Direct Testimony

Of

David Brightwell
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Policy Program
Energy Division
Illinois Commerce Commission

Petition Pursuant to Rider EEP of Schedule of Rates for Gas Service to Initiate a

Proceeding to Determine the Accuracy of the Rider EEP Reconciliation

Statement

North Shore Gas Company and

The Peoples Gas Light and Coke Company

Docket Nos. 10-0565/10-0566 Consolidated

October 13, 2011

I. Witness Qualifications

Q. Please state your name, job title and business address.

A. My name is David Brightwell. I am an Economic Analyst in the Policy Program of the Energy Division of the Illinois Commerce Commission ("Commission"). My business address is 527 East Capitol Avenue, Springfield, Illinois 62701.

Q. Please describe your educational background.

A. I received a Ph.D. in economics from Texas A&M University in 2008. My major fields of study were industrial organization and labor economics, and my minor field was econometrics. I received a bachelor's degree in political science in 1992 and a master's degree in applied economics in 2002 from Illinois State University.

Q. Please describe your work background.

A. I have been employed as an Economic Analyst with the Commission since June 2008. I have focused on energy efficiency and smart grid related issues at the Commission. Staff has a non-voting role in the Peoples/ North Shore Gas Energy Efficiency Program's Governance Board. Since approximately January 2009, I have been a regular participant in both the Board meetings and the Operating Committee meetings. From 2002-2008, I attended Texas A&M University. While attending Texas A&M, I was a teaching assistant for my dissertation advisor Professor John Moroney for the 2002-2003, 2003-2004, and 2006-2007 academic

years and his research assistant in the summer 2003 semester. As a research assistant, I performed econometric analysis for the book *Energy and Sustainable Development in Mexico* written by John Moroney and Flory Dieck-Assad. I was the instructor for various economic classes from the 2004 summer semester through the 2007-2008 school years. From 2000-2002, I served as a graduate assistant for David Loomis at Illinois State University.

Q. Have you previously testified before the Commission?

A. Yes. I have.

II. <u>Purpose of Testimony</u>

Q. What is the purpose of your testimony in this proceeding?

A. I recommend that the Commission allow 44.6% (disallow 55.4%) of the expenses related for wall insulation. In the reconciliation of Program Year 1 expenses, the Commission allowed the Utilities to recover 70% of expenditures for wall insulation because the TRC value equaled 0.70 (Dockets 09-0436/0437 cons., Amendatory Order, dated April 12, 2011, pp. 20-22). My recommendation to allow the recovery of 44.6% of expenditures for wall insulation is based on the same reasoning. However, I believe the program managers incorrectly updated the TRC values at the beginning of Program Year 2. If the TRC values would have been updated

correctly, the TRC value for wall insulation would have been between 0.41 and 0.51. The average within this range equals 0.446.

Q. What is the value of your proposed disallowance?

A. The disallowances are $262,416 and $5,053 for Peoples Gas SC 1 and SC2, respectively and $58,846 and $831 for North Shore SC 1 and SC 2, respectively. These disallowances represent 55.4% (recovery of 44.6%) of the expenditures on wall insulation reported by the Utilities. (North Shore: NS-PGL Ex 2.1, Table 8, p. 24. Peoples: NS-PGL Ex. 2.2, Table 8, p. 24).

Q. Why did the Commission disallow expenditures for wall insulation in the Program Year 1 reconciliation?

A. The Commission ruled that the cost-effectiveness analysis that supported wall insulation was so deeply flawed that if it had been done correctly "the prudent designer would have either excluded wall insulation from the portfolio (in favor of other measures that would have also increased energy savings and consumer comfort, but more cost-effectively), or would have managed the portfolio to minimize the impact of a cost-ineffective measure." (Dockets 09-0436/0437 cons., Amendatory Order, April 12, 2011, p. 19). Among the reasons that the Commission found the analysis was flawed were that the program administrators assumed that there were no labor costs associated with installing wall insulation

while simultaneously promoting the program to contractors who performed the work. The program administrators also ignored any costs associated with repairing walls after insulation. The Commission also felt that it was inherently contradictory for the program administrator to assume the poor economy would make wall insulation a do-it-yourself project while also assuming that these same customers would have the walls open as part of larger home remodeling projects which require money to complete (Id, pp. 18-19).

Q. Did the Program rely on the same cost-effectiveness analysis for wall insulation in Program Year 2?

Y. Yes. The Program managers used the same flawed cost-effectiveness analysis in Program Year 2. Additionally, I believe the assumptions made to update the cost-effectiveness analysis were also flawed and overstated the TRC value for wall insulation. Accurate assumptions about the buildings would result in TRC test values ranging from 0.41 to 0.51. The average of 8 scenarios with this range was 0.446. These are the bases for my recommendation to disallow the expenses mentioned above.

Q. In the Program Year 1 reconciliation, the Commission allowed the Utilities to recover 70% of its expenditures on wall insulation. Why do you recommend that the Commission only allow 44.6% of costs to be recovered in the Program Year 2 reconciliation?

A. In my opinion, Program managers did not correctly use information available to them when they updated TRC estimates in Program Year 2. If the Program managers had correctly used the information available from Year 1, the TRC values would have ranged between .41 and .51 with an average value equal to .446.

Q. How were TRC values updated?

A. In the original cost-effectiveness calculations, energy savings were determined by assuming a 1400 square foot building with a single story and a basement (Attachment 1, Table 1, p. 6). It was assumed that the total wall insulation based on this building was 3366 square feet (Id, Table 5, p. 13). Program managers arrived at the 3366 square foot estimate by assuming that insulation in both the main story and basement walls would be installed. The energy savings model assumed 8 foot high basement walls and 9 foot high main story walls (Companies' Response to Staff DR POL 3.01). In the first Program Year, the average customer who participated in the program installed 1147 square feet of insulation (Companies' Responses to Staff DR POL 1.05, part a). The Program managers updated the energy savings estimates by calculating the savings per square foot from the original assumptions and then multiplying the savings per square foot by 1147 – the actual square footage from Program Year 1 (Companies' Responses to Staff DR POL 1.05, part b). The TRC values were then estimated by using the energy savings from the method described.

