400 RETROFITTED BUNGALOWS: AN ENERGY USE ANALYSIS

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CNT Energy | Historic Chicago Bungalow Association

Intro

- Emily Bailey Burns –Grants Manager, HCBA
- Rachel Scheu—Director of Research, CNT Energy
- CNT/HCBA Collaboration
 - Energy\$avers Program
 - **D** Utility Bill Analysis
 - Findings and Case Studies
 - Next Steps

Intro

Sneak Peek

- Bungalows are inefficient
- Energy savings lower than anticipated
- Highest savings found in 2-4 person households

- Who we are, what we do
- Bungalow characteristics (size, age, construction, systems, etc)
- Why bungalows are important









Bungalow Development





Bungalow Characteristics

- **Built between 1910 1940**
- One and one half stories
- Face brick with stone trim
- Low-pitched roof with overhang
- Rectangular shape: narrow at the front and rear ends, longer on the sides
- Generous windows
- Full basement
- Offset front entrance, or side entrance





Why are bungalows important?

- 1/3 of single family housing stock
- 80,000 Constructed
 - How do we reach them?



Bungalow Tracking & Identification

							Prior																	
					land	Bldg	Land	Prior Bldg						Exterior										
					Assessed	Assessed	Assessed	Assessed	Market	Type	of			Constructi	# of Full	# of Half	Basemen	Basemer	nt .	At	tic			
Township	PIN	Nbhd	Tax Code	Class	Value	Value	Value	Value	Value	Reside	nce	Use	# of Apts	on	Baths	Baths	Type	Finish	Attic T	vpe Fin	ish			
72 - Lake	19-25-101-028-0000	150	72028	2-02	3,213	9.233	3.628	12,469	92.33	9 One Sto	rv Sir	ngle Fam	0	Frame	1	0	Full	ormal Rec	R Parti	al Living	Area			
72 - Lake	19-25-103-011-0000	150	72028	2-03	3,213	10.209	3.628	12,776	102.09	1 One Sto	rv Sir	ngle Fam	0	Frame	2	0	Full	Unfinishe	d Non	e No	ne			
72 - Lake	19-25-104-012-0000	150	72028	2-04	3,213	13,182	3.628	16.398	131.82	5 1.5 - 1.9	Stor Sir	ngle Fam	0	(11	2	1	F	and Dec	D 5-1	Li in	A			
72 - Lake	19-25-104-016-0000	150	72028	2.02	2.242	11 700	2 620	12 100	447.00				•			0								
72 - Lake	19-25-104-029-0000	150	72028																					
72 - Lake	19-25-106-020-0000	150	72028				Garage					Chicago						Timber/Fr						
72 - Lake	19-25-106-039-0000	150	72028	Cent	tral #of	Garage	Constructi	Attached				Bungalo	N			W/O a	Original	ame	Stucco	Stone	Arts and		Prairie	
72 - Lake	19-25-107-011-0000	150	72028	Ai	r Fireplace	s Size	on	Garage	Age	Land SF	Blog SF	Yes/No	Certifiable	e Ad	dress	Dormer	Windows	Bungalow	Bungalow	Bungalow	Crafts	Detroit	Style	Notes
72 - Lake	19-25-107-018-0000	150	72028	No	0 0	None	None	None	87	3,780	962	No	No											
72 - Lake	19-25-107-019-0000	150	72028	No	0 0	2 Car	Frame	No	93	3,780	1,056	Yes	Yes	7119 S	Whipple St									
72 - Lake	19-25-107-020-0000	150	72028	Ye	s 0	2 Car	Masonry	No	81	3,780	2,099	No	No											
72 - Lake	19-25-108-025-0000	150	72028			2 Car	Frame	No	72	3,780	1,530	No	No											
72 - Lake	19-25-110-003-0000	150	72028			2 Car	Frame	No	70	3,780	1,107	No	No											
72 - Lake	19-25-114-004-0000	150	72028	N	0 0	2 Car	Frame	No	70	3,780	1,107	No	No											
72 - Lake	19-25-114-005-0000	150	72028	No	0 0	2 Car	Frame	No	79	3,780	1,285	No	No											
72 - Lake	19-25-114-007-0000	150	72028	No	0 c	2 Car	Masonry	No	70	3,780	1,209	No	No											
