PUBLIC POLICY AND REAL ENERGY EFFICIENCY

Assessing the effects of Federal policies on energy consumption and the environment

APPENDICES

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Appendix A

Analysis Methodology & Detailed Results

NEW ENERGY EFFICIENT HOME CREDIT

Analysis Methodology

The latest release of REM/Rate (v11.41) was used to quantify the impact of the New Energy Efficient Home Credit as proposed in 2003.[1] REM/Rate computes site and real energy consumption, greenhouse gas emissions and energy cost. Both real energy consumption and greenhouse gas emission computations are based on the type of fuel used at the home and the location. The emission data for all 50 states were obtained from the American Gas Association.

Energy costs were input into the REM/Rate based on the most recent average state electric and natural gas costs published by the EIA for each of the locations analyzed. Costs for both electricity and natural gas are average statewide costs for the most recent year for which data was available. Electric energy costs are based on average revenue per kilowatt-hour for electricity sold to residential consumers. Any seasonal or daily variations in energy cost or demand costs, where applicable, are factored into these values. Natural gas energy costs reflect the average price per thousand cubic feet delivered to residential consumers. Applicable energy costs are summarized in Table A.1.

Table A.1 - Summary of Regional Energy Costs

Location	Electricity Cost [1]		Natural Gas Cost [2]		Elec./NG Cost Ratio
	($/kWh)	($/MMBtu)	($/MCF)	($/MMBtu)	
Massachusetts (Boston)	0.108	31.64	12.80	14.08	2.25
New York (New York)	0.138	40.43	11.75	12.93	3.13
Georgia (Atlanta)	0.076	22.27	10.58	11.64	1.91
Illinois (Chicago)	0.086	25.20	9.04	9.94	2.54
Texas (Dallas)	0.081	23.73	8.90	9.79	2.42
Colorado (Denver)	0.078	22.85	8.36	9.20	2.48
Arizona (Phoenix)	0.090	26.37	10.51	11.56	2.28
Washington (Seattle)	0.065	19.05	9.79	10.77	1.77

Notes:
1. Estimated electric utility average revenue per kWh to residential consumers during 2002.
2. Average price of natural gas delivered to residential consumers during 2001.

A 2,265 square foot one story residence with a full basement was modeled in REM/Rate to measure the comparative impact of the pending energy credit legislation. The National Association of Home Builders (NAHB), which compiles data on hew home construction, describes the profile of a typical new home

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[1] The term New Energy Efficient Home Credit as proposed in 2003 as used in this Section refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005. built in 2000 as a

2,265 square foot home with 3 bedrooms, 2-1/2 bathrooms, a 2-car garage, a fireplace and central air conditioning (NAHB 2001).

Residential energy consumption is differentiated by code requirements for insulation and fenestration based on climatic region. To capture this variation in the analysis, energy consumption for the building model described above was simulated in at least one city in each of the seven major geographic regions of the United States. In most instances, these locations represent the largest housing market in that part of the country (Table A.2).

In order to calculate the heating and cooling energy consumption, climate information was input for each of the locations analyzed. A library of weather data for all major U.S. cities is included in REM/Rate. Heating degree-days and cooling degree-hours for each location is also available, but are used for code compliance purposes only. Other location-specific climate data available in REM/Rate include ASHRAE W-Factor, design heating temperature, and design cooling temperature

Table A.2 - Summary of Regional Housing Variations

U.S. Census Region	DOE Region	Representative City
New England	1	Boston, MA
Middle Atlantic	2	New York, NY
South Atlantic	4	Atlanta, GA
East North Central	5	Chicago, IL
West South Central	6	Dallas, TX
Mountain	8	Denver, CO
Mountain	9	Phoenix, AZ
Pacific	10	Seattle, WA

2000 MINNESOTA ENERGY CODE

Analysis Methodology

An analysis was performed comparing the energy costs, real energy consumption and atmospheric emissions of both a standard atmospherically vented natural gas water heater and a power direct vent (PDV) natural gas water heater versus an electric water heater for a typical single-family residence. The comparison was done for two different residential customers within the Minnegasco service territory, one being provided with electric service from Northern States Power (now part of Xcel Energy Inc.) and one located in a rural area getting electric service from an electric cooperative.

Both the atmospheric natural gas water heater (EF=0.62) and power direct-vent natural gas water heater (EF=0.59) were considered to be 40-gallons in capacity. The electric water heater installed in a residence located within the Xcel service territory was considered to be of the 50-gallon size (EF=0.88) while the electric water heater in the electric co-op area was 105 gallons (EF=0.91). Electric water heaters typically have slower recovery rates and larger tank size than water heaters that rely on combustion. The much larger 105-gallon capacity electric unit is typical of what is normally installed in electric co-op areas where the water heater only operates during the late evening and early morning (off-peak) hours when electric rates are low and therefore the greater storage volume is required to have enough hot water available to meet demands during the daytime period when the water heater is not allowed to operate due to high electric demand on the grid (on-peak period). Tables A.3 and A.4 present the results of the comparison for both a customer in the Xcel territory and a customer in the co-op utility areas. In each case a typical annual hot water load (Output Btu) is supplied by each water heater. Dividing the Output requirement by the energy factor gives the equivalent Input energy required for each water heater. This Input energy quantity is then converted into natural gas (therms) or electricity (kilowatt-hours, kWh) consumption. In the case of the PDV gas water heater some small quantities of electricity are also consumed by the blower, controls and ignition device (DOE 2000, A.O. Smith 2000) and were accounted for.

Appropriate costs for natural gas and electricity were then used to determine a total annual energy cost that would be seen by the homeowner in each case. For homes located in the Xcel service territory, operating costs with gas are more than 50% lower than with electric. In our case study, annual savings of from $172 - $185 are possible with natural gas water heaters. In the co-op areas, savings also resulted with natural gas water heaters although at a much lower level due to the lower cost of electricity during the off-peak period but the homeowner must install an electric water heater with more than twice as much storage capacity as a gas water heater.

A comparison of real energy consumption and corresponding atmospheric emissions for each water heater scenario described above was also performed using appropriate energy conversion factors and source pollutant emission factors. The EPA Emissions & Generation Resource Integrated Database (E-GRID 2001) reports generation and emissions operating data for all major electric utilities in the U.S. and each of their electric generating plants. This database was accessed to determine the fuel mix, heat rates and emission rates for generation plants located in or providing power to Minnesota. Similar information was also available from a recent American Gas Association report (AGA 2000). The electric utility cooperatives within Minnegasco's service territory that offer incentives to builders and homeowners who install electric water heaters purchase electricity from providers whose power plant fuel mix is greater than 95% coal. The Xcel power plant fuel mix is more diversified with 62% coal, 25% nuclear and the remainder coming from gas, oil, hydro and biomass.

Detailed Results

Table A.3 – Water Heater Analysis for Typical Residential Installation, 12 Months Operation, Located in CenterPoint Energy and Xcel Service Territory

Site & Real Energy		Water Heater #1	Water Heater #2	Water Heater #3	Electric (#3) vs. Gas Atmos. (#1)	Electric (#3) vs. Gas PDV (#2)
Fuel Type		**Natural Gas**	**Natural Gas**	**Electric**		
Vent Type		**Atmos. Vent**	**Power Direct Vent**	**None**		
Storage Volume	Gal	40	40	105		
Hot Water Output	Btu/Yr	13,327,200	13,327,200	13,327,200		
Energy Factor		0.62	0.59	0.88		
Req'd. Heat Input	Btu/Yr	21,495,484	22,588,475	15,144,545		
Electric Use	kWh/Yr	0	97	4,437		
Natural Gas Use	Therms/Yr	214.95	225.88	0		
Natural Gas Rate	$/Therm	0.550	0.550	0.550		
Electric Rate, Off-Peak	$/kWh	0.068	0.068	0.068		
Electric Rate, Standard	$/kWh	0.068	0.068	0.068		
Electric Cost	$/Yr	0	7	303	303	297
Natural Gas Cost	$/Yr	118	124	0	-118	-124
Total Annual Energy Cost	$/Yr	118	131	303	185	172
Electric Real Efficiency	%	27.4%	27.4%	27.4%		
Natural Gas Real Efficiency	%	91.0%	91.0%	91.0%		
Electric Real Energy Req'd	Btu/Yr	0	1,208,252	55,272,064	55,272,064	54,063,812
Natural Gas Real Energy Req'd	Btu/Yr	23,621,411	24,822,500	0	-23,621,411	-24,822,500
Total Real Energy Req'd	Btu/Yr	23,621,411	26,030,751	55,272,064	31,650,653	29,241,312

Emissions from Electric Use 2.339913736 2.123337238

CO2 Emission Rate	lbs/MWh	1,508.61	1,508.61	1,508.61
SO2 Emission Rate	lbs/MWh	3.58	3.58	3.58
NOX Emission Rate	lbs/MWh	4.08	4.08	4.08
Mercury Emission Rate	lbs/GWh	0.0205	0.0205	0.0205
CO2 Emissions	lbs/Yr	-	146.34	6,694.17
SO2 Emissions	lbs/Yr	-	0.35	15.89
NOX Emissions	lbs/Yr	-	0.396	18.104
Mercury Emissions	lbs/Yr	-	0.000002	0.000091

Emission from Gas Use

CO2 Emission Rate	lbs/MMBtu	117.6	117.6	117.6
SO2 Emission Rate	lbs/MMBtu	0.00059	0.00059	0.00059
NOX Emission Rate	lbs/MMBtu	0.193	0.193	0.193
CO2 Emissions	lbs/Yr	2,527.87	2,656.40	1,781.00
SO2 Emissions	lbs/Yr	0.013	0.013	0.009
NOX Emissions	lbs/Yr	4.15	4.36	2.92

