT BETWEEN 1910-1940

BRICK EXTERIOR WITH STONE ACCENTS

COVERED ENTRANCE

ONE-AND-ONE-HALF STORIES TALL

PROTRUDING FRONT BAY

FRONT DORMER AT CENTER OF PEAK

LOW-PITCHED HIP ROOF WITH OVERHANG

PLAY AGAIN

Credit: www.historicchicagobungalow.info

Historic Chicago Bungalow Initiative

www.chicagobungalow.org


http://www.chicagobungalow.org/pages/about_us/2.php

Most Visited CNT Time Tracker Google Scholar 31 Google Calendar Gmail - Inbox - rscheu... CHIRP Radio • From th... iGoogle

chicago historic bungalow association

Bookmarks

HISTORIC CHICAGO BUNGALOW INITIATIVE




CONTACT US CALENDAR OF EVENTS
Search HCBI Now FIND

About Us Loans, Grants & Certification Member Discounts Restore, Renovate, Go Green Special Programs Publications Expo In the News

What is a Chicago Bungalow?
Staff
Board of Directors
Partners

Q&A

How can the Historic Chicago Bungalow Association help keep my home affordable?
The HCBA's energy savers grant is open to every certified Bungalow owner. For low-income assistance programs, contact the HCBA at (312) 675-0300 to see if you qualify.



NEWSLETTER SIGN-UP > GO

About the HCBI


Launched by Mayor Richard M. Daley in September of 2000, the Historic Chicago Bungalow Initiative is designed to foster an appreciation of the Chicago Bungalow as a distinctive housing type, encourage sympathetic rehabilitation of Chicago bungalows, and assist bungalow owners with adapting their homes to current needs, which in turn helps to strengthen Chicago bungalow neighborhoods.

The Historic Chicago Bungalow Association is the non profit organization that administers the Initiative. The program offers a variety of financial resources, from grants to loans, and technical resources, from special permit assistance to "how-to" seminars. Certifying your bungalow with the Historic Chicago Bungalow Association is the first step in accessing these financial incentives and benefits.

Staff

Click here to contact any member of the staff of the Historic Chicago Bungalow Association to get your questions answered.

Online Forms



HISTORIC CHICAGO BUNGALOW

AND GREEN
HOME

EXPO 2011

Saturday, April 9
• 10am-4pm •

at The Merchandise Mart
(Chicago River at Wells St.)

FREE ADMISSION
& RAFFLE PRIZES



SPECIAL GUEST APPEARANCES:

Kelly Edwards of HGTV's "Design on a Dime," Lou Manfredini of HouseSmarts TV and WGN 720, and "The House Doctor" Bob Yapp

- 16 Workshops • More than 100 exhibitors, artisans, lenders and tradespeople
- Grants and resources for energy improvements •
- On-site HCBA certification



FOR INFO:

Visit chicagobungalow.org or call 311

REGISTER ONLINE FOR A CHANCE TO WIN AN  WASHER/DRYER

SPONSORS



CITY OF CHICAGO
RICHARD M. DALEY
MAYOR



HISTORIC
CHICAGO BUNGALOW
ASSOCIATION



ATAChicago

J.L. Construction, Inc.



Miner, Barnhill & Galland

Engaged Owners

Chicago Bungalow Owners are:

- Organized
- Motivated
- Engaged
- Proud of their homes

Prime audience for retrofit
engagement

CHICAGO
CLIMATE
ACTION
PLAN

OUR CITY. OUR FUTURE.

Realtors Who Specialize in Bungalows

www.historicchicagobungalow.info

MENU

- Home
- About Me
- What Makes Me Different
- What is a Historic Chicago Bungalow?
- History
- The Chicago Bungalow Initiative
- Green Bungalows
- Searching for a Bungalow
- Listing your Bungalow
- Bungalow of the Month
- Neighborhoods
- Resources
- Contact

BOOKMARK US

FIFTEEN STEPS TO A
SUCCESSFUL
BUNGALOW SALE

YOUR MARKETPLACE FOR BUYING & SELLING HISTORIC CHICAGO BUNGALOWS

Welcome to the first web site devoted exclusively to buying and selling historic Chicago bungalows. You will find me as passionate as you are about preserving these historic bungalows in ways that is as true and authentic as the Arts & Crafts movement that inspired them, while sincerely devoted to helping you upgrade them in ways that meet a modern lifestyle.