Q. How do you think the Program managers should have updated the TRC values?

A. I believe the Program managers should have considered the possibility that customers were only installing insulation in the main story rather than the main story and the basement. It is clear that the building dimensions implied from the methods conducted by the Program managers are unrealistic. If the managers

estimated reasonable building dimensions and updated the energy savings on a housing unit with those dimensions, the savings would have been substantially different and the TRC values would range from 0.41 to 0.51.

Q. Why is it clear that the dimensions are unrealistic?

A. If one assumes that the total amount of insulation is 1147 square feet and that both a basement with 8 foot high walls and a main story with 9 foot high walls receive insulation, then the sum of the length and the width of the walls is approximately 34 feet.[1] Under this assumption, the maximum possible floor space in the house is approximately 578 square feet. That is, the house consists of a 289 square foot basement and a 289 square foot main story. It is unreasonable to assume there are many people living in such small houses.

Q. How did you determine that the TRC values would range from 0.41 to 0.51?

A. The original savings calculations assumed the east and west walls were 82 feet in length and the north and south walls were 17 feet in length. The height of each wall was 9 feet. I asked the Companies to calculate the energy savings and cost-effectiveness for these dimensions assuming no insulation was installed in basement walls. The response indicated that the TRC value was 0.51 when administrative costs were excluded from the calculation and 0.49 when administrative costs were included (Companies' Supplemental Response to Staff DR POL 4.01, part b).

[1] The square footage of the walls equals H(2L+2W) where H is the height of walls, L is the length and W is the width. The length and width are multiplied by 2 because there are 2 walls with these dimensions. If both a basement and a main story are insulated the total insulation is the sum of basement wall insulation and main story wall insulation. Under the assumptions of 8 foot basement walls and 9 foot main story walls the formula is 8(2L+2W) + 9(2L+2W) = 34(L+W). The square footage installed in Year 1 was 1147. Using the formula above, 34(L+W)=1147 reveals that L+W =33.75, rounding to 34 and using the principle that square footage is maximized by choosing L=W reveals that the maximum square footage is 289 when both the length and the width are 17 feet.

I then attempted to determine some possible dimensions for the buildings that were observed. That is, buildings that had 1147 square feet of wall space and 1133[2] square feet of floor space or ceiling space on each level (2266 combined square feet between the basement and main floor). Using the mathematical formulas needed to fit walls and floors to these wall and floor space square footages, I determined that there was no solution when walls were assumed to be 9 feet high. If walls were assumed to be 8.5 feet high, the length and width of walls needed to sum to approximately 67.5 feet. I chose a building with 36-foot long east/west walls and 31.5-foot north/south walls (1134 square feet per floor level). Assuming these dimensions and no basement insulation, the TRC values were 0.45 and 0.42 depending on whether administrative costs were included in the calculation (Companies' Supplemental Response to Staff DR POL 4.02, part b).

I repeated this process assuming walls were 8.25 feet high. The east/west walls were assumed to be 43.4 feet long and the north south walls were assumed to be 26.1 feet long (1132.7 square feet of floor space). The TRC values were estimated to equal 0.44 and 0.41 depending on whether administrative costs were included in the calculations (Companies' Supplemental Response to Staff DR POL 4.03, part b).

I also assumed the walls were 8 feet high. Under this assumption, the east/west walls were 48.2 feet and the north/south walls were 23.5 feet (1132.7 square feet). The TRC values were equal to 0.44 and 0.41 depending on whether administrative costs were included or not (Companies' Supplemental Response to Staff DR POL 4.04, part b).

[2] According to the Companies' responses to Staff DR POL 1.04, part a, the square footage of attic insulation sold in Yr 1 averaged 1113 square feet. I mistakenly calculated floor space assuming 1133 rather than 1113. Due to the utilities initially objecting to the original data requests POL 4.01 – 4.04 because it required additional analysis not originally performed, the time it took to receive a supplemental response and the likely small difference in TRC values associated with correcting for a 20 square foot difference, I did not pursue new information based on the 1113 square feet that was observed in Year 1.

Under the four scenarios described there are eight estimates for the TRC ratio value, four that include administrative costs and four that exclude administrative costs. The average of those eight values equals 0.446. In my opinion, the TRC value equal to 0.446 represents a reasonable estimate of the TRC value for wall insulation under realistic assumptions of the building dimensions. Since the Commission used the TRC value to determine how much the Companies were allowed to recover in the reconciliation of program year 1 wall insulation expenses, I believe that 44.6% (a 55.4% disallowance) of expenditures on wall insulation represents the appropriate level of recovery in this reconciliation proceeding.

Q. Does this conclude your direct testimony?

A. Yes.

Dockets 10-0565/0566
Consolidated
Staff Ex. 2.0
Attachment 1

DRAFT DOCUMENT

ENERGY SAVING MEASURES
PEOPLE'S GAS PROJECT

ENERGY MODELING OF A CHICAGO RESIDENTIAL HOME

USING

TREAT™ - TARGETED RESIDENTIAL ENERGY ANALYSIS TOOLS

CNT ENERGY

Working Document V. 001

Study by

Anne Evens Director
Larry Kotewa PE
Michael Whelton PhD

Contributions by

16th January 2009.