Total Emissions

CO2 Emissions	lbs/Yr	2,527.87	2,802.74	8,475.17	5,947.30	5,672.43
SO2 Emissions	lbs/Yr	0.013	0.361	15.895	15.88	15.53
NOX Emissions	lbs/Yr	4.15	4.76	21.03	16.88	16.27
Mercury Emissions	lbs/Yr	-	0.000002	0.000091	0.000091	0.000089

Notes: 1) Emissions rates for electric real energy taken from EPA E-GRID database analysis of electric utilities in Minnegasco territory
2) Emissions rates for gas real energy taken from AGA report "Real Energy and Emission Factors for Residential Energy Consumption"

Table A.4 – Water Heater Analysis for Typical Residential Installation, 12 Months Operation, Located in CenterPoint Energy and Electric Co-op Service Territory

Site & Real Energy		Water Heater #1	Water Heater #2	Water Heater #3	Electric (#3) vs. Gas Atmos. (#1)	Electric (#3) vs. Gas PDV (#2)
Fuel Type		**Natural Gas**	**Natural Gas**	**Electric**		
Vent Type		**Atmos. Vent**	**Power Direct Vent**	**None**		
Storage Volume	Gal	40	40	105		
Hot Water Output	Btu/Yr	13,327,200	13,327,200	13,327,200		
Energy Factor		0.62	0.59	0.91		
Req'd. Heat Input	Btu/Yr	21,495,484	22,588,475	14,645,275		
Electric Use	kWh/Yr	0	97	4,291		
Natural Gas Use	Therms/Yr	214.95	225.88	0		
Natural Gas Rate	$/Therm	0.550	0.550	0.550		
Electric Rate, Off-Peak	$/kWh	0.034	0.034	0.034		
Electric Rate, Standard	$/kWh	0.068	0.068	0.068		
Electric Cost	$/Yr	0	7	146	146	139
Natural Gas Cost	$/Yr	118	124	0	-118	-124
Total Annual Energy Cost	$/Yr	118	131	146	28	15
Electric Real Efficiency	%	24.9%	24.9%	24.9%		
Natural Gas Real Efficiency	%	91.0%	91.0%	91.0%		
Electric Real Energy Req'd	Btu/Yr	0	1,329,562	58,816,364	58,816,364	57,486,802
Natural Gas Real Energy Req'd	Btu/Yr	23,621,411	24,822,500	0	-23,621,411	-24,822,500
Total Real Energy Req'd	Btu/Yr	23,621,411	26,152,062	58,816,364	35,194,954	32,664,303

Emissions from Electric Use 2.489959839 2.249014431

CO2 Emission Rate	lbs/MWh	2,587.44	2,587.44	2,587.44
SO2 Emission Rate	lbs/MWh	8.84	8.84	8.84
NOX Emission Rate	lbs/MWh	4.82	4.82	4.82
Mercury Emission Rate	lbs/GWh	0.0473	0.0473	0.0473
CO2 Emissions	lbs/Yr	-	250.98	11,102.77
SO2 Emissions	lbs/Yr	-	0.86	37.93
NOX Emissions	lbs/Yr	-	0.468	20.683
Mercury Emissions	lbs/Yr	-	0.000005	0.000203

Emission from Gas Use

CO2 Emission Rate	lbs/MMBtu	117.6	117.6	117.6
SO2 Emission Rate	lbs/MMBtu	0.00059	0.00059	0.00059
NOX Emission Rate	lbs/MMBtu	0.193	0.193	0.193
CO2 Emissions	lbs/Yr	2,527.87	2,656.40	1,722.28
SO2 Emissions	lbs/Yr	0.013	0.013	0.009
NOX Emissions	lbs/Yr	4.15	4.36	2.83

Total Emissions

CO2 Emissions	lbs/Yr	2,527.87	2,907.39	12,825.06	10,297.19	9,917.67
SO2 Emissions	lbs/Yr	0.013	0.871	37.941	37.93	37.07
NOX Emissions	lbs/Yr	4.15	4.83	23.51	19.36	18.68
Mercury Emissions	lbs/Yr	-	0.000005	0.000203	0.000203	0.000198

Notes: 1) Emissions rates for electric real energy taken from EPA E-GRID database analysis of electric utilities in Minnegasco territory
2) Emissions rates for gas real energy taken from AGA report "Real Energy and Emission Factors for Residential Energy Consumption"

Appendix B

Chronology of Federal Energy Efficiency Programs and Policies

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Residential Buildings

Year Enacted	Year Expired	Title of Legislation/Program	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1976		Energy Conservation and Production Act of 1976	Existing Buildings	Not Specified	Established energy conservation standards for new buildings; weatherization assistance for low-income people; and demonstration grants and loan guarantees for energy conservation measures in existing buildings.
			New Buildings	Not Specified	Required the Department of Housing and Urban Development (HUD) to develop, promulgate, implement and enforce compliance with performance standards to improve the energy efficiency of all new buildings in the nation. Responsibility was transferred from HUD to the Department of Energy (DOE) the following year. In November 1979, DOE published proposed performance standards in the Federal Register (44 FR 68120).
1977		National Energy Extension Service Act of 1977	All Buildings	Not Specified	Authorized states to establish energy conservation extension programs.
		Department of Energy Organization Act	All Buildings	Not Specified	The Department of Energy Organization Act brought the federal government's energy-related agencies and programs into a single agency. The Department of Energy, activated on October 1, 1977, assumed the responsibilities of the Federal Energy Administration, the Energy Research and Development Administration, the Federal Power Commission, and parts and programs of several other agencies.
1978		National Energy Tax Act of 1978	All Buildings	Not Specified	Established tax credits for residential conservation measures and solar energy applications.
1979		State Energy Conservation Plans	All Buildings	Not Specified	Provides financial assistance to develop, modify or implement supplemental State energy conservation plans. The purpose of this rulemaking was to promote the conservation of energy and to reduce the rate of growth of energy demand through the development and implementation of comprehensive State energy conservation programs and the provision of Federal financial and technical assistance to States in support of such programs.
1980		Crude Oil Windfall Profits Tax Act of 1980	All Buildings	Not Specified	Increased the Energy Tax Act business energy tax credit for solar, wind, geothermal, and ocean thermal technologies from 10 percent to 15 percent, and extended the credits from December 1982 to December 1985. Expanded and liberalized the tax credit for equipment that either converted biomass into a synthetic fuel, burned the synthetic fuel, or used the biomass as a fuel.
1983		Model Energy Code	All Buildings	Site Energy	Published and maintained by the International Code Council (ICC) as the "International Energy Conservation Code" (IECC), contains energy efficiency criteria for new residential and commercial buildings and additions to existing buildings.
1986		Energy Conservation Mandatory Performance Standards for New Federal Residential Buildings	Federal Buildings	Not Specified	Proposed interim standards published in 1986 culminating in recommendations being made to both DOE and ASHRAE on new residential building standards.
		Energy-Efficient Design of Low-Rise Residential Buildings (ASHRAE Std. 90.2)	All Buildings	Energy Cost	Although not explicitly stated by the standard, economics were used as the basis for informing the professional judgment of the project committee in setting the criteria for the building envelope. The minimum efficiency criteria for HVAC and service water heating equipment are both as established by the National Appliance Energy Conservation Act (NAECA).
1989		Energy Conservation Voluntary Performance Standards for New Non-Federal Residential Buildings	New Buildings	Not Specified	Proposed interim standards culminating in recommendations being made to both DOE and ASHRAE on new residential building standards.
			All Buildings	Not Specified	Authorizes the development of voluntary guidelines that may be used by State and local governments, utilities, builders, real estate agents, lenders, agencies in mortgage markets, and others, to enable and encourage the assignment of energy efficiency ratings to residential buildings.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Residential Buildings

Year Enacted	Year Expired	Title of Legislation/Program	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1992		Energy Policy Act of 1992 (EPAct)	All Buildings	Not Specified	Not later than 18 months after the date of enactment, the Secretary, in consultation with the Secretary of Housing and Urban Development, the Secretary of Veterans Affairs, representatives of existing home energy rating programs, and other appropriate persons, shall, by rule, issue voluntary guidelines that may be used by State and local governments, utilities, builders, real estate agents, lenders, agencies in mortgage markets, and others, to enable and encourage the assignment of energy efficiency ratings to residential buildings.
1992		Housing and Community Development Act of 1992	All Buildings	Not Specified	Required the Department of Housing and Urban Development to test a pilot energy efficient mortgage program in five states.
		Veterans' Home Loan Program Amendment of 1992	All Buildings	Not Specified	Required the Veteran's Administration to adopt a national energy efficient mortgage program for its veteran home loan program
		ENERGY STAR	All Buildings	Site Energy	A government-backed program helping businesses and individuals protect the environment through superior energy efficiency. Qualified new homes are certified to meet strict energy-efficiency guidelines set forth by EPA. The performance requirements of Energy Star are presently based on the 1993 Model Energy Code (MEC 93) and NAECA. To be Energy Star labeled a new home is required to have a HERS rating equal to or greater than 86.0 or be approximately 30 percent more efficient than a comparable home built to the HERS Guideline.
1998		Home Energy Rating System (HERS)	All Buildings	Real Energy	In October 1998, the mortgage industry, RESNET and National Association of State Energy Officials adopted the Mortgage Industry National Home Energy Rating System Accreditation Standard. Originally the percent energy savings algebraically defined the HERS score. However, to address fuel neutrality issues, the HERS scoring algorithm has metamorphosed twice - once to the Modified Loads algorithm and then to the Normalized Modified Loads algorithm.
2001		Energy-Efficient Design of Low-Rise Residential Buildings (ASHRAE Std. 90.2-2001)		Energy Cost	Although not explicitly stated by the standard, economics were used as the basis for informing the professional judgment of the project committee in setting the criteria for the building envelope. The minimum efficiency criteria for HVAC and service water heating equipment are both as established by the National Appliance Energy Conservation Act.
2005		Energy Policy Act of 2005	All Buildings	Energy Cost	The proposed legislation includes a credit of $2,000 for builders of manufactured and site-built homes that use 50 percent less energy for space heating and cooling than homes built according to the 2003 International Energy Conservation Code. In addition, there is a $1,000 tax credit for manufactuered homes that use 30 percent less energy than this reference code. In both cases, the energy reduction is measured in terms of dollars saved. The bill provides that Energy Star labeled manufactured homes are eligible for the 30 percent credit, even if they don't achieve the 30 percent savings target. For existing homes, the bill provides a 20 percent tax credit up to $2,000 for upgrading building envelope components to be in compliance with model codes for new homes.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Federal, Institutional and Commercial Buildings