For buyers, my goal is to help you find, buy, and if desired transform Chicago's most common form of residential architecture into certified historic treasures. For sellers, I'll help you understand how your bungalow compares to others on the market, find the craftsmen who can make any necessary repairs, target market to an audience who most care about preserving them, and ultimately, get you top dollar for your bungalow.

In both cases it is my knowledge of the market, bungalow certification process, and relationships with honest and competent contractors that sets me apart from other realtors. As a buyer's agent, I preview literally hundreds of homes a year, and that view from the inside out helps my bungalow buyers and sellers truly understand a bungalow's real value.

I look forward to helping you buy or sell your own historic Chicago bungalow. In the pages that follow, I offer a bit of bungalow history, a graphical depiction of how a historic Chicago bungalow is defined, a direct link to my friends at the Chicago Bungalow Association, a little color on the Historic Chicago Bungalow Initiative, and a way to search for bungalows only (without having to sift through hundreds of irrelevant properties).

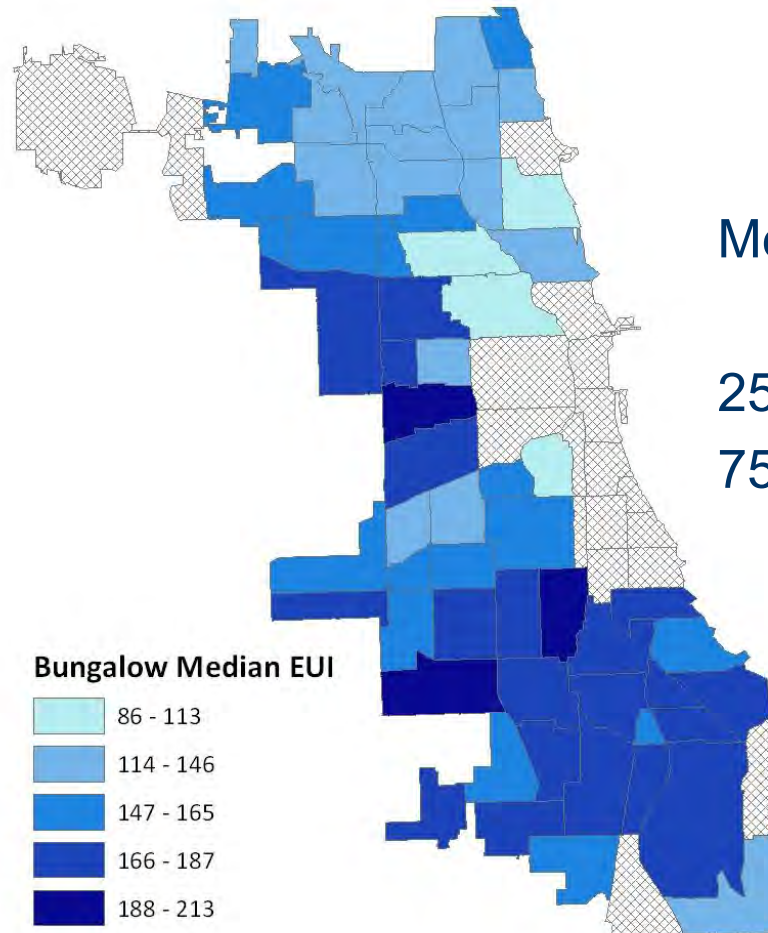
There is much more on these pages, so I invite you to linger, to learn, and if and when you are ready, contact me for specific information or services.