INTRODUCTION

This research describes an energy modeling methodology that represents the energy use in a typical single family home. In particular the study focuses on the development of an energy modeling process for a Chicago bungalow.

Based on this methodology a platform is established for the prediction of energy savings by which designed energy saving measures can be analyzed. The energy model provides a systems analysis for the various improvement initiatives and a cost benefit analysis for each improvement measure.

The study provides supporting data for the development of the People's gas rebate program for energy efficient residential housing measures. The paper documents predicted costs of improvement measures and the associated energy savings for the Retailer Program and the Furnace Program as established by People's Gas.

OUTLINE OF STUDY OBJECTIVES

The objectives of the study are summarized as follows:

1. Establishment of an operational framework for energy modeling of residential homes.
2. Selection of a particular building type to act as baseline model for energy savings;
3. Establishment and compilation of energy model data;
   - Weather data;
   - Physical building and energy systems and;
   - Energy billing data.
4. Development of a baseline model using TREAT™ – Targeted Residential Energy Analysis Tools.
5. Design of energy saving measures.

6. Energy savings predictions of standard replacement of systems and high efficiency replacement of systems.

7. Development of results and concluding remarks.

Figure 1 describes the energy modeling process that was established to support the measures design for the energy efficiency program.

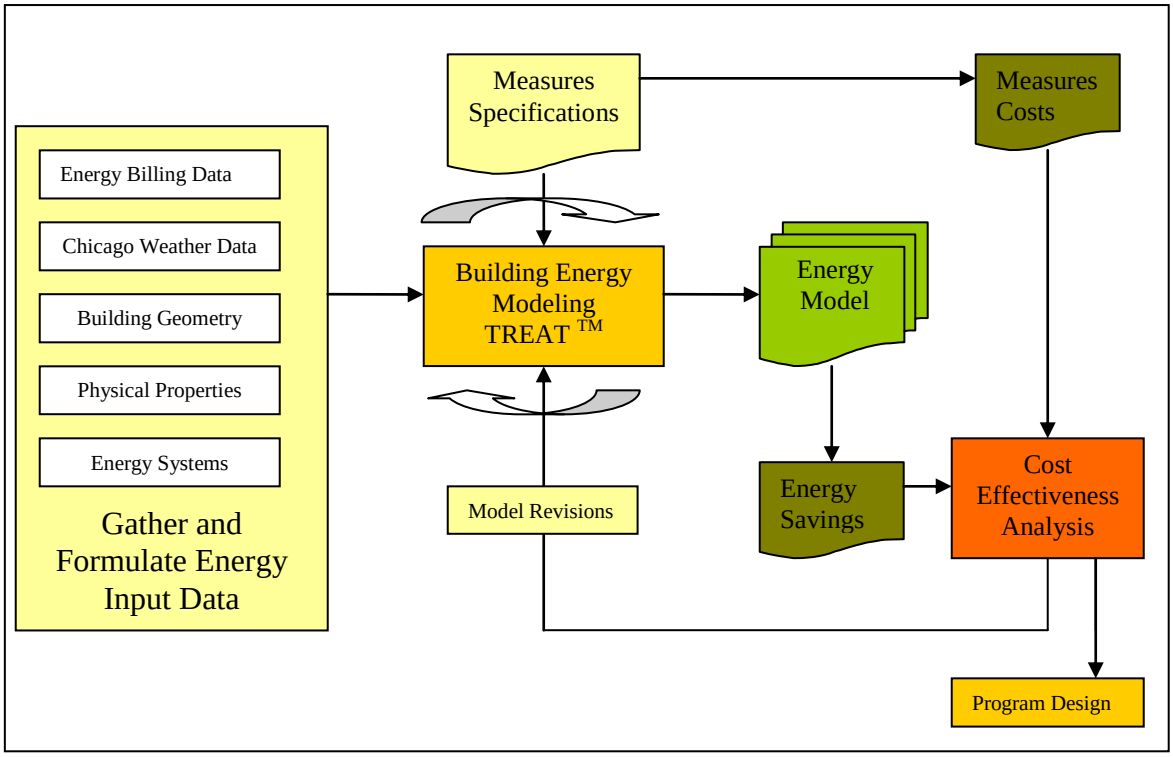

Figure 1 Energy Modeling Framework as an Input Output System

ENERGY MODELING APPROACH

The energy use of a residential home is specific to the nature and condition of the physical building system, the energy systems performance, weather conditions and user behavior. In terms of energy savings, measures related to weatherization e.g. insulation, and heating systems - furnaces and boilers, are directly associated with the relationship of the physical model, the weather data, the billing data. Other energy saving measures such as appliances e.g. clothes washers and water heaters are primarily user behavior related and product performance related, and savings are less determined by weather, location, and physical building properties.

Computational energy modeling is an established approach[1] to predicting energy use in buildings. TREAT™ is an energy modeling software program that computes energy use in single or multi-family buildings[2]. TREAT conforms to the Home Energy Rating System Building Energy Simulation Test[3], which supports the certification of energy simulation programs in the USA.

The software was chosen as a modeling environment given its ability to model residential energy use and to model costs of improvement strategies such as systems replacements and physical enhancements to the building fabric.

The modeling strategy is limited in terms of encapsulating the range of variability that the Chicago residential housing stock displays. Therefore experiential based choices were made with respect to the selection of the most common type of residential home and the physical properties of the home.

DEVELOPMENT OF ENERGY BILLING DATA PROFILES

An energy use profile for both gas and electricity was created from data compiled by City of Chicago Utility companies and further developed by CNT Energy[4]. Figure 2 illustrates the energy profiles for average gas and electricity use for residential homes in the City of Chicago for 2005.

WEATHER DATA

TREAT utilizes daily temperatures to model heating and cooling loads and subsequent energy use. Temperatures for the Chicago area[5] were used in the analyses.