Year Enacted	Year Expired	Title of Legislation/Program	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1975		Energy Policy and Conservation Act of 1975	All Buildings	Not Specified	Established programs to foster energy conservation in federal buildings and major U.S. industries. It also established the State Energy Conservation Program.
		State Energy Conservation Program.	All Buildings	Not Specified	Provided states with funding for energy efficiency and renewable energy projects.
		Institutional Conservation Program	Institutional Buildings	Site Energy	Provided hospitals and schools with a technical analysis of their buildings, and identified the potential savings from proposed energy conservation measures.
		Energy Conservation in New Building Design (ASHRAE Standard 90-75)	All New Buildings	Site Energy	First major initiative to develop guidelines to improve the utilization of energy in new buildings. The document addressed new building design for effective utilization of energy regardless of the source of that energy, although the foreword indicated that "it [was] the intent of ASHRAE to include a section on annual fuel and energy resource impact determination as soon as possible."
1976		Energy Conservation and Production Act of 1976	All Existing Buildings	Not Specified	Established demonstration grants and loan guarantees for energy conservation measures in existing buildings.
			All New Buildings	Not Specified	Required the Department of Housing and Urban Development (HUD) to develop, promulgate, implement and enforce compliance with performance standards to improve the energy efficiency of all new buildings in the nation. Responsibility was transferred from HUD to the Department of Energy (DOE) the following year. In November 1979, DOE published proposed performance standards in the Federal Register (44 FR 68120).
		Energy Conservation Standards for New Buildings Act of 1976	All New Buildings	Real Energy	Authorized the development of building energy performance standards (BEPS). Various sections in the act support the concept of equating for all energy use, not just on-site energy use. The energy performance standards first proposed in November 1979 require that the design energy consumption of a new building design not exceed its design energy budget as determined from the standards. Weighting factors (i.e., resource utilization factors) were developed in support of these standards to reflect, respectively, the energy consumption to the Nation of providing energy to a building site starting at the energy source, and the social impacts of using different fuel types.
1977		Department of Energy Organization Act	All Buildings	Not Specified	This act brought the federal government's energy-related agencies and programs into a single agency. The Department of Energy, activated on October 1, 1977, assumed the responsibilities of the Federal Energy Administration, the Energy Research and Development Administration, the Federal Power Commission, and parts and programs of several other agencies.
		National Energy Extension Service Act of 1977	All Buildings	Not Specified	Authorized states to establish energy conservation extension programs.
		Executive Order 12003	Federal Buildings	Site Energy	Designed to ensure that each federal agency to the maximum extent practicable aims to achieve the following goals: (1) For all Federally-owned existing buildings a reduction of 20 percent in the average annual energy use per gross square foot of floor area in 1985 from the average energy use per gross square foot of floor area in 1975. (2) For all Federally-owned new buildings a reduction of 45 percent in the average annual energy requirement per gross square foot of floor area in 1985 from the average annual energy use per gross square foot of floor area in 1975.
1978		National Energy Tax Act of 1978	All Buildings	Not Specified	Provided for business energy tax credit of 10 percent for investments in solar, wind, geothermal, and ocean thermal technologies;
		National Energy Conservation Policy Act of 1978	Federal and Institutional Buildings	Energy Cost	Defines the applicability of the Federal Energy Management Program and establishes requirements for demonstration of solar energy in Federal buildings, energy audits, life-cycle-cost analyses, and retrofitting of Federal buildings. Also created a program of energy conservation grants for schools, hospitals, and local government buildings.
		Powerplants and Industrial Fuel Use Act of 1978	All Buildings	Real Energy	States the goals of reducing the importance of petroleum and increasing the Nation's capability to use indigenous energy resources of the United States to further the goals of energy self-sufficiency.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Federal, Institutional and Commercial Buildings

Year Enacted	Year Expired	Title of Legislation/Program	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1979		State Energy Conservation Plans	All New Buildings	Not Specified	Provides financial assistance to develop, modify or implement supplemental State energy conservation plans. The purpose of this rulemaking was to promote the conservation of energy and to reduce the rate of growth of energy demand through the development and implementation of comprehensive State energy conservation programs and the provision of Federal financial and technical assistance to States in support of such programs.
1980		Energy Security Act	All Buildings	Not Specified	Consisted of six major acts: U.S. Synthetic Fuels Corporation Act, Biomass Energy and Alcohol Fuels Act, Renewable Energy Resources Act, Solar Energy and Energy Conservation Act and Solar Energy and Energy Conservation Bank Act, Geothermal Energy Act, and Ocean Thermal Energy Conversion Act.
		Energy Conservation in New Building Design (ASHRAE Standard 90A-1980)	All New Buildings	Real Energy	A revision to ASHRAE Standard 90-75 published in 1980, which included a Section on Annual Fuel and Energy Resource Determination (Section 12). This section provided a method for calculating the quantities of energy resources required and the impact of on-site energy use on those resources.
		Housing and Community Development Act of 1980	Federal Buildings	Not Specified	The act required that DOE promulgate interim standards by August 1981 and extended the promulgation for final standards to April 1983. The interim standards were only to apply to Federal buildings.
		Crude Oil Windfall Profits Tax Act of 1980	All Buildings	Not Specified	Increased the Energy Tax Act business energy tax credit for solar, wind, geothermal, and ocean thermal technologies from 10 percent to 15 percent, and extended the credits from December 1982 to December 1985. Expanded and liberalized the tax credit for equipment that either converted biomass into a synthetic fuel, burned the synthetic fuel, or used the biomass as a fuel.
1981		Omnibus Reconciliation Act of 1981	Federal Buildings	Not Specified	Amended the previous act and eliminated the provision for a possible statutory sanction for noncompliance in the previous act and added a provision that except for Federal buildings, voluntary standards would be developed solely as guidelines to provide technical assistance for the design and construction of energy efficient buildings.
1983		Warner Amendment of 1983	All Buildings	Not Specified	Allocated oil overcharge funds – called petroleum violation escrow funds – to state energy programs. In 1986, these funds became substantial when the Exxon and Stripper Well settlements added more than $4 billion into this mix.
		Model Energy Code	All Commercial Buildings	Site Energy	Published and maintained by the International Code Council (ICC) as the "International Energy Conservation Code" (IECC), contains energy efficiency criteria for new commercial buildings and additions to existing buildings.
1988		Federal Energy Management Improvement Act of 1988	Federal Buildings	Energy Cost	This act amends the National Energy Conservation Policy Act of 1978, establishing Federal energy management goals through FY 1995.
1989		Energy Conservation Performance Standards	New Federal and Commercial Buildings	Not Specified	Proposed interim standards published in 1989 culminating in recommendations being made to both DOE and ASHRAE on commercial building standards. Mandatory for new federal builidngs, vouluntary for new commercial buildings.
		Energy Standard for Buildings Except Low-Rise Residential Buildings (ASHRAE/IESNA Std. 90.1-1989)	All New Buildings	Energy Cost	Although there is no explicit indication of the basis for the prescriptive criteria contained in the standard, the Foreword informs us that economics were used as the basis for informing the professional judgment of the project committee in setting the criteria, and all sections of the standard apply the economic approach as consistently as possible to ensure that the standard is balanced among the respective sections.
		Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989	All Buildings	Not Specified	Act designed to foster greater efficiency in the use of available energy supplies and greater use of renewable energy technologies.
1990		State Energy Efficiency Programs Improvement Act of 1990	All Buildings	Not Specified	Encouraged states to undertake activities designed to improve efficiency and simulate investment in and use of alternative energy technologies.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Federal, Institutional and Commercial Buildings

Year Enacted	Year Expired	Title of Legislation/Program	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1991		Executive Order 12759.	Federal Buildings	Site Energy	Requires each agency to develop and implement a plan to reduce the overall energy use (Btu/gross square foot) of the Federal buildings it operates by at least 20 percent in 2000 compared to 1985 energy use levels, to the extent that these measures minimize life cycle costs and are cost-effective (Sec 1). For the purpose of this order the term "energy use" means the energy that is used at a building or facility and measured in terms of energy delivered to the building or facility (Sec 14).
1992		Energy Policy Act of 1992 (EPAct)	Federal Buildings	Site Energy	Requires each federal agency to apply energy conservation measures to, and improve the design for the construction of, its Federal buildings so that the energy consumption per gross square foot of its Federal buildings in use during the fiscal year 1995 is at least 10 percent less than the energy consumption per gross square foot of its Federal buildings in use during the fiscal year 1985 and so that the energy consumption per gross square foot of its Federal buildings in use during the fiscal year 2000 is at least 20 percent less than the energy consumption per gross square foot of its Federal buildings in use during fiscal year 1985 (Sec. 543).
			Commercial/Institutional Buildings	Not Specified	Not later than 2 years after the date of the enactment, each State shall certify to the Secretary that it has reviewed and updated the provisions of its commercial building code regarding energy efficiency. Such certification shall include a demonstration that such State's code provisions meet or exceed the requirements of ASHRAE Standard 90.1-1989.
		ENERGY STAR	All Buildings	Site Energy	A government-backed program helping businesses and individuals protect the environment through superior energy efficiency. Qualified commercial buildings are certified to meet strict energy-efficiency guidelines set forth by EPA. Over 16 percent of all commercial building space carries the Energy Star label.
1994		Executive Order 12902	Federal Buildings	Site Energy	Requires each agency to develop and implement a plan to reduce energy consumption by 30 percent by the year 2005 relative to the agency's 1985 energy use based on energy consumption per gross square foot of its buildings in use to the extent that these measures are cost-effective (Sec. 301). In addition, as part of this order, DOE is requested to prepare a report on the issues involved in instituting life cycle analysis for Federal energy and product purchases that address the full fuel cycle costs, including issues concerning energy exploration development, processing, transportation, storage, distribution, consumption, and disposal, and related impacts on the environment (Sec. 309).
		Federal Energy Management and Planning Programs	Federal Buildings	Energy Cost	Requires each federal agency to establish energy costs in the base year by multiplying the total units of energy used in the base year. These energy costs then become the baseline against which energy savings are calculated (Sec 436.17).
		Rebuild America	All Buildings	Not Specified	A DOE sponsored program that gives grant money to city governments around the country to form community partnerships that work together to renovate old commercial, multi-family housing and education buildings, bringing them up to current standards of energy efficiency
1996		State Energy Program	All Buildings	Not Specified	Created by Congress in 1996 to consolidate two other programs-the State Energy Conservation Program and the Institutional Conservation Program.
1998		National Energy Conservation Policy Act	Federal Buildings	Energy Cost	Defines the term "energy savings" as a reduction in the cost of energy, from a base cost established through a methodology set forth in the contract, utilized in an existing Federally owned building or buildings or other Federally owned facilities as a result of the lease or purchase of operating equipment, improvements, altered operation and maintenance, or technical services; or the increased efficient use of existing energy sources by cogeneration or heat recovery, excluding any cogeneration process for other than a Federally owned building or buildings or Federally owned facilities (Sec 803).