Bungalows are even **MORE** energy intensive

	Cook County	Chicago	Bungalows
Median	129	141	158
25th percentile	99	112	132
75th percentile	157	175	188
N	444,204	206,681	7,157

Energy use intensity of bungalows



Median EUI = 158

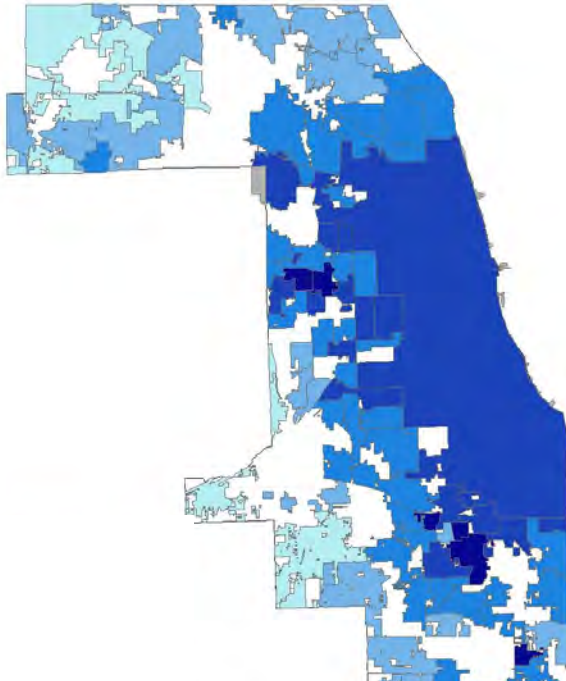
25th percentile EUI = 132

75th percentile EUI = 188

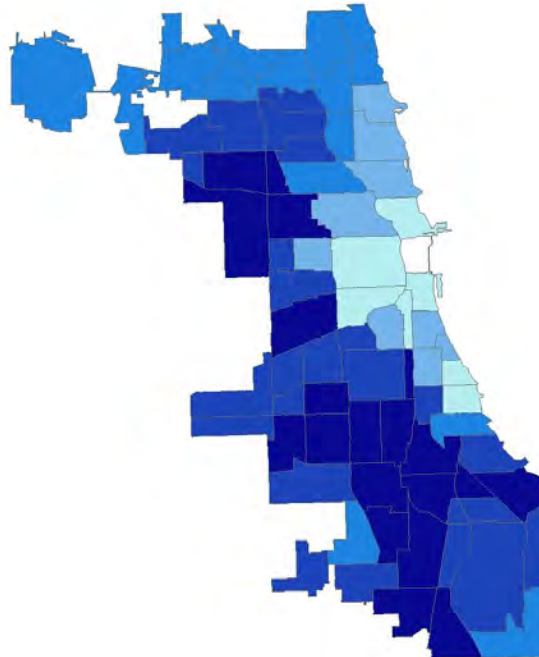
© CNT Energy 2011

Bungalows Are More Energy Intensive than Chicago and County Homes

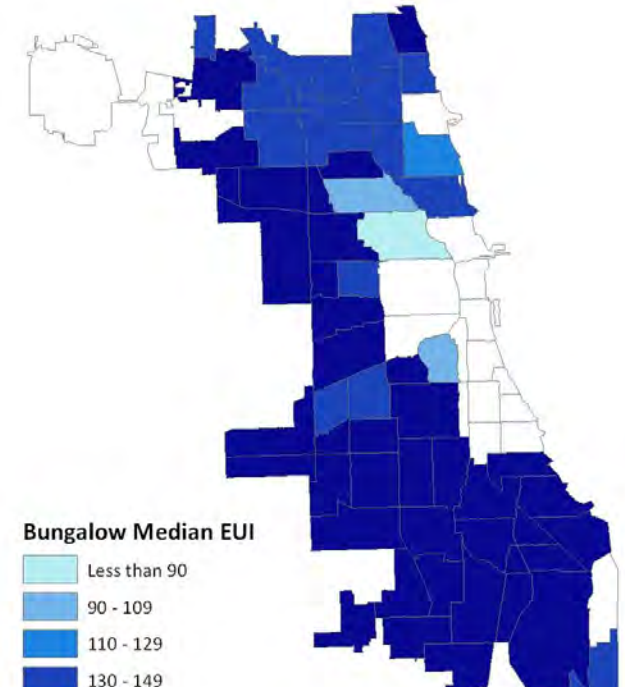
County of Cook
Median EUI = **129**
Median Year Built 1956