72 - Lake	19-25-114-008-0000	150	72028	No	0 o	2 Car	Frame	No	73	3,780	1,227	No	No											
72 - Lake	19-25-114-009-0000	150	72028	No	0 0	1 Car	Frame	No	74	3,780	936	No	No											
72 - Lake	19-25-114-013-0000	150	72028	No	o 0	None	None	None	90	3,780	960	No	No											
72 - Lake	19-25-114-027-0000	150	72028	No	0 0	None	None	None	86	3,780	900	No	No	7044.0.5										
72 - Lake	19-25-114-028-0000	150	72028		5 0	1 Car	Frame	No	80	3,780	1,094	Yes	Yes	72115 F	ancisco Ave				<u></u>					
72 - Lake	19-25-114-029-0000	150	72028			2 Car	Frame	No	80	3,780	1,300	Vec	Vec	7213 5 F	ancisco Ave									
72 - Lake	19-25-114-030-0000	150	72028		0 0	2 Car	Frame	No	80	3,780	1.264	Yes	Yes	7221 S F	ancisco Ave									
72 - Lake	19-25-114-031-0000	150	72028	N	0 0	2 Car	Frame	No	76	3,780	1,183	Yes	Yes	7225 S Fi	ancisco Ave									
72 - Lake	19-25-114-032-0000	150	72028	No	o 0	2 Car	Masonry	No	80	3,780	1,369	Yes	Yes	7237 S Fi	ancisco Ave									
72 - Lake	19-25-114-033-0000	150	72028	No	0 o	1.5 Car	Frame	No	80	3,780	1,084	Yes	Yes	7218 S	Mozart St									
72 - Lake	19-25-114-034-0000	150	72028	- No	0 0	2 Car	Frame	No	80	3,780	1,417	Yes	Yes	7222 S	Mozart St									
72 - Lake	19-25-114-035-0000	150	72028	- No	o 0	2 Car	Frame	No	79	3,780	1,412	Yes	Yes	7224 S	Mozart St									
72 - Lake	19-25-114-039-0000	150	72028	- No	0	2 Car	Frame	No	80	3,780	1,044	Yes	No	7220.0										
72 - Lake	19-25-115-002-0000	150	72028			2 Car	Frame	No	80	3,150	995	- Yes	Yes	7230 5	Mozart St									
72 - Lake	19-25-115-002-0000	150	72028			None	None	None	79	3,150	1,015	Vec	Ves	7236 5	Mozart St									
72 - Lake	19-25-115-004-0000	150	72028	N	0 0	2 Car	Frame	No	80	3,150	1,387	Yes	Yes	7238 S	Mozart St									-
72 - Lake	19-25-115-005-0000	150	72020	No	o 0	1 Car	Frame	No	80	3,150	952	Yes	Yes	7240 S	Mozart St									
72 - Lake	19-25-115-006-0000	150	72028	No	o 0	2 Car	Frame	No	72	3,150	1,388	No	No											
72 - Lake	19-25-115-000-0000	150	72028	No	0 c	1.5 Car	Frame	No	80	3,654	1,207	Yes	Yes	7203 S	Mozart St									
72 - Lake	10-25-115-008-0000	150	72020	No	o 0	2 Car	Frame	No	80	3,654	1,121	Yes	Yes	7205 S	Mozart St									
72 - Lake	19-25-115-000-0000	150	72020	- No	0 0	2 Car	Frame	No	80	3,654	1,207	Yes	Yes	7209 S	Mozart St									
72 - Lake	19-25-115-005-0000	150	72020	- No	0 0	2 Car	Frame	No	81	3,654	988	Yes	Yes	7213 S	Mozart St									
72 - Lake	10.25-115-015-0000	150	72028			1 Car	Frame	No	81	3,654	988	Ver	Yes	7215 5	Mozart St									
72 - Lake	19-25-115-026-0000	150	72028		0 0	1 Car	Frame	No	80	3,150	995	Yes	Yes	7219 5	Mozart St									
72 - Lake	19-25-115-027-0000	150	72028		0 0	2 Car	4	No	80	3,150	1,208	Yes	Yes	7223 5	Mozart St									
72 - Lake	19-25-200-014-0000	150	72028	No	0 0	2 Car	Frame	No	79	3,150	1,221	Yes	Yes	7239 S	Mozart St									
72 - Lake	19-25-200-017-0000	150	72028	No	0 o	1.5 Car	Frame	No	79	3,150	983	Yes	Yes	7206 S C	alifornia Ave									
72 - Lake	19-22-200-033-0000	150	72028	No	0 o	1.5 Car	Frame	No	79	3,150	983	Yes	Yes	7208 S C	alifornia Ave									
				No	0 O	1 Car	Frame	No	98	3,780	1,196	No	No											
				No.	0 0	1 Car	Frame	No	79	3,780	1.2.1	Yes	Yes	7133 S G	alifornia Ave									1

Bungalow Tracking & Identification



Bungalow Tracking & Identification



Did you know that you live in a Historic Chicago Bungalow?