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Federal, Institutional and Commercial Buildings

Year Enacted	Year Expired	Title of Legislation/Program	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1999		Executive Order 13123	Federal Buildings	Real Energy	Requires all agencies [of the federal government] to reduce energy consumption per gross square foot of its facilities by 30 percent by 2005 and 35 percent by 2010 relative to 1985 (Sec. 202). Agencies are required to strive to reduce total energy use and associated greenhouse gas and other air emissions, as measured at the source. To that end, agencies are required to undertake life-cycle cost-effective projects in which source energy decreases, even if site energy use increases (Sec. 206).
1999		Energy Standard for Buildings Except Low-Rise Residential Buildings (ASHRAE/IESNA Std. 90.1-1999)	All New Buildings	Energy Cost	Drawing upon the lessons learned from the 1989 standard, economics were used as the basis for informing the professional judgment of the project committee in setting the criteria, and all sections of the standard attempt to apply the economic approach consistently to ensure more balance among the respective sections (e.g., envelope, lighting, mechanical).
2001		National Energy Policy	Federal Buildings	Not Specified	Directs heads of executive departments and agencies to take appropriate actions to conserve energy use at their facilities to the maximum extent consistent with the effective discharge of public responsibilities. Agencies located in regions where electricity shortages are possible should conserve especially during periods of peak demand. There is no specific discussion as to whether energy conservation should be benchmarked using site- or source-energy consumption.
		Federal Energy Management Program	Federal Buildings	Not Specified	By promoting energy efficiency and the use of renewable energy resources at federal sites, the Federal Energy Management Program helps agencies save energy.
		Leadership in Energy and Environmental Design	All Buildings	Energy Cost	The LEED Green Building Rating System™ is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. Members of the U.S. Green Building Council representing all segments of the building industry developed LEED and continue to contribute to its evolution.
2005		Energy Policy Act of 2005	Commercial/Institutional Buildings	Energy Cost	The proposed legislation provides a tax deduction of up to $1.80 per square foot for new commercial buildings that reduce energy use by 50 percent relative to the requirements of ASHRAE 90.1. The bill also allows owners of existing buildings to earn a partial deduction of $0.60 per square foot per system for upgrading one or two major building systems (envelope, lighting or HVAC) to 50 percent more efficient than ASHRAE 90.1 standards.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Appliances

Year Enacted	Year Expired	Title of Legislation/Program	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1975		Energy Policy and Conservation Act of 1975	Not Specified	Not Specified	Established a wide range of energy conservation programs, including fuel-economy standards for passenger cars, appliance labeling and standards programs, and energy conservation programs for federal buildings.
1977		National Energy Extension Service Act of 1977	Not Specified	Not Specified	Authorized states to establish energy conservation extension programs.
		Department of Energy Organization Act	Not Specified	Not Specified	The Department of Energy Organization Act brought the federal government's energy-related agencies and programs into a single agency. The Department of Energy, activated on October 1, 1977, assumed the responsibilities of the Federal Energy Administration, the Energy Research and Development Administration, the Federal Power Commission, and parts and programs of several other agencies.
1978		National Energy Policy and Conservation Act of 1978	Various	Not Specified	Directed the Department of Energy (DOE) to develop mandatory efficiency standards for 13 products. DOE proposed regulations for eight products in 1980, but these standards were never finalized.
		National Energy Tax Act of 1978	Solar Applications	Not Specified	Established tax credits for solar energy applications.
		Appliances and Commercial Equipment Standards Program	Various	Site Energy	DOE program started in 1978 to determine and enforce minimum efficiency standards with the authority of the National Appliance Energy Conservation Act of 1987 (NAECA) and the Energy Policy Act of 1992 (EPAct). The program develops test procedures and minimum efficiency standards for residential appliances and commercial equipment.
1979		State Energy Conservation Plans	Not Specified	Not Specified	Provides financial assistance to develop, modify or implement supplemental State energy conservation plans. The purpose of this rulemaking was to promote the conservation of energy and to reduce the rate of growth of energy demand through the development and implementation of comprehensive State energy conservation programs and the provision of Federal financial and technical assistance to States in support of such programs.
1980		EnergyGuide	Various		Requires manufacturers of refrigerators, freezers, dishwashers, clothes washers, room air conditioners, water heaters, furnaces, boilers, central air conditioners, heat pumps and pool heaters have to attach EnergyGuide labels to their appliances to give consumers important information about the energy use of the appliance. The labels must be secured to the outside or hung on the inside of the appliance. They are designed to help shoppers choose appliances that use less gas or electricity, cost less to operate and help protect the environment.
1987		National Appliance Energy Conservation Action of 1987	HVAC	Site Energy	Set minimum efficiency levels, seasonal energy efficiency ratio (SEER) and heating service performance factor (HSPF); required consumer labeling; provided enforcement: verification and monetary penalties
		ENERGY STAR	Various	Site Energy	A government-backed program helping businesses and individuals protect the environment through superior energy efficiency. ENERGY STAR qualified appliances incorporate advanced technologies that use 10-50% less energy and water than standard models.
2005		Energy Policy Act of 2005	Various	Site Energy	Establishes an energy efficient appliance credit for dishwashers and clothes washers that meet the minimum criteria of the ENERGY STAR program and refrigerators that consume 15 to 25 percent less energy than the 2001 energy conservation standards.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Vehicles

Year Enacted	Year Expired	Legislation/Event	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1967		Air Quality Act of 1967	All Vehicles	Not Specified	Regulated ambient air quality. Established emissions standards and a basic fuel and fuel additive registration program.
1970		Clean Air Act	All Vehicles	Not Specified	Established the National Ambient Air Quality Standards and began regulating fuel additives for air pollution reduction. Gave the EPA the authority to regulate fuel and fuel additives, which included the authority to control or prohibit the sale of any fuel or fuel additive that it determined would endanger the public health or welfare (Sec. 211).
1975		The Energy Policy and Conservation Act of 1975	Passenger automobiles/light duty trucks	Site Energy	Established Corporate Average Fuel Economy [CAFE] standards for passenger cars and light trucks. The stated near-term goal was to double new car fuel economy by model year 1985. Passenger cars and light trucks with a gross vehicle weight rating (GVWR) of 8,500 lbs. or less manufactured for sale in the United States must meet these standards. The CAFE standards are applied on a fleet-wide basis for each manufacturer; i.e., the fuel economy ratings for a manufacturer's entire line of passenger cars must average at least 27.5 mpg for the manufacturer to comply with the standard.
1977		Executive Order 12003	Passenger automobiles/light duty trucks	Site Energy	Authorized the Administrator of General Services to promulgate rules to ensure that the minimum statutory requirement for fleet average fuel economy is exceeded (1) for fiscal year 1978 by 2 miles per gallon, (2) for fiscal year 1979 by 3 miles per gallon, and (3) for fiscal years 1980 and after by 4 miles per gallon.
		Department of Energy Organization Act	All Vehicles		The Department of Energy Organization Act brought the federal government's energy-related agencies and programs into a single agency. The Department of Energy, activated on October 1, 1977, assumed the responsibilities of the Federal Energy Administration, the Energy Research and Development Administration, the Federal Power
1978		Energy Tax Act of 1978	Alternative Fuels	Not Specified	Established a 4 cents per gallon (then the entire amount of the federal gasoline excise tax) exemption from excise taxes for motor fuels blended with biomass-derived alcohols (minimum of 10-percent alcohol).
1982		Surface Transportation Assistance Act of 1982	Alternative Fuels	Not Specified	Raised the gasoline tax rate from 4 to 9 cents per gallon and increased the exemption for gasohol from 4 to 5 cents per gallon. Set a 9 cents per gallon exemption for fuels containing 85 percent or more alcohol.
1984		Tax Reform Act of 1984	Alternative Fuels	Not Specified	Raised the exemption for gasohol from 5 to 6 cents per gallon. Increased the blender's tax credit from 40 to 60 cents per gallon of blend for 190-proof alcohol.
1986		Tax Reform Act of 1986	Alternative Fuels	Not Specified	Reduced the exemption for 85-percent alcohol fuels from 9 to 6 cents per gallon.
1988		Alternative Motor Fuel Act	Passenger automobiles/light duty trucks	Not Specified	Encourages the development and widespread use of methanol, ethanol, and natural gas as transportation fuels by consumers and the production of methanol, ethanol, and natural gas powered vehicles. The act calls for the Federal Government to acquire the maximum number of passenger automobiles and light duty trucks powered by alcohol, dual energy, natural gas or dual energy natural gas vehicles as is practical. These vehicles shall be supplied by original equipment manufacturers (Sec 400AA).
			Heavy Duty Trucks	Not Specified	The AMFA calls for the Department of Energy to establish a commercial application program to study the use of alcohol and natural gas in heavy-duty trucks. This is to be done in cooperation with manufacturers of heavy-duty engines and other Federal agencies (Sec 400BB).
			Buses	Not Specified	Calls for the Department of Energy to assist State and local government agencies in the testing in urban settings of buses capable of operating on alcohol and buses capable of operating on natural gas for emissions levels, durability, safety and fuel economy, comparing the different types with each other and with diesel powered buses (Sec. 400CC).
1989		Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989	All Vehicles	Not Specified	Act designed to foster greater efficiency in the use of available energy supplies and greater use of renewable energy technologies. The Act directed the Secretary of Energy to: pursue cost competitive use of renewable energy technologies without the need of Federal financial incentives; establish long-term Federal research goals and multi-year funding goals; undertake initiatives to improve the ability of the private sector to commercialize in the near term renewable energy and energy efficiency technologies; and, foster collaborative research and development efforts involving the private sector through government support of a program of joint ventures.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Vehicles