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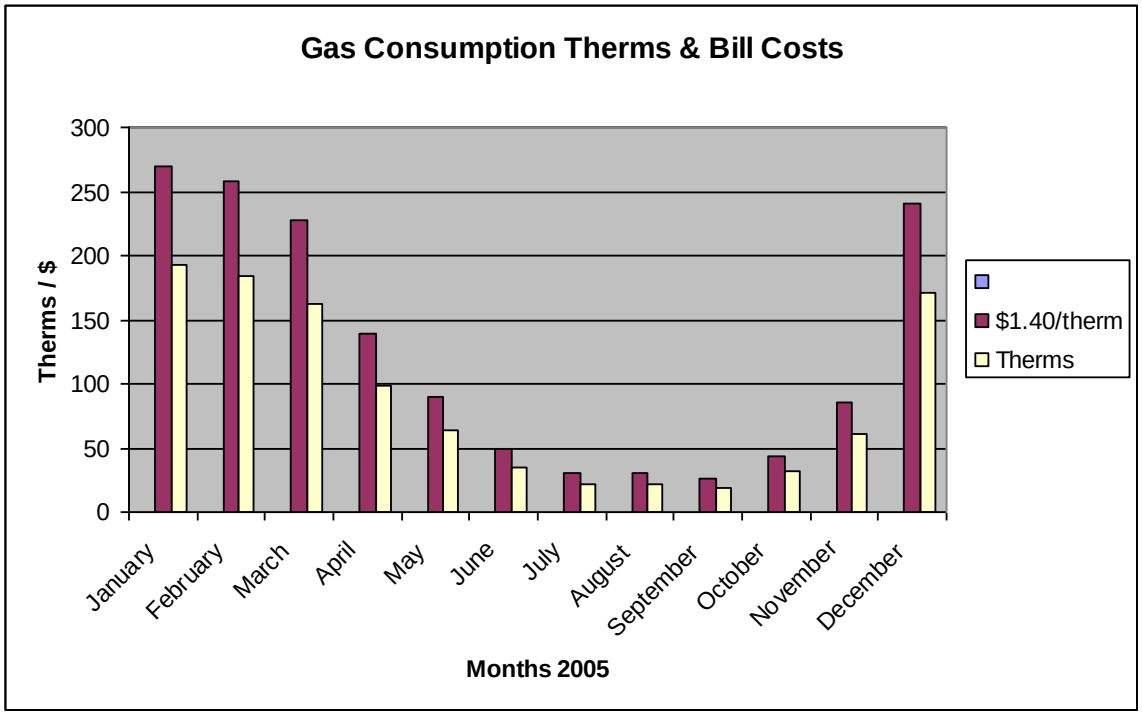
[1] http://www.doe2.com/
[2] http://treatsoftware.psdconsulting.com/user_manuals.html
[3] http://www.nrel.gov/docs/legosti/fy96/7332b.pdf
[4] CNT Energy: internal document wrt energy data.
[5] Temperature Location: http://www.engr.udayton.edu/faculty/jkissock/gsod/ILCHICAG.txt



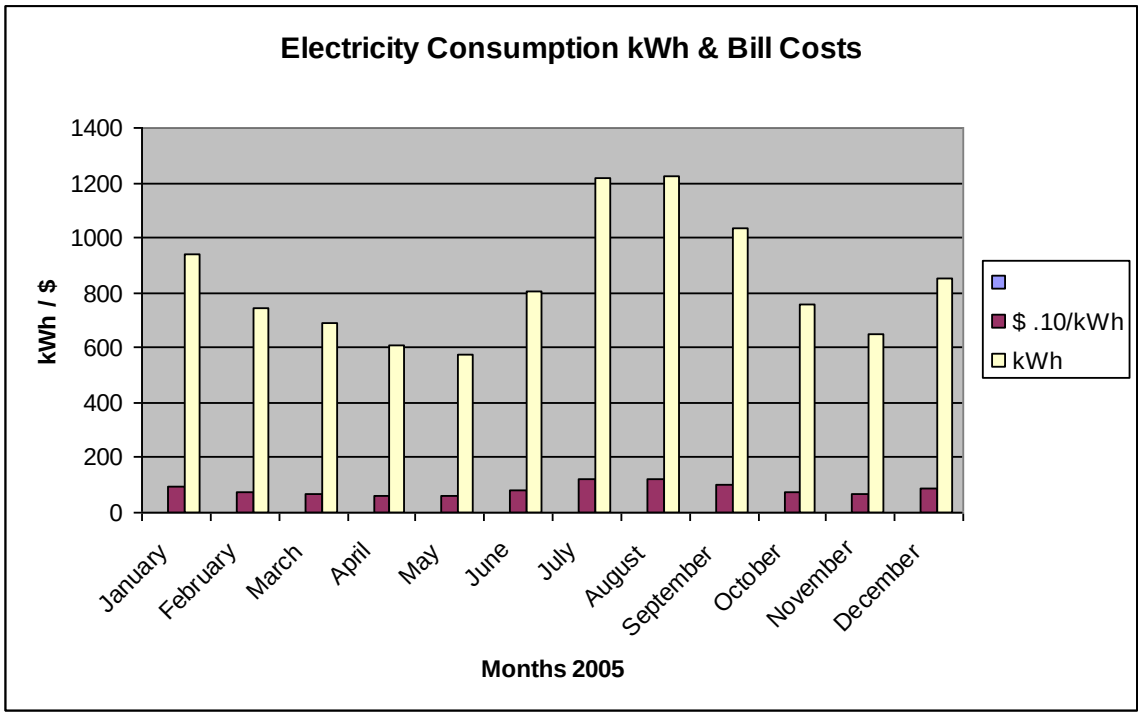


Figure 2 City of Chicago Residential Energy Use Profiles

BUILDING TYPE SELECTION AND GEOMETRY

The methodology centers on the development of an energy use model for a typical residential home in the City of Chicago. Examples of recent and local energy retrofit projects in the City of Chicago include the Chicago green bungalow initiative[6] and Comed's Energy Efficiency Showcase[7].