BE COMFORTABLE & SAVE MONEY FREE energy efficiency programs and other benefits may be available to you!

www.chicagobungalow.org

- History of Grant and Funding
 - Established in 2008
 - Subsidized Retrofits
 - Leverage funding sources
 - Peoples Energy Settlement Funds
 - IL Department of Commerce
 Economic and Opportunity (DCEO)
 - Energy Impact Illinois
 - Peoples Energy Rebate



Homeowner Eligibility



HISTORIC CHICAGO BUNGALOW ASSOCIATION Energy\$avers Grant Program Application

The Historic Chicago Bungalow Association's EnergySavers Grant Program provides weatherization services to certified bungalow owners in the City of Chicago. These services include air-sealing leaks and cracks to reduce air infitration, and insulating your attic to help reduce your energy consumption and make your more comfortable in your home. If your application is preliminarily approved, a participating weatherization contractor will contact you to schedule an energy assessment of your bungalow. Be sure to submit ALL required information with your completed and signed application form, as missing information will result in a delay of grant approval.

BUNGALOW OWNER INF	ORMATION:		
Bungalow Owner Name(s):			
Bungalow Address:		City/S	State:
Zip Code: Teleph	one #: ()	Bungalow Memb	er #: Ward :
Email Address (required):			
*(Optional) Ethnic/Racial Bac	ground:		
Asian/Pacific Islander	American Indian/Alaska	n Native 🛛 Hispanic	Black UWhite
HOUSEHOLD INCOME &	OCCUPANCY VERIFICAT	ION:	
Number of Household Memb	ers: Appro	ximate Household Income	:
Please list all current househo	ld occupants, their age, and	relation to the homeowne	er listed above:
Name of Occupant	Relat	onship to Homeowner	Age
Please attach copies of inco 3 months or 90 days of pays unemployment documents	me verification documents tubs, W-2/Tax form(s), Soci or letter/statement of unen	for each member of the he al Security/Pension/Disabili ployment, etc.	ousehold age 19 and above: ty payment statements,
			(OVER)

Household Size						
	50 %	60%	80%	100%	120%	140%
1	\$25,800	\$30,960	\$41,250	\$51,600	\$61,800	\$72,240
2	\$29,450	\$35,340	\$47,150	\$58,900	\$70,650	\$82,460
3	\$33,150	\$39,780	\$53,050	\$66,300	\$79,500	\$92,820
4	\$36,800	\$44,160	\$58,900	\$73,600	\$88,300	\$103,040
5	\$39,750	\$47,700	\$63,650	\$79,500	\$95,400	\$111,300
6	\$42,700	\$51,240	\$68,350	\$85,400	\$102,450	\$119,560
7	\$45,650	\$54,780	\$73,050	\$91,300	\$109,500	\$127,820
8	\$48,600	\$58,320	\$77,750	\$97,200	\$116,600	\$136,080

Typical Retrofit Recipients

Number of Energy\$avers Recipients by Age



*Information based on the 307 Energy\$avers Recipients 2010-2013

Typical Retrofit Recipients

Ethnic Make Up of Energy\$avers Recipients



Typical Retrofit Recipients

Number of Energy\$avers Recipients By Household Size



Typical Retrofit Recipients



Typical Retrofit Recipients

Number of Recipients with 50% AMI or Less by Household Size and Age



Measures Installed



Measures Installed : Air sealing Outer-rim plate gap





Photo credit: DNR Construction

Measures Installed : Air sealing Outer-rim plate gap





Photo credit: DNR Construction

Measures Installed : Air sealing Plumbing, Chimney & Mechanical Penetrations





Photo credit: DNR Construction

Measures Installed : Air sealing Plumbing, Chimney & Mechanical Penetrations





Photo credit: DNR Construction

Measures Installed : Air sealing

Weatherstrip and sweep



BEDROOM BEDROOM BEDROOM BEDROOM BEDROOM BEDROOM BEDROOM BEDROOM

Photo credit: DNR Construction

Measures Installed : Insulation (unfinished attic)



Photo credit: DNR Construction



Measures Installed : Insulation (finished attic)



Photo credit: DNR Construction





Measures Installed : Insulation





Measures Installed : Infiltration Reduction



CNT Energy

- We help reduce energy usage and costs in households, buildings, and communities
- Areas of expertise include:
 - Dynamic pricing and smart grid
 - Energy-efficient, green, and healthy buildings
 - Regional energy planning

energy

• We manage programs in Illinois and consult nationally and internationally







- An affiliate of the Center for Neighborhood Technology
- Other CNT affiliates include IGO CarSharing





CNT Energy



ENERGY Efficiency & Benergy Efficiency & Benergy	
	Chicagoland Single-Family Housing Characterization
	J. Spanier, R. Scheu, L. Brand, and J. Yang Partnership for Advanced Residential Retrofit (PARR)
	June 2012
Balling .**	
U.E. Department of Energy	