Year Enacted	Year Expired	Legislation/Event	Application	Basis for Energy Efficiency	Summary of Legislation/Program
1990		Clean Air Act Amendments	Fleets	Not Specified	Creating several initiatives to reinforce one of the original goals of the CAA to reduce mobile source pollutants. Implemented by the U.S. Environmental Protection Agency, the Clean Fuel Fleet Program is one such initiative. Federal, state, municipal, fuel provider and private fleets are currently mandated by the Clean Air Act Amendments (CAAA). Fleets that own, operate, lease or control at least 10 light-duty vehicles, trucks (8,500 lbs. or less) or heavy-duty vehicles (8,500 – 26,000 lbs.) are covered. Of the fleet vehicles, 10 or more must be operating in an affected area and be centrally fueled or capable of being centrally fueled 100% of the time at a station that is owned, operated or controlled by the affected fleet operator.
1990		Clean Fuel Fleet Program (CFFP)	Fleets	Not Specified	Required fleets in cities with significant air quality problems to incorporate vehicles that will meet clean-fuel emissions standards. Under the CAAA, states were given the option to adopt the CFFP or a substitute program that achieves equivalent or better emissions reductions.
		Omnibus Budget Reconciliation Act of 1990	Alternative Fuels	Not Specified	Raised the gasoline excise tax rate from 9.1 to 14.1 cents per gallon, reduced the gasohol exemption from 6.0 to 5.4 cents per gallon, and reduced the blender's tax credit from 60 to 54 cents per gallon. Retained the exemption for 85-percent alcohol fuels at 6 cents per gallon. Extended these incentives to the year 2000. Provided an income tax credit of 10 cents per gallon for the first 15 million gallons of ethanol manufactured by qualified small producers with annual outputs of less than 30 million gallons.
1991		Intermodal Surface Transportation Efficiency Act of 1991			ISTEA is widely recognized as pivotal legislation. It made key policy changes that not only strengthened the role of comprehensive planning in the transportation decision-making process but also set a new direction for federally supported transportation activities in the United States. ISTEA declared the Interstate highway system complete; shifted attention from new facility construction towards efficient management, operation, and maintenance of the existing system; and focused resources and processes on creation of a "seamless" intermodal transportation system. ISTEA also initiated a variety of procedural and funding changes designed to "level the playing field" among decision-making agencies as well as among modal options. This legislation sunsets on September 30, 1997.
1992		Energy Policy Act of 1992	Fleets	Not Specified	Accelerated the use of alternative fuels in the transportation sector. Fleets that own, operate, lease or control at least 50 light-duty vehicles (8,500 lbs. or less) in the United States are covered. Of the fleet vehicles, 20 or more must be operating primarily within any affected area. The vehicles must also be centrally fueled or capable of being centrally fueled. A fleet must meet all three requirements to be "covered" by EPAct. Municipal and private fleets are currently being considered for mandates and an advance notice of proposed rulemaking (ANOPR) was issued in April of 1998.
			Alternative Fuels	Not Specified	Extended gasohol excise tax exemption to blends containing less than 10-percent (7.7 and 5.7 percent) alcohol. To encourage the use of alternatives to petroleum-based transportation fuels, set guidelines and established incentives for (1) purchasing clean-fuel vehicles for federal, state, and private fleets and (2) arranging refueling facilities for these fleets.
1993		Omnibus Budget Reconciliation Act of 1993	Alternative Fuels	Not Specified	Raised gasoline excise tax rate from 14.1 to 18.4 cents per gallon.
		Partnership for a New Generation of Vehicles	All Vehicles	Not Specified	This partnership, between the United States Federal Government and the automotive industry, was founded to establish global technical leadership in the development and production of affordable, fuel-efficient, low emission
1998		Clean Fuel Fleet Program of 1998	Alternative Fuels	Not Specified	Requires fleets in cities with significant air quality problems to incorporate vehicles that will meet clean-fuel emissions standards. Under the CAAA, states were given the option to adopt the Clean Fuel Fleet Program (CFFP) or a substitute program that achieves equivalent or better emissions reductions.

Chronology of Federal Statutory and Voluntary Energy Efficiency Programs and Policies Affecting Vehicles

Year Enacted	Year Expired	Legislation/Event	Application	Basis for Energy Efficiency	Summary of Legislation/Program
2003		NHTSA Rulemaking	Light Trucks	Site Energy	In April of 2003 NHTSA establishing the average fuel economy standards for light trucks that will be manufactured in the 2005-2007 model years (MYs). The standards for all light trucks manufactured is set at 21.0 mpg for MY 2005, 21.6 mpg for MY 2006, and 22.2 mpg for MY 2007.
2003		NHTSA Rulemaking	Passenger automobiles/light duty trucks	Site Energy	In December of 2003 NHTSA issued a Notice of Proposed Rulemaking seeking comments on possible enhancements to the CAFE program that will further the move toward more fuel efficient vehicles while maintaining vehicle safety and the well being of the motor vehicle industry. NHTSA is looking to improve the structure of the CAFE program within existing legislative authority.
		Electric and Hybrid Vehicle Research, Development, and Demonstration Program	Alternative Fuels	Real Energy	Establishes a petroleum-equivalent fuel economy value to be used by the Environmental Protection Agency in calculating corporate average fuel economy values (Sec. 474.1). Calculates the petroleum-equivalent fuel economy by dividing the appropriate petroleum-equivalency factor by the combined energy consumption value, and round to the nearest 0.01 miles per gallon (Sec. 474.3).
2005		Energy Policy Act of 2005	Alternative Fuels	Site Energy	Establishes an alternative motor vehicle credit for new qualified vehicles powered by fuel cell, lean burn and hybrid engines. The amount of the credit is determined by the level of energy savings achieved reletive to the model year fuel econmy standards

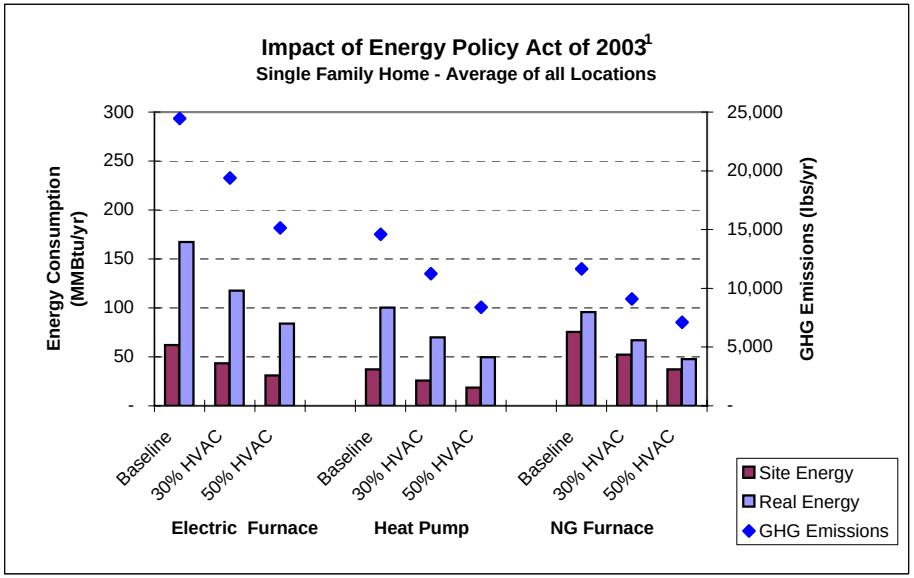
Appendix C

Residential Housing Energy Consumption and Greenhouse Gas Emissions

REM/Rate Results - Summary
1-Story w/ Basement - Average of all Locations

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	50.5	11.8	62.3	0%	139.1	28.2	167.2	0%	1,362	305	1,668	0%	24,273	117.4	64.7	24,455	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	36.4	7.2	43.6	30%	100.4	17.2	117.6	30%	983	184	1,167	30%	19,239	93.2	51.4	19,383	21%
50% HVAC Energy Cost Reduction[6]	50% HVAC	25.7	5.5	31.2	50%	70.8	13.2	83.9	50%	694	142	835	50%	15,040	72.4	41.3	15,153	38%
Baseline ASHP[1,3]	Baseline	25.3	11.8	37.1	0%	70.3	29.9	100.2	0%	684	305	989	0%	14,478	68.3	38.6	14,585	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	17.5	8.5	26.0	30%	48.6	21.5	70.1	30%	473	220	692	30%	11,177	53.1	29.9	11,260	23%
50% HVAC Energy Cost Reduction[6]	50% HVAC	12.1	6.4	18.5	50%	33.5	16.2	49.8	50%	328	166	494	50%	8,319	39.6	22.4	8,381	43%
Baseline NG[1,4]	Baseline	63.5	12.0	75.4	0%	67.2	28.7	95.9	0%	703	310	1,013	0%	11,607	20.6	21.2	11,649	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	43.7	8.7	52.3	31%	46.2	20.8	67.0	30%	484	224	709	30%	9,060	16.7	16.8	9,094	22%
50% HVAC Energy Cost Reduction[6]	50% HVAC	30.9	6.2	37.2	51%	32.7	14.9	47.6	50%	346	162	507	50%	7,071	12.9	13.1	7,097	39%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.