Figure 3 illustrates a massing model of a Chicago bungalow describing the geometrical parameters used to model physical properties of the building. The models are a representation of a typical building type and are limited with respect being fully representative of all residential building sets. Further model sets are necessary for broader representation.

Table 1 lists the general physical description for the model.

Table 1 General Properties of Building Type

Building Properties	Description	Variations Modeled
Building Type	Single Family Home (Chicago Bungalow)	
Size and Spaces	1400 sq ft Footprint, 1 story and basement, unused attic space	
Construction	Brick Frame	
Conditioned Spaces	Conditioned 1St Floor and Basement	
Window Types	Glazing 12 # 3'x5' single pane windows.	
Air Infiltration	Very Leaky Building	
Insulation:	None	
Heating Systems	Gas Air Furnace – 80% Eff	Gas Water Boiler – 80% Eff

[6] http://egov.cityofchicago.org/webportal/COCWebPortal/COC_ATTACH/GreenBungalowRpt.pdf http://egov.cityofchicago.org/webportal/COCWebPortal/COC_ATTACH/bungalow_energy_analysis_2004.pdf

[7] http://www.exeloncorp.com/NR/rdonlyres/FB49B9EB-870A-46DB-B273-DA724AD24EDF/2790/ChicagoBungalowEnergySavingsEstimates.pdf

Air Conditioning	Window Units	

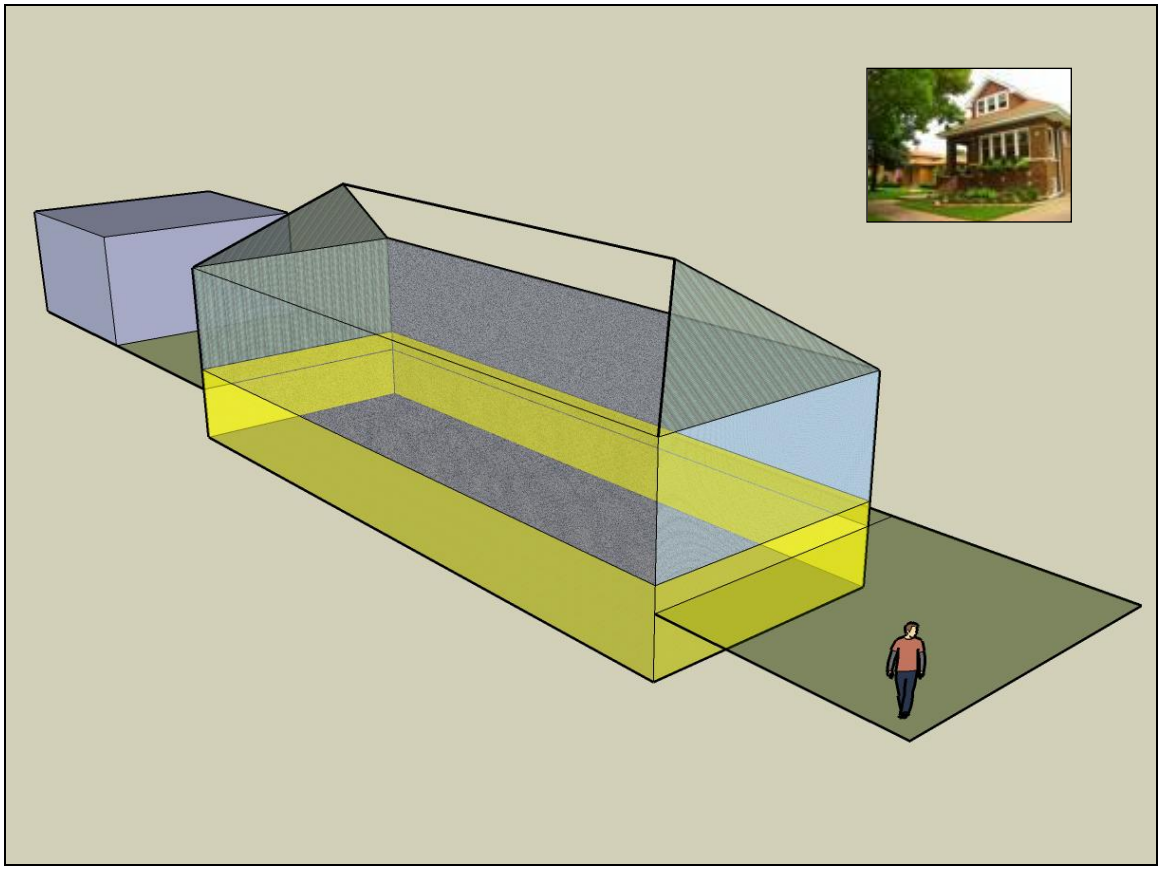


Figure 3 Chicago Bungalow Massing Model (Sketch Up™ 3d View).

MODEL DEVELOPMENT

Figure 4 illustrates the modeling environment and user interface for data input. Each segment comprises of information necessary to establish a realistic model of the building. The TREAT™ user manual (See Ref 2) further describes the system framework and modeling environment.