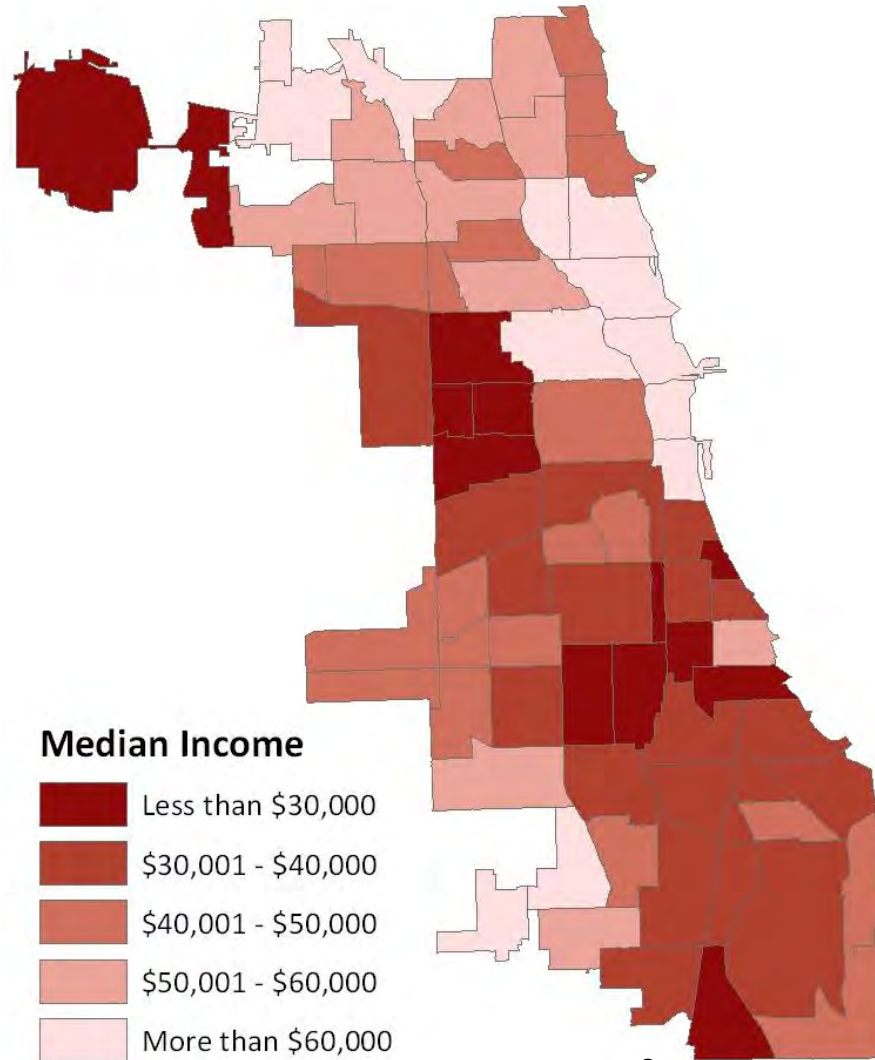
City of Chicago
Median EUI = **141**
Median Year Built 1926