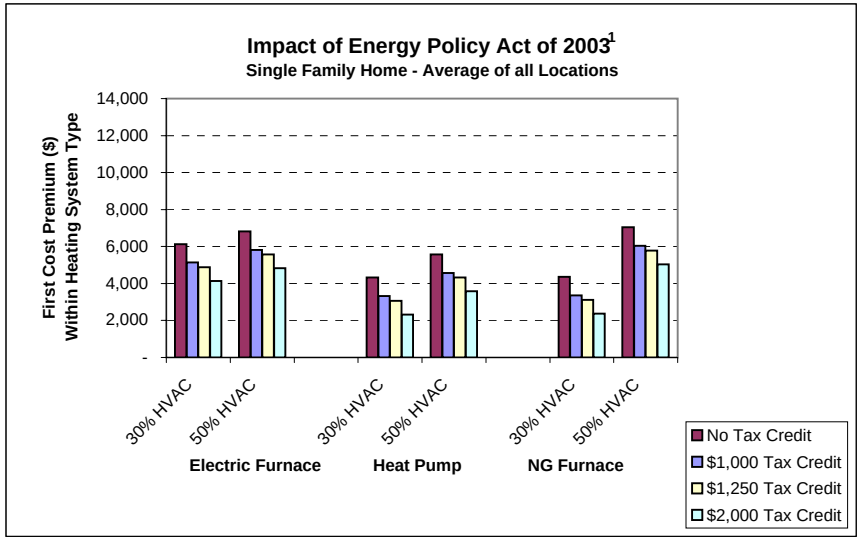


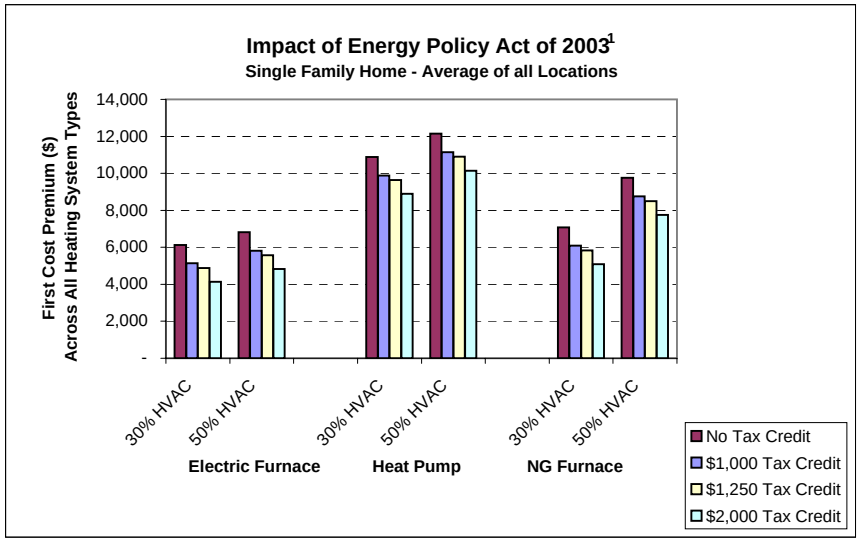
[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Average of All Locations

Description	Chart Label	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
30% HVAC Energy Cost Reduction[5]	30% HVAC	30%	30%	132,208	3,376	2,757	138,342	6,134	6,134	5,134	5,134	4,884	4,884	4,134	4,134
50% HVAC Energy Cost Reduction[5]	50% HVAC	50%	50%	132,208	3,466	3,357	139,031	6,823	6,823	5,823	5,823	5,573	5,573	4,823	4,823
30% HVAC Energy Cost Reduction[5]	30% HVAC	30%	58%	138,777	3,296	1,024	143,097	4,320	10,889	3,320	9,889	3,070	9,639	2,320	8,889
50% HVAC Energy Cost Reduction[5]	50% HVAC	50%	70%	138,777	3,210	2,365	144,352	5,576	12,144	4,576	11,144	4,326	10,894	3,576	10,144
30% HVAC Energy Cost Reduction[5]	30% HVAC	30%	16%	134,926	2,600	1,765	139,292	4,366	7,084	3,366	6,084	3,116	5,834	2,366	5,084
50% HVAC Energy Cost Reduction[5]	50% HVAC	51%	40%	134,926	3,263	3,773	141,962	7,036	9,754	6,036	8,754	5,786	8,504	5,036	7,754

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.



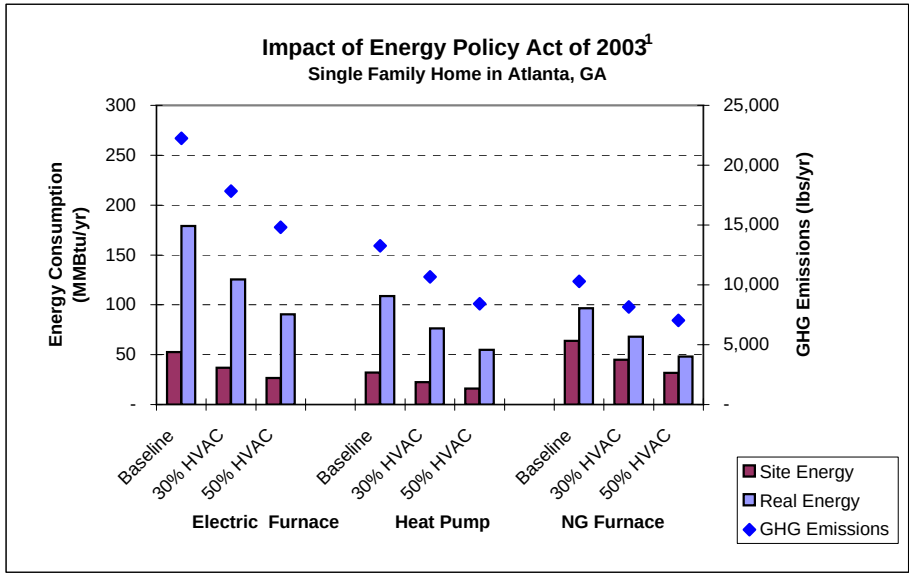


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Summary
1-Story w/ Basement - Atlanta GA

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	41.4	11.3	52.7	0%	140.8	38.4	179.2	0%	920	251	1,171	0%	22,025	145.1	65.5	22,235.8	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	30.1	6.8	36.9	30%	102.3	23.1	125.5	30%	668	151	819	30%	17,663	116.4	52.6	17,831.9	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	21.2	5.4	26.6	50%	72.1	18.4	90.4	50%	472	119	591	50%	14,675	96.6	43.6	14,815.3	33%
Baseline ASHP[1,3]	Baseline	20.7	11.3	32.0	0%	70.4	38.4	108.8	0%	460	251	711	0%	13,142	86.5	39.1	13,267.7	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	14.4	8.1	22.5	30%	49.0	27.5	76.5	30%	320	181	501	30%	10,556	69.5	31.4	10,656.7	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	10.1	6.0	16.1	50%	34.3	20.4	54.7	50%	223	132	355	50%	8,336	54.9	24.8	8,415.5	37%
Baseline NG[1,4]	Baseline	52.2	11.5	63.7	0%	57.4	39.1	96.5	0%	587	256	843	0%	10,240	32.3	21.2	10,293.9	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	36.8	8.1	44.9	30%	40.5	27.5	68.0	30%	411	179	590	30%	8,116	24.9	16.7	8,157.8	21%
50% HVAC Energy Cost Reduction[6]	50% HVAC	25.9	5.8	31.7	50%	28.5	19.7	48.2	50%	293	130	423	50%	7,003	22.6	14.6	7,040.2	32%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Atlanta GA

Description	Upgrade Cost			Annual Energy Cost ($/yr.)			Energy Use	Energy Cost	Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
	Env.	HVAC	Total	Heating	Cooling	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	-	-	-	920	251	1,171	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	2,841	1,960	4,801	668	151	819	30%	30%	3,801	3,801	3,551	3,551	2,801	2,801
10% Env/20% HVAC Energy Use Reduction[6]	2,841	1,960	4,801	668	151	819	30%	30%	3,801	3,801	3,551	3,551	2,801	2,801
50% HVAC Energy Cost Reduction[5]	3,841	3,453	7,294	472	119	591	50%	50%	6,294	6,294	6,044	6,044	5,294	5,294
17% Env/33% HVAC Energy Use Reduction[6]	3,841	3,453	7,294	472	119	591	50%	50%	6,294	6,294	6,044	6,044	5,294	5,294
Baseline ASHP[1,3]	-	-	-	460	251	711	0%	0%	-	5,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	2,841	906	3,747	320	181	501	30%	30%	2,747	9,316	2,497	9,066	1,747	8,316
10% Env/20% HVAC Energy Use Reduction[6]	2,841	906	3,747	320	181	501	30%	30%	2,747	9,316	2,497	9,066	1,747	8,316
50% HVAC Energy Cost Reduction[5]	1,108	3,566	4,674	223	132	355	50%	50%	3,674	10,243	3,424	9,993	2,674	9,243
17% Env/33% HVAC Energy Use Reduction[6]	1,108	3,566	4,674	223	132	355	50%	50%	3,674	10,243	3,424	9,993	2,674	9,243
Baseline NG[1,4]	-	-	-	587	256	843	0%	0%	-	1,718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	4,305	1,160	5,465	411	179	590	30%	30%	4,465	7,183	4,215	6,933	3,465	6,183
10% Env/20% HVAC Energy Use Reduction[6]	4,305	1,160	5,465	411	179	590	30%	30%	4,465	7,183	4,215	6,933	3,465	6,183
50% HVAC Energy Cost Reduction[5]	3,119	3,450	6,569	293	130	423	50%	50%	5,569	8,287	5,319	8,037	4,569	7,287
17% Env/33% HVAC Energy Use Reduction[6]	3,119	3,450	6,569	293	130	423	50%	50%	5,569	8,287	5,319	8,037	4,569	7,287