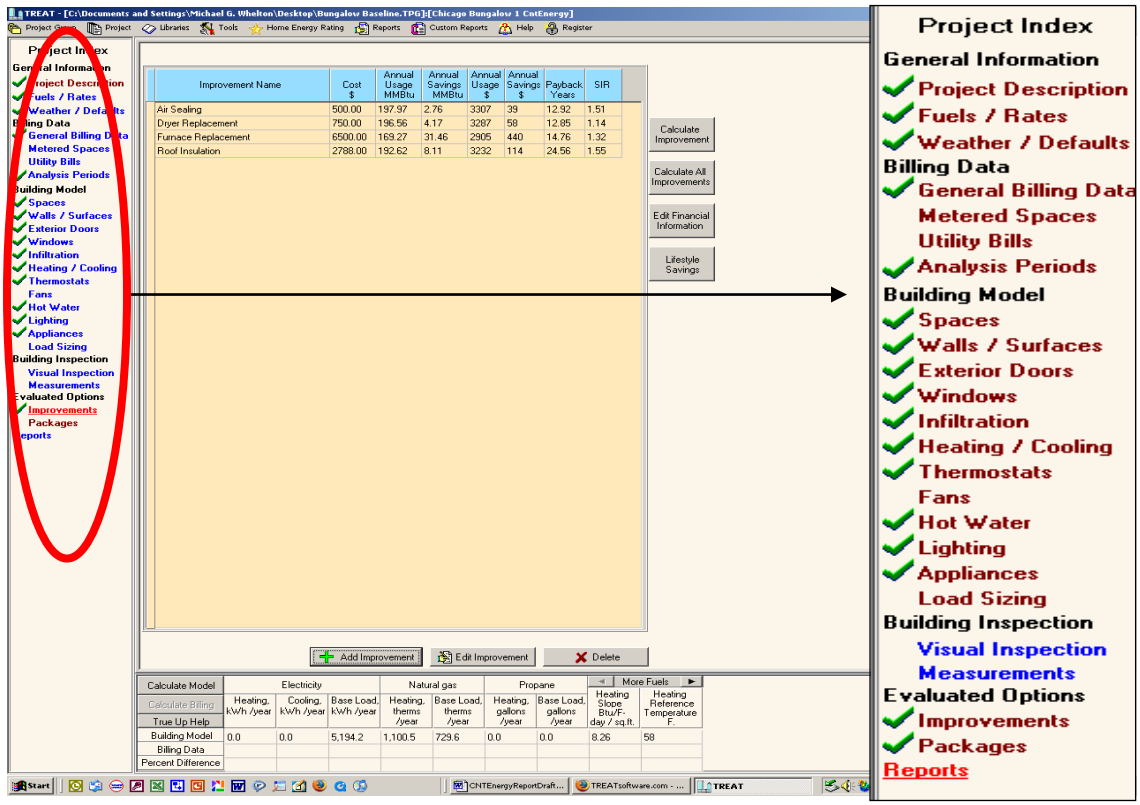


Figure 4 TREAT™ User Interface for Modeling Parameters

POSITIONING ENERGY USE MODEL IN HOUSING STOCK

TREAT calibrates the computational energy model with actual billing data as seen in Figure 2. The energy model was calibrated to model residential homes that depict high energy use intensity. Figure 5 illustrates the range of housing stock that the model intends to represent, and where energy efficiency measures can provide the greatest opportunity for energy savings.

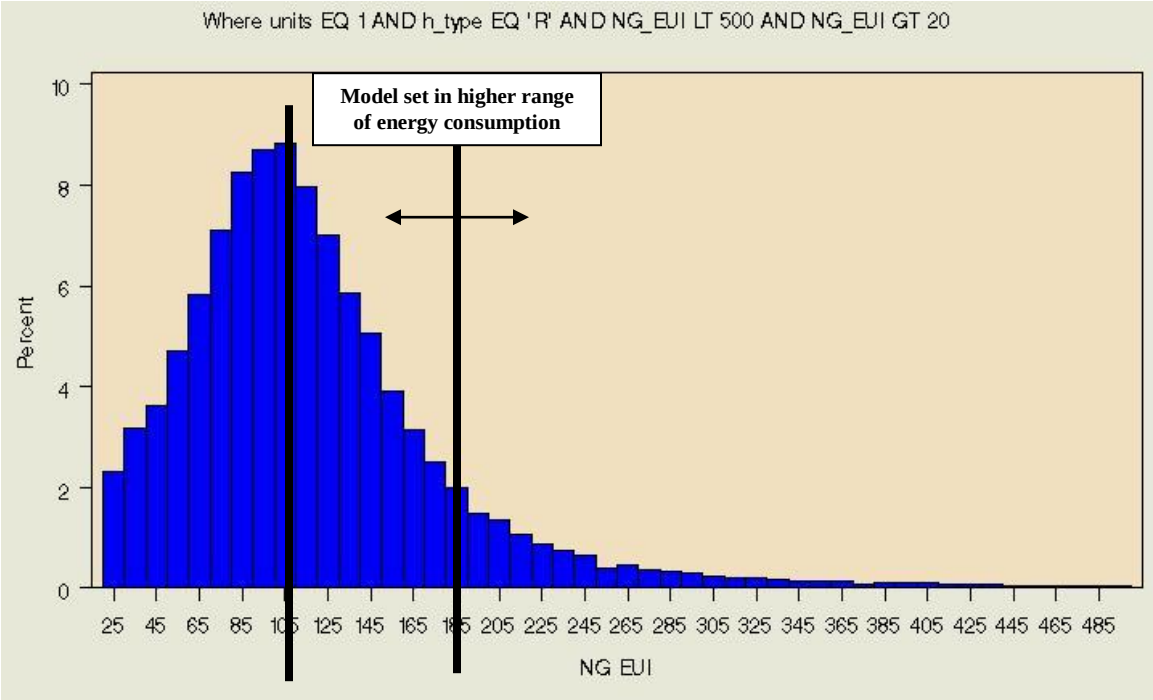


Figure 5 Illustration of Energy Model Range of Representation

MEASURES DEVELOPMENT

Table 2 outlines the measures that were identified for modeling energy savings.