Bungalows in Chicago
Median EUI = **158**
Median Year Built 1919

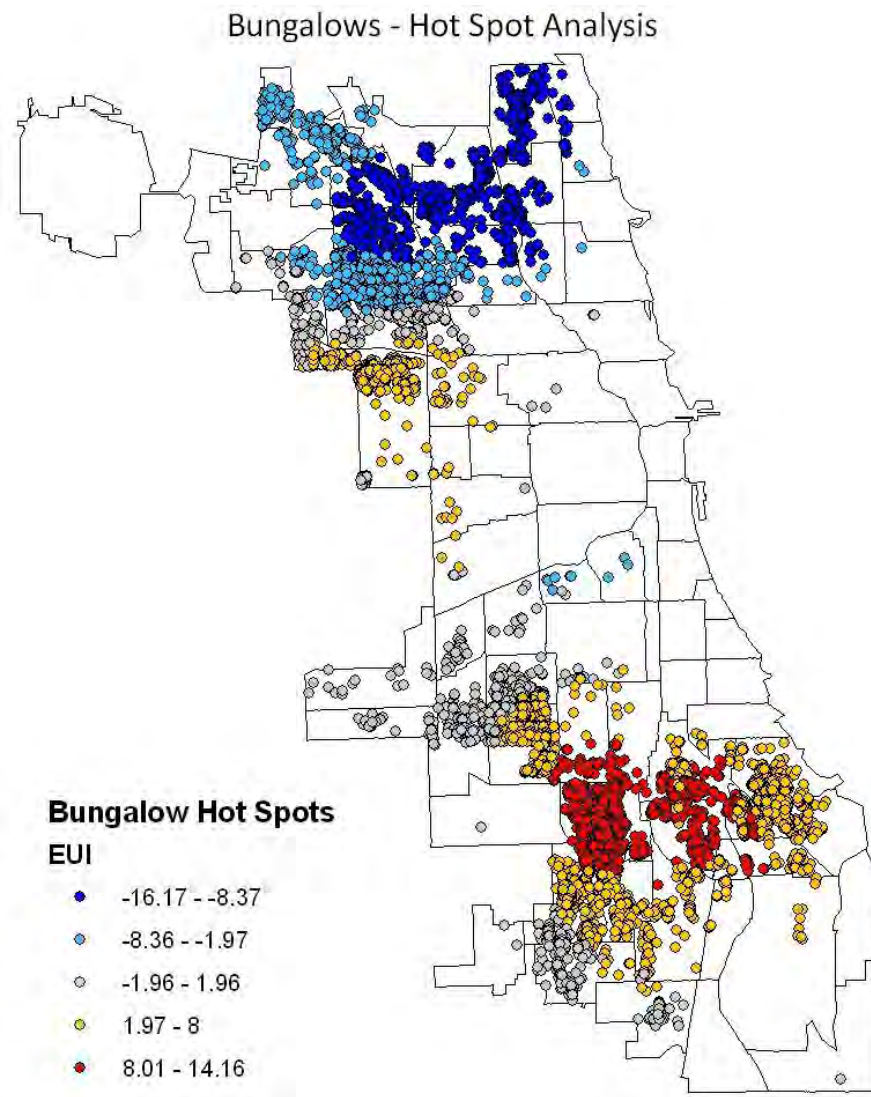
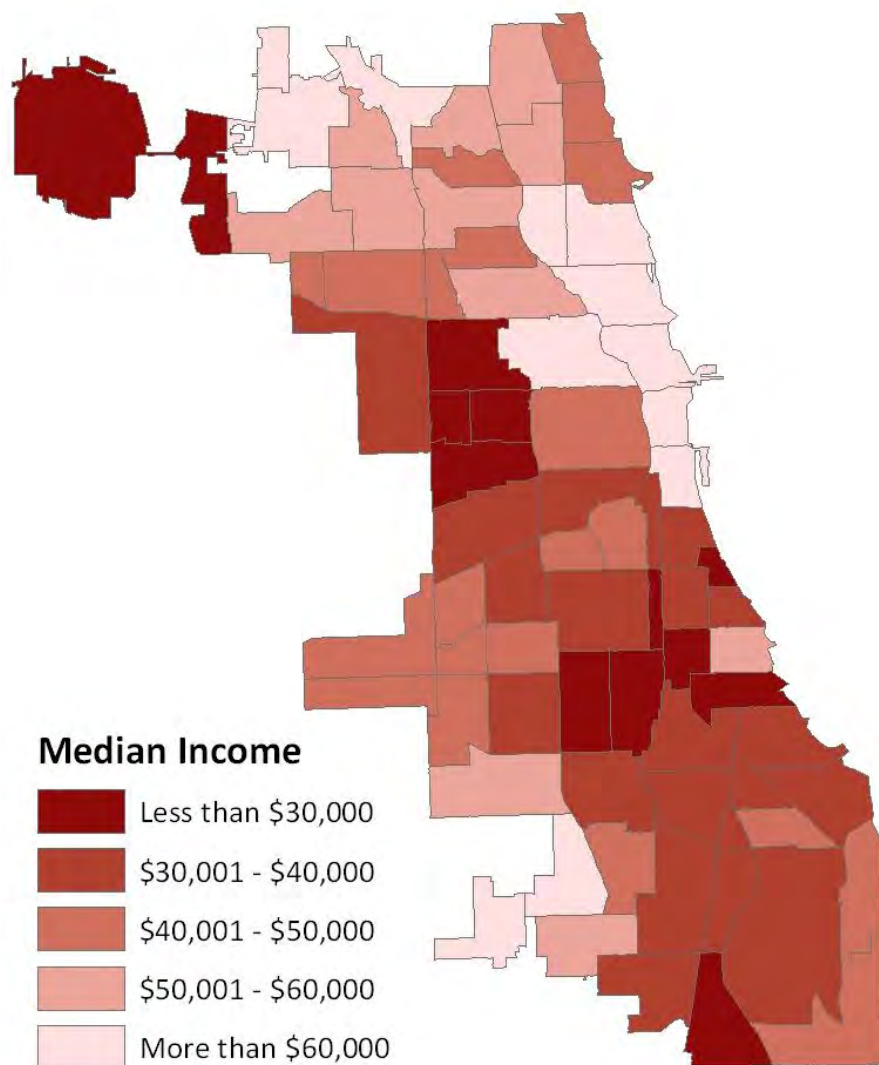