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - Atlanta GA

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	77.7	41.4	33.1	36.7	31.3	41.4	11.3	52.7	0%	0%	920	251	1,171	0%	0%
1-1B	30% HVAC Energy Cost Reduction[5]	81.7	30.1	27.9	28.6	25.7	30.1	6.8	36.9	30%	30%	668	151	819	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	81.7	30.1	27.9	28.6	25.7	30.1	6.8	36.9	30%	30%	668	151	819	30%	30%
1-1D	50% HVAC Energy Cost Reduction[5]	84.3	21.2	26.8	22.9	20.6	21.2	5.4	26.6	50%	50%	472	119	591	50%	50%
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	84.3	21.2	26.8	22.9	20.6	21.2	5.4	26.6	50%	50%	472	119	591	50%	50%
1-2A	Baseline ASHP[1,3]	84.8	41.3	33.0	36.6	31.3	20.7	11.3	32.0	0%	39%	460	251	711	0%	39%
1-2B	30% HVAC Energy Cost Reduction[5]	87.3	31.6	28.6	29.1	26.0	14.4	8.1	22.5	30%	57%	320	181	501	30%	57%
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	88.3	31.6	28.6	29.1	26.0	14.4	8.1	22.5	30%	57%	320	181	501	30%	57%
1-2D	50% HVAC Energy Cost Reduction[5]	89.3	26.5	27.9	26.1	22.2	10.1	6.0	16.1	50%	69%	223	132	355	50%	70%
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	89.3	26.5	27.9	26.1	22.2	10.1	6.0	16.1	50%	69%	223	132	355	50%	70%
1-3A	Baseline NG[1,4]	84.9	39.7	33.7	35.0	31.5	52.2	11.5	63.7	0%	-21%	587	256	843	0%	28%
1-3B	30% HVAC Energy Cost Reduction[5]	87.4	28.9	17.5	27.4	25.9	36.8	8.1	44.9	30%	15%	411	179	590	30%	50%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	87.4	28.9	17.5	27.4	25.9	36.8	8.1	44.9	30%	15%	411	179	590	30%	50%
1-3D	50% HVAC Energy Cost Reduction[5]	89.3	22.6	24.0	22.4	21.4	25.9	5.8	31.7	50%	40%	293	130	423	50%	64%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	89.3	22.6	24.0	22.4	21.4	25.9	5.8	31.7	50%	40%	293	130	423	50%	64%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions
1-Story w/ Basement - Atlanta GA

Alt.	Description	Real Energy Consumption (MMBtu/yr)					Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[10]	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	123.2	29.4	49.1	67.3	269.0	38,822	255.7	115.5	17,781	4,244	7,083	9,714	117.1	28.0	46.7	64.0	52.9	12.6	21.1	28.9
1-1B	30% HVAC Energy Cost Reduction[5]	102.2	20.2	49.0	67.3	238.7	34,452	226.9	102.5	14,753	2,910	7,075	9,714	97.2	19.2	46.6	64.0	43.9	8.7	21.1	28.9
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	102.2	20.2	49.0	67.3	238.7	34,452	226.9	102.5	14,753	2,910	7,075	9,714	97.2	19.2	46.6	64.0	43.9	8.7	21.1	28.9
1-1D	50% HVAC Energy Cost Reduction[5]	85.5	16.1	49.1	67.3	218.0	31,468	207.3	93.6	12,345	2,330	7,079	9,714	81.3	15.3	46.6	64.0	36.7	6.9	21.1	28.9
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	85.5	16.1	49.1	67.3	218.0	31,468	207.3	93.6	12,345	2,330	7,079	9,714	81.3	15.3	46.6	64.0	36.7	6.9	21.1	28.9
1-2A	Baseline ASHP[1,3]	61.7	29.4	49.1	67.3	207.5	29,939	197.2	89.0	8,900	4,243	7,083	9,714	58.6	27.9	46.7	64.0	26.5	12.6	21.1	28.9
1-2B	30% HVAC Energy Cost Reduction[5]	48.9	24.2	49.0	67.3	189.4	27,344	180.1	81.3	7,058	3,498	7,075	9,714	46.5	23.0	46.6	64.0	21.0	10.4	21.1	28.9
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	48.9	24.2	49.0	67.3	189.4	27,344	180.1	81.3	7,058	3,498	7,075	9,714	46.5	23.0	46.6	64.0	21.0	10.4	21.1	28.9
1-2D	50% HVAC Energy Cost Reduction[5]	39.7	18.0	49.1	67.3	174.1	25,131	165.5	74.7	5,735	2,601	7,081	9,714	37.8	17.1	46.6	64.0	17.1	7.7	21.0	28.9
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	39.7	18.0	49.1	67.3	174.1	25,131	165.5	74.7	5,735	2,601	7,081	9,714	37.8	17.1	46.6	64.0	17.1	7.7	21.0	28.9
1-3A	Baseline NG[1,4]	52.8	30.1	25.3	67.3	175.5	22,715	96.3	53.6	5,901	4,340	2,761	9,714	3.7	28.6	-	64.0	8.3	12.9	3.5	28.9
1-3B	30% HVAC Energy Cost Reduction[5]	42.0	24.0	25.3	67.3	158.6	20,586	88.9	49.0	4,654	3,462	2,756	9,714	2.1	22.8	-	64.0	6.4	10.3	3.4	28.9
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	42.0	24.0	25.3	67.3	158.6	20,586	88.9	49.0	4,654	3,462	2,756	9,714	2.1	22.8	-	64.0	6.4	10.3	3.4	28.9
1-3D	50% HVAC Energy Cost Reduction[5]	35.9	20.6	25.2	67.3	149.0	19,467	86.6	47.0	4,027	2,976	2,750	9,714	3.0	19.6	-	64.0	5.8	8.8	3.4	28.9
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	35.9	20.6	25.2	67.3	149.0	19,467	86.6	47.0	4,027	2,976	2,750	9,714	3.0	19.6	-	64.0	5.8	8.8	3.4	28.9

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Atlanta GA

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	2,841	1,960	137,009	4,801	4,801	3,801	3,801	3,551	3,551	2,801	2,801
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	2,841	1,960	137,009	4,801	4,801	3,801	3,801	3,551	3,551	2,801	2,801
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	3,841	3,453	139,502	7,294	7,294	6,294	6,294	6,044	6,044	5,294	5,294
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	3,841	3,453	139,502	7,294	7,294	6,294	6,294	6,044	6,044	5,294	5,294
1-2A	Baseline ASHP[1,3]	0%	39%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	57%	138,777	2,841	906	142,524	3,747	10,316	2,747	9,316	2,497	9,066	1,747	8,316
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	57%	138,777	2,841	906	142,524	3,747	10,316	2,747	9,316	2,497	9,066	1,747	8,316
1-2D	50% HVAC Energy Cost Reduction[5]	50%	69%	138,777	1,108	3,566	143,451	4,674	11,243	3,674	10,243	3,424	9,993	2,674	9,243
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	50%	69%	138,777	1,108	3,566	143,451	4,674	11,243	3,674	10,243	3,424	9,993	2,674	9,243
1-3A	Baseline NG[1,4]	0%	-21%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	30%	15%	134,926	4,305	1,160	140,391	5,465	8,183	4,465	7,183	4,215	6,933	3,465	6,183
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	30%	15%	134,926	4,305	1,160	140,391	5,465	8,183	4,465	7,183	4,215	6,933	3,465	6,183
1-3D	50% HVAC Energy Cost Reduction[5]	50%	40%	134,926	3,119	3,450	141,495	6,569	9,287	5,569	8,287	5,319	8,037	4,569	7,287
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	50%	40%	134,926	3,119	3,450	141,495	6,569	9,287	5,569	8,287	5,319	8,037	4,569	7,287

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - Atlanta GA

Alt.	Description	Ceiling Insul[7]		Ext. Wall Insul.[7]				Found. Insul.[7]			Floor Insul.[7]		Door Type[7]		Window Type[7]		Building Sealing[8]		Cost Premium	
		R38	R49	R13	R15	R19	R25	R7	R11	R19	R19	R25	R2.8	Storm	U0.50	0.4SHGF	0.5ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	934	-	-	1,282	-	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	2,841	2,841
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	-	1,282	-	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	2,841	2,841
1-1D	50% HVAC Energy Cost Reduction[5]	-	934	-	-	1,282	-	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	3,841	3,841
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	934	-	-	1,282	-	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	3,841	3,841
1-2A	Baseline ASHP[1,3]	Incl.	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	934	-	-	1,282	-	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	2,841	2,841
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	-	1,282	-	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	2,841	2,841
1-2D	50% HVAC Energy Cost Reduction[5]	Incl.	-	-	108	-	-	Incl.	-	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,108	1,108
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	-	-	108	-	-	Incl.	-	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,108	1,108
1-3A	Baseline NG[1,4]	Incl.	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	934	-	-	1,282	-	-	208	-	-	1,880	Incl.	-	Incl.	Incl.	Incl.	-	4,305	4,305
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	-	1,282	-	-	208	-	-	1,880	Incl.	-	Incl.	Incl.	Incl.	-	4,305	4,305
1-3D	50% HVAC Energy Cost Reduction[5]	-	934	-	-	-	1,560	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	3,119	3,119
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	934	-	-	-	1,560	-	-	625	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	3,119	3,119