Table 2 Residential Housing Energy Saving Measures

Measure Name/Description
1. Ceiling Insulation (R-38)
2. Wall Insulation (R-11)
3. ENERGY STAR Clothes Washers (Energy Star: MEF >/= 1.72 and WF </=8.0)
4. Storage Water Heater (Energy Star: EF >/= 0.62)
5. Tankless Water Heater (Energy Star: EF >/= 0.82)
6. Gas Condensing Water Heater (Energy Star: EF >/= 0.80)
7. 92-93% AFUE, High Efficiency Gas Furnace
8. 94+% AFUE, High Efficiency Gas Furnace
9. High efficiency gas boiler 85% Eff.

10. High efficiency gas boiler 95% Eff.

RESULTS

The energy model was further developed to model the improvement measures as set out in Table 3. The model set a baseline case, a standard measures replacement case and a high efficiency measures replacement case. The differential results between the standard case and high efficiency case shown in Table 4 were used as inputs to the cost effectiveness assessment process as shown in Figure 1. Table 5 summarizes the costs per unit for the final selected measures.

CONCLUDING REMARKS AND FURTHER DEVELOPMENT

The following projects are identified to further improve the quality of the modeling process:

- Analyze billing data by location to establish energy usage and costs for specific building types. Set up data sets with GIS applications;
- Gather field data on physical building properties wrt building system R-values;
- Develop a database of measures costs for improved modeling and potential budget management of energy retrofit projects;
- Explore the use of Monte Carlo simulation as a means of modeling cost variability of energy saving measures;
- Improve “model and feedback” cycle with project stakeholders, i.e. create smaller batch sizes of “model”, rapid development and feedback cycle to improve rates of learning;
- Determine benchmarks for cost effectiveness of measures; and
- Seek post-program feedback to test performance of results.
- Collaborate with energy efficiency program partners to implement the above.

Table 3 Baseline, Standard and High Efficiency Cases

Measure Name/Description High Efficiency Case	**Measure life (yrs) *Source DEER***	**Unit Sizes - Physical Building Model**	**Units**	**Baseline Case Assumptions**	**Standard Case Assumptions**
Ceiling Insulation (R-38) Contractor Installed Cellulose	20	1400	Square foot	No Insulation Exists	No Insulation Added
Wall Insulation (R-11) Self Install Batts	20	3366	Square foot	No Insulation Exists	No Insulation Added
ENERGY STAR Clothes Washers (Energy Star: MEF >/= 1.72 and WF </=8.0)	11	1	Per home	Gas Water Heating Older>1994	Conventional Washer Unit
Storage Water Heater (Energy Star: EF >/= 0.62)	11	1	Per home	SWH 40 Gallon Eff 70%	SWH 40 Gallon EF 59
Tankless Water Heater (Energy Star: EF >/= 0.82)	20	1	Per home	SWH 40 Gallon Eff 70%	Basic Tankless EF 59
Gas Condensing Water Heater (Energy Star: EF >/= 0.80)	11	1	Per home	SWH 40 Gallon Eff 70%	Basic Gas Condensing EF 59
92-93% AFUE, High Efficiency Gas Furnace	20	1	Per home	80% Eff	80 % Eff
94+% AFUE, High Efficiency Gas Furnace	20	1	Per home	80% Eff	80 % Eff
High efficiency gas boiler 85% Eff.	20	1	Per home	80% Eff	80 % Eff
High efficiency gas boiler 95% Eff.	20	1	Per home	80% Eff	80% Eff

Table 4 Measures Costs and Energy Savings

Measure Name/Description	Units	Standard Unit Cost $/Unit	Standard Gross Therm Savings/yr/unit	Standard kWh/yr Savings/yr/Unit	Standard Total Home Cost $ for Measure	High Eff Upgrade Total Cost $/Unit *	Incremental measure cost from Standard to High Eff ($) / Unit	Total Home Cost - Differential from Standard Cost to High Eff ($)	Gross therm savings/yr	kWh Savings/yr	High Eff. Therm savings/yr/unit	High Eff. kWh Savings/yr/unit
Ceiling Insulation (R-38) Contractor Installed Cellulose	Square foot	0	0	0	0	3.00	3.00	4200.00	467.00	970	0.33	0.69
Wall Insulation (R-11) Self Install Batts	Square foot	0	0	0	0	0.35	0.35	1178.10	275.00	-313	0.08	-0.09
ENERGY STAR Clothes Washers (Energy Star: MEF >/= 1.72 and WF </=8.0)	Per home	400	na	na	400	700.00	300.00	300.00	11.76	25.87	11.76	25.87
Storage Water Heater (Energy Star: EF >/= 0.62)	Per home	600	57	11	600	900.00	300.00	300.00	42.00	3	42.00	3.00
Tankless Water Heater (Energy Star: EF >/= 0.82)	Per home	1200	57	11	1200	1500.00	300.00	300.00	115.00	6	115.00	6.00
Gas Condensing Water Heater (Energy Star: EF >/= 0.80)	Per home	800	57	11	800	1000.00	200.00	200.00	110.00	6	110.00	6.00
92-93% AFUE, High Efficiency Gas Furnace	Per home	2500	0	0	2500	3500.00	1000.00	1000.00	97.00	0	97.00	0.00
94+% AFUE, High Efficiency Gas Furnace	Per home	2500	0	0	2500	4000.00	1500.00	1500.00	130.00	0	130.00	0.00
High efficiency gas boiler 85% Eff.	Per home	3500	0	0	3500	4500.00	1000.00	1000.00	170.00	0	170.00	0.00
High efficiency gas boiler 95% Eff.	Per home	3500	0	0	3500	5000.00	1500.00	1500.00	256.00	0	256.00	0.00