Project Scope – HCBA Energy\$avers

- Characteristics of the homes pre-retrofit
 - Energy use (gas + electricity)
- How this population of homes compares to other energy + housing data sets
- Program trends and patterns:
 - Savings
 - Measures
 - \$ Spent
 - CFM50 reduction
 - HH Income
 - HH size
 - HVAC systems
 - Contractors
 - Geospatial distribution



Results & Findings - Snapshot

- 1. Bungalows are energy intensive, especially gas intensive.
- 2. Sample is representative of larger CNT Energy & local databases. But different than national databases.
- 3. Pre-retrofit Gas usage distributed across city except for highest users.
- 4. Bungalows saved ~9% total energy use (kBtu) after retrofit.
- 5. Savers and non-savers are distributed across the city.
- Weak correlation between energy savings & blower door reduction. (median CFM50 reduction = 41%)
- 7. Highest savers had highest pre-retrofit gas use.
- 8. 2-4 member households saved the most, while households with 5+ members saved the least.



Findings 1. Bungalows are energy intensive

Bungalows are ~10% more energy intensive per square foot than single family homes in Chicago

Energy Use Intensity (kBtu/sf/yr) Source: CNT Energy & HCBA					
	HCBA Pre- retrofit n=307	Chicago Single Family n= 200,037			
Median	154	141			
25th %	132	113			
75th %	188	173			

There are ~437,000 single family home in Chicago (2010)





Bungalows use a lot of gas (primarily for space heating)



Therms use in Bungalows (pre-retrofit)

Homes (n=370)



Electricity Use in Bungalows

These Households Use Less Electricity than Typical US Household



Homes (n=325)



Findings 2. This sample is representative of large local databases but...

	Energy Use Intensity (kBtu/sf/yr) Source: CNT Energy & HCBA Datasets				
	HCBA Pre- retrofit n=307	HCBA Membership n=6,439			
Median EUI	154	157			
25th %	132	132	·		
75th %	188	187			
IQR	56	55			



Findings 2. ...but not represented well in national samples

• Bungalows consume 17.5% more natural gas than the Chicago median; 77% more than the five state region, 85% more than others in the climate region

	Т	herms/yr	Source: CNT E	nergy & HCBA, RI	ECS Datasets	
	HCBA Pre- retrofit n=370	Chicago Single Family n= 200,037	Cook County Single Family n= 432,605	Pre-1942 Brick 1.5 story homes in Cook County n = 48,365		
Mean	1,653	1,437	1,392	1,608		
IQR	500	555	553	573		





Findings 4. Bungalows reduced energy use 9% after retrofit

- 83% of homes reduced total energy use. (Range -25% to 46%; median = 8.97%)
 - 12% of savers saved >20% (31)



Gas Savings

- 83% of homes reduced gas use. (range -36% to 48%; median = 8.9%)
 - 18% of savers saved >20% (55)



Bungalow therms Savings Distribution (2013)

Findings 5. Savers and non-savers are distributed across city



Findings 6. Weak Savings correlation to CFM50 reduction

HH with CFM50 readings above the median pre-retrofit had higher gas savings



energy

CFM50 Reduction vs Gas Savings

Median	7.31%	10.44%
Mean	7.72%	10.86%
N	184	183
	<5478	>=5478

Findings 7. Households that used more natural gas before the retrofit saved more

Consider targeting highest gas use homes

energy



Gas Savings% by pre-retrofit therms quartiles

© CNT Energy 2013

Findings 8. 2 - 4 person households saved most, while households with 5+ members saved least



HCBA Participant household size





- Post Analysis Site Visits
 - Looked at high savers and negative savers
 - 7 site visits in may
 - Trends: changes in occupancy, time-at-home
 - Second Site Visit in June
 - Visited homes less likely to have:
 - changes in occupancy
 - Changes in time-at-home

Bobby F.

- Blower door reduction 50%
- High user= 1732 therms
- Reduction of 29.3%
- **B** 80.4% Efficient Boiler
- Temp. 73 always
- Homeowner stated feeling more comfortable



Photo Source: Cook County Assessor

Bettye P.

- 45% reduction
- **D** 1781
- 9.6% Therms savings
- Boiler 83% eff.
 - Serviced every year
- Temp. 73 always
- Lower utility bills, but

Photo Source: Cook County Assessor

not necessarily more comfortable

□ Robert & Ida H.

- 41% Reduction
- 1242 Therms pre-retrofit
- 13.2% Therm savings
- Furnace at 90% efficiency;
- serviced every year
- **D** Consistent temp 66
- Lower bills



Photo Source: Cook County Assessor

Conclusion & Next Steps

- Comprehensive Occupant Survey
- Continue to monitor post-retrofit utility results
- Look at potential program components:
 - Mechanical systems
 - Increased attention to measures that effect electricity usage
 - Potential advanced air sealing and insulation measures

Thank You!



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