Bungalow Owners Span Socio-Economic Groups



© CNT Energy 2011

Lower-income areas have higher EUIs.



How can these data be used to drive retrofit demand?

- Homeowners
- Auditors and contractors
- Program managers and policymakers
- Drive program design/influence and increase retrofit demand

Program managers / policymakers

- Set priorities for energy efficiency investment – city could look at this and decide to prioritize bungalows
- Design financing options for different ownership types and geographies (TIF districts, etc)
- Informs neighborhood-based marketing strategies
- Geographic targeting allows you to align multiple program goals like energy efficiency, equity, neighborhood preservation and economic development

Auditors / Contractors

- Market services based on aggregated data
- Workforce development is faster – can know the distribution of energy use in a given home type, instead of learning through field experience
- Target home types with high energy use – specialization of services

Homeowners

- Empower Homeowners with Information
 - Compare to neighbors/similar homes – there's significant opportunities to save on energy bills
 - Total cost of ownership info before purchasing
 - Incorporate efficiency improvements into MLS before time of sale

Realtors and Appraisers

- Appraisers need lots of data points to value efficiency improvements
- Realtors need third party verification and comparables

Challenges

- Data sharing and privacy concerns
- Quality of data across the nation
- How relevant is this to other cities? Is there the equivalent of the bungalow belt?