Table 5 Full Measures Costs Data Per Unit

Measure Name/Description	Unit Sizes - Physical Building Model	Units	Standard Unit Cost $/Unit	High Eff Upgrade Cost $/Unit	CNT Energy Internal References & Online Resources
Ceiling Insulation (R-49): Fiberglass Batts Self Installed	1400.00	Square foot	NA	1.00	http://www.homedepot.com/webapp/wcs/stores/servlet/Navigation?Ntk=AllProps&N=10000003+90234+527411&storeId=10051&catalogId=10053&langId=-1 http://www.greenbeaninsulation.com/investment-returns.html COST PER SQ FT FOR FOAM- full installation varies in cost from $1.30-$1.90 per sqft COST PER SQ FT FOR CELLULOSE- full installation for blow-in cellulose usually ranges from $0.75-$0.95 per sqft for R-30 in attics, R-15 in walls. DRILL & FILL in existing wall cavities usually ranges from $1.25-$1.50/sqft. http://www.jea.com/about/pub/downloads/AtticInsulationUpgrade.pdf http://www.accuspect.com/cost.asp Insulation Insulate open attic to modern standards $1 - $1.50 / sq. ft. Blow insulation into flat roof, cathedral ceiling or wall cavity $2 - $3.50 /sq. ft. Lump Sum: 1,800-$2,500 single family (From Kevin at Delta) typically $2/sqft.
Ceiling Insulation (R-49) contractor installed (Blown Cellulose)	1400.00	Square foot	NA	3.50	
Ceiling Insulation (R-38): Fiberglass Batts Self Installed	1400.00	Square foot	NA	0.80	
Ceiling Insulation (R-38) contractor installed (Blown Cellulose)	1400.00	Square foot	NA	3.00	
Ceiling Insulation (R-30): Fiberglass Batts Self Installed	1400.00	Square foot	NA	0.52	
Ceiling Insulation (R-30) contractor installed (Blown Cellulose)	1400.00	Square foot	NA	2.75	
Wall Insulation (R-11): self-installed (batting or rigid)	3366.00	Square foot	NA	0.35	
Wall Insulation (R-11): contractor installed (spray foam)	3366.00	Square foot	NA	2.25	
Wall Insulation (R-19): self-installed (batting or rigid)	3366.00	Square foot	NA	0.40	
Wall Insulation (R-19): contractor installed (spray foam)	3366.00	Square foot	NA	2.50	
Hot water pipe insulation (Domestic Hot Water only)	200.00	Per linear foot	NA	1.00	http://www.leaningpinesoftware.com/hot_water_pipes.shtml - R-4 used in Model http://www.northwesternenergy.com/documents/E+Programs/E+NaturalGasRebate-Equipment.pdf rebate info, insulating pipe.
Low E double pane windows (ENERGY STAR: U-Factor </= 0.35)	180.00	Square foot	20	33.33	http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10&productId=100081911&N=10000003+500324+10234013 http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&productId=100547854&langId=-1&catalogId=10
ENERGY STAR Doors (ENERGY STAR: U-Factor </= 0.35)	19.50	Square foot	20	60.61	http://www.housingprohome.com/thermatru_entry.html

TABLE 5 CONTD. Measure Name/Description	Unit Sizes - Physical Building Model	Units	Standard Unit Cost $/Unit	High Eff Upgrade Cost $/Unit	CNT Energy Internal References & Online Resources
ENERGY STAR Clothes Washers (Energy Star: MEF >/= 1.72 and WF </=8.0)	1.00	Per unit	400	700.00	http://www.sears.com/shc/s/s_10153_12605_Appliances_Washers+%26+Dryers_View+All+Washers?filter=Energy+Star+Compliant|Yes http://www.energystar.gov/index.cfm?c=clotheswash.pr_crit_clothes_washers See Washer Calc sheet
Storage Water Heater (Energy Star: EF >/= 0.62)	1.00	Per unit	600	900.00	Plumbing Contractor (Mobile Plumbing): Input $1000 High Eff Model Comed Cares Cost Report - $1550 http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10053&productId=100627491 http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeater_ProgramRequirements_2008.pdf http://www.consumerreports.org/cro/appliances/heating-cooling-and-air/water-heaters/tankless-water-heaters/overview/tankless-water-heaters-ov.htm http://www.energystar.gov/index.cfm?fuseaction=gas_tankless.display_products_html http://www.energystar.gov/index.cfm?fuseaction=gas_storage.display_products_html EF Conventional Water Heaters .59
Tankless Water Heater (Energy Star: EF >/= 0.82)	1.00	Per unit	1200	1500.00	
Gas Condensing Water Heater (Energy Star: EF >/= 0.80)	1.00	Per unit	800	1000.00	
92-93% AFUE, High Efficiency Gas Furnace	1.00	Per home	2500	3500.00	Comfortable Air Corp: $2000 basic model, $2500 - $3500 90+% eff Kevin from Delta Institute: Budget for $2200 - $3000 basic models, All Temp Contractor (Rachel Cnt Contractor): $4225 92% eff. Single Family Home Quotation Comfortable Air Corp: Budget for Boilers: $3500-$3800 basic model, $5000 95% eff Kevin Dick at Delta Institute: Budget for $4500 for Boiler Replacement Other: Comed Cares Cost Report $8100 Other: Chicago Bungalow $4800
94+% AFUE, High Efficiency Gas Furnace	1.00	Per home	2500	4000.00	
High efficiency gas boiler 85% Eff.	1.00	Per home	3500	4500.00	
High efficiency gas boiler 95% Eff.	1.00	Per home	3500	5000.00	