Next steps

- Describing the energy characteristics of other common architectural styles



Bungalow



Colonial



Frame Cottage



Georgian



Newer Luxury



Townhome



Raised Ranch



Ranch



Split level



Townhome

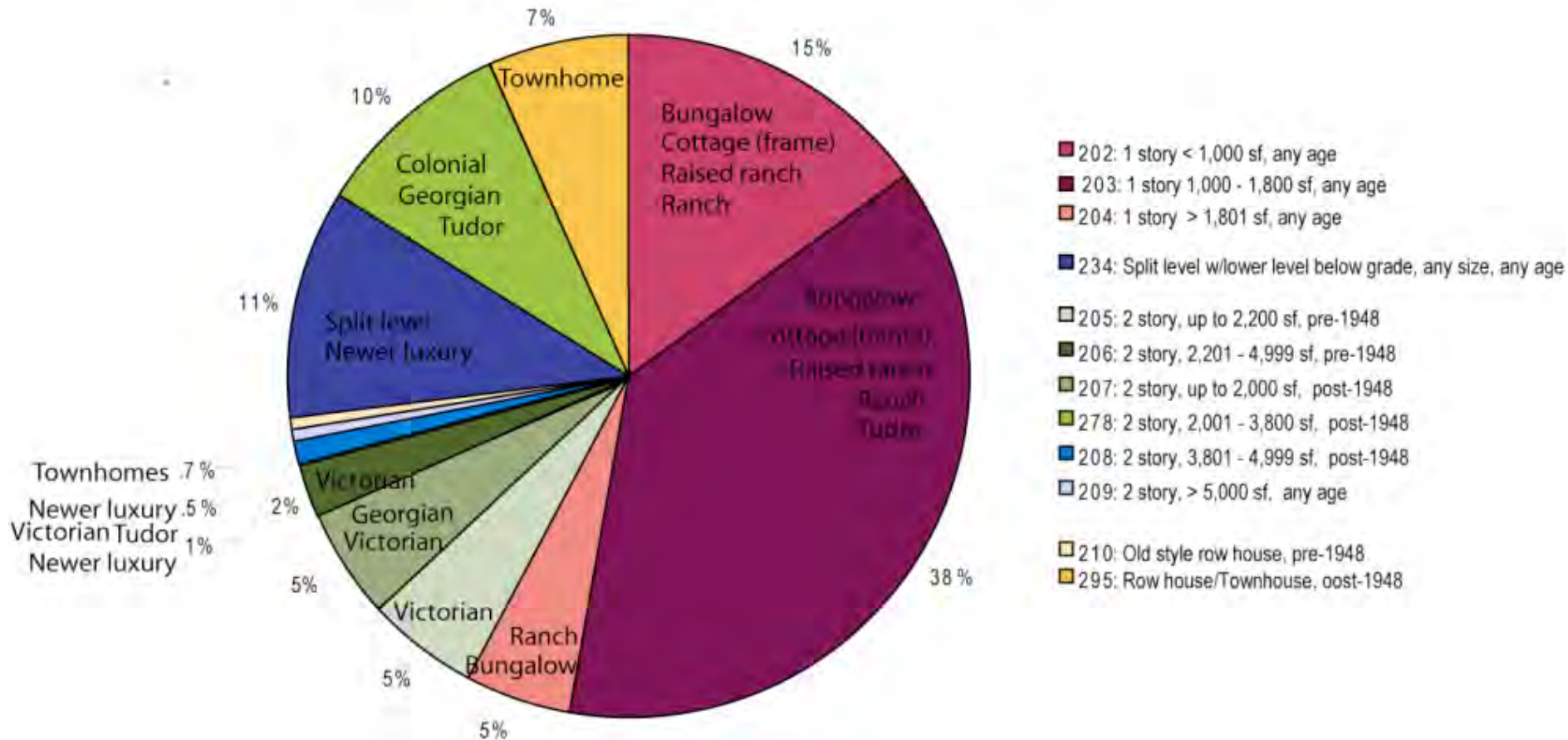


Tudor



Victorian

Cook County Single Family Housing and the Common Architectural Styles Represented within Tax Assessor Classifications



Next steps

- Use model to create EUI distributions of other home types
- Measuring the impact of retrofit programs on a large scale
- Formalizing real estate partnerships
 - Total Cost of Ownership calculator
 - Energy data into MLS

Total Cost of Ownership Calculator

connectMLS - Connecting Your Real Estate Community - Internet Explorer provided by Dell

http://connectmls1.mredilc.com/tools/PaymentCalc.jsp?firstPop=true&popup=true&lp=748500&tax=2781

Calculate Amortization Table Clear Cancel

[Click here to print this page](#)

* Purchase Price: 748500

Down Payment: 0 % or \$ 0

* Interest Rate: %

* Number Of Years: 30

Taxes: 2781 ☐ Monthly ☒ Annual

Insurance: ☐ Monthly ☐ Annual

Association Fees: ☐ Monthly ☐ Annual

Transportation: 826 ☒ Monthly ☐ Annual

Energy: 2160 ☐ Monthly ☒ Annual

Other: ☐ Monthly ☐ Annual

PMI / MIP: % or \$

(Enter 0% to omit PMI/MIP from the calculation.)

Monthly Principal & Interest (PI):

Total Estimated Payment:

We have a lot on our plate...



Mangia!

Contact Us

Rachel Scheu
rscheu@cntenergy.org
(773) 269-4032

Jessica Spanier
jspanier@cntenergy.org
(773) 269-4038