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC
1-Story w/ Basement - Atlanta GA

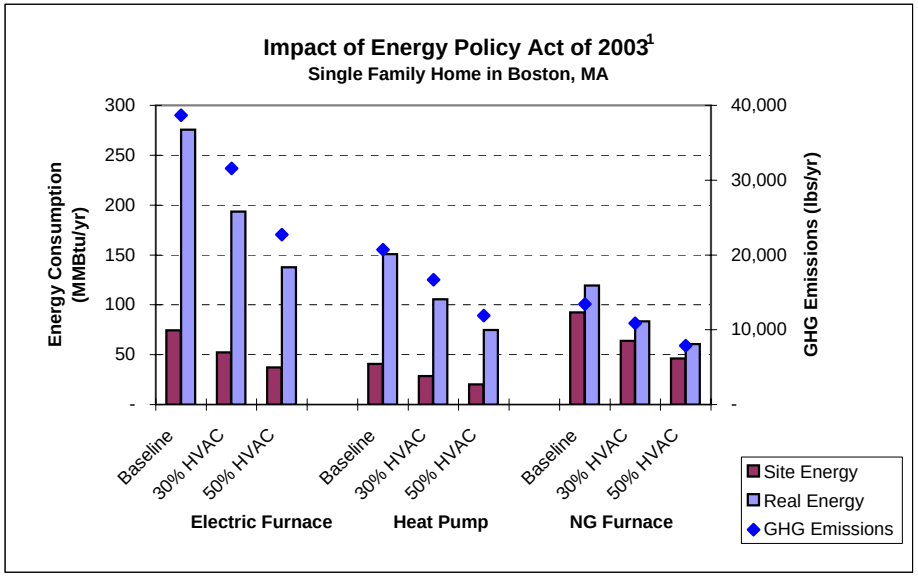
Alt.	Description	Duct Sealing[7]			Elec Furn.[7]	NG Furnace[7]		Air-Source Heat Pump[7]			Electric A/C[7]				Prog Stat	Total Cost	Cost Premium	
		Tape	Mastic	Aerosol	100% Eff.	78AFUE	90AFUE	10SEER	12SEER	16SEER	10SEER	12SEER	14SEER	17SEER		($)	Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	-	-	1,520	-	100	1,960	1,960	1,960
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	-	-	1,520	-	100	1,960	1,960	1,960
1-1D	50% HVAC Energy Cost Reduction[5]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453	3,453
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453	3,453
																-		
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-	-	-	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	566	-	-	-	-	-	-	906	906	906
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	566	-	-	-	-	-	-	906	906	906
1-2D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	-	3,226	-	-	-	-	-	3,566	3,566	3,566
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	-	3,226	-	-	-	-	-	3,566	3,566	3,566
																-		
1-3A	Baseline NG[1,4]	Incl.	-	-	-	Incl.	-	-	-	-	Incl.	-	-	-	-	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	Incl.	-	-	-	-	-	720	-	-	100	1,160	1,160	1,160
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	Incl.	-	-	-	-	-	720	-	-	100	1,160	1,160	1,160
1-3D	50% HVAC Energy Cost Reduction[5]	-	-	680	-	-	1,150	-	-	-	-	-	1,520	-	100	3,450	3,450	3,450
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	-	-	1,150	-	-	-	-	-	1,520	-	100	3,450	3,450	3,450

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Boston MA

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	67.8	6.7	74.5	0%	250.9	24.8	275.7	0%	2,142	210	2,352	0%	38,396	194.3	76.0	38,666.1	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	48.9	3.4	52.3	30%	180.9	12.6	193.5	30%	1,543	107	1,650	30%	31,366	158.8	62.1	31,587.0	18%
50% HVAC Energy Cost Reduction[6]	50% HVAC	34.1	3.1	37.2	50%	126.2	11.5	137.6	50%	1,078	98	1,176	50%	22,578	114.3	44.7	22,736.5	41%
Baseline ASHP[1,3]	Baseline	34.1	6.7	40.8	0%	126.2	24.8	151.0	0%	1,075	210	1,285	0%	20,560	104.1	40.7	20,705.0	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	23.6	4.9	28.5	30%	87.3	18.1	105.5	30%	744	154	898	30%	16,547	83.8	32.8	16,664.0	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	16.4	3.8	20.2	50%	60.7	14.1	74.7	50%	518	120	638	50%	11,809	59.8	23.4	11,892.1	43%
Baseline NG[1,4]	Baseline	85.5	6.8	92.3	0%	94.1	25.2	119.2	0%	1,131	216	1,347	0%	13,396	18.9	19.5	13,434.3	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	59.0	5.0	64.0	31%	64.9	18.5	83.4	30%	784	157	941	30%	10,821	16.0	15.8	10,852.9	19%
50% HVAC Energy Cost Reduction[6]	50% HVAC	42.6	3.7	46.3	50%	46.9	13.7	60.6	49%	562	116	678	50%	7,853	11.0	11.4	7,875.2	41%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Boston MA

Description	Base Cost	Upgrade Cost			Annual Energy Cost ($/yr.)			Energy Use	Energy Cost	Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2000 Credit)	
	($)	Env.	HVAC	Total	Heating	Cooling	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	132,208	-	-	-	2,142	210	2,352	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	132,208	3,661	3,113	6,774	1,543	107	1,650	30%	30%	5,774	5,774	5,524	5,524	4,774	4,774
10% Env/20% HVAC Energy Use Reduction[6]	132,208	3,661	3,113	6,774	1,543	107	1,650	30%	30%	5,774	5,774	5,524	5,524	4,774	4,774
50% HVAC Energy Cost Reduction[5]	132,208	2,503	3,453	5,956	1,078	98	1,176	50%	50%	4,956	4,956	4,706	4,706	3,956	3,956
17% Env/33% HVAC Energy Use Reduction[6]	132,208	2,503	3,453	5,956	1,078	98	1,176	50%	50%	4,956	4,956	4,706	4,706	3,956	3,956
Baseline ASHP[1,3]	138,777	-	-	-	1,075	210	1,285	0%	0%	-	5,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	138,777	3,561	906	4,467	744	154	898	30%	30%	3,467	10,035	3,217	9,785	2,467	9,035
10% Env/20% HVAC Energy Use Reduction[6]	138,777	3,561	906	4,467	744	154	898	30%	30%	3,467	10,035	3,217	9,785	2,467	9,035
50% HVAC Energy Cost Reduction[5]	138,777	1,000	2,053	3,053	518	120	638	50%	50%	2,053	8,622	1,803	8,372	1,053	7,622
17% Env/33% HVAC Energy Use Reduction[6]	138,777	1,000	2,053	3,053	518	120	638	50%	50%	2,053	8,622	1,803	8,372	1,053	7,622
Baseline NG[1,4]	134,926	-	-	-	1,131	216	1,347	0%	0%	-	1,718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	134,926	1,503	2,310	3,813	784	157	941	31%	30%	2,813	5,531	2,563	5,281	1,813	4,531
10% Env/20% HVAC Energy Use Reduction[6]	134,926	1,503	2,310	3,813	784	157	941	31%	30%	2,813	5,531	2,563	5,281	1,813	4,531
50% HVAC Energy Cost Reduction[5]	134,926	2,034	4,732	6,766	562	116	678	50%	50%	5,766	8,484	5,516	8,234	4,766	7,484
17% Env/33% HVAC Energy Use Reduction[6]	134,926	2,034	4,732	6,766	562	116	678	50%	50%	5,766	8,484	5,516	8,234	4,766	7,484

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - Boston MA

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	73.6	67.8	19.5	40.8	25.6	67.8	6.7	74.5	0%	0%	2,142	210	2,352	0%	0%
1-1B	30% HVAC Energy Cost Reduction[b]	78.2	48.9	16.8	31.4	21.2	48.9	3.4	52.3	30%	30%	1,543	107	1,650	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[b]	78.2	48.9	16.8	31.4	21.2	48.9	3.4	52.3	30%	30%	1,543	107	1,650	30%	30%
1-1D	50% HVAC Energy Cost Reduction[b]	83.3	34.1	15.4	23.2	16.0	34.1	3.1	37.2	50%	50%	1,078	98	1,176	50%	50%
1-1C	17% Env/33% HVAC Energy Use Reduction[b]	83.3	34.1	15.4	23.2	16.0	34.1	3.1	37.2	50%	50%	1,078	98	1,176	50%	50%
1-2A	Baseline ASHP[1,3]	84.2	67.8	19.5	40.8	25.6	34.1	6.7	40.8	0%	45%	1,075	210	1,285	0%	45%
1-2B	30% HVAC Energy Cost Reduction[b]	86.7	51.8	17.2	32.2	21.4	23.6	4.9	28.5	30%	62%	744	154	898	30%	62%
1-2C	10% Env/20% HVAC Energy Use Reduction[b]	86.7	51.8	17.2	32.2	21.4	23.6	4.9	28.5	30%	62%	744	154	898	30%	62%
1-2D	50% HVAC Energy Cost Reduction[b]	89.6	43.3	17.8	28.9	19.4	16.4	3.8	20.2	50%	73%	518	120	638	50%	73%
1-2E	17% Env/33% HVAC Energy Use Reduction[b]	89.6	43.3	17.8	28.9	19.4	16.4	3.8	20.2	50%	73%	518	120	638	50%	73%
1-3A	Baseline NG[1,4]	84.1	65.1	20.0	38.8	25.8	85.5	6.8	92.3	0%	-24%	1,131	216	1,347	0%	43%
1-3B	30% HVAC Energy Cost Reduction[5]	87.2	48.9	17.5	31.2	21.5	59.0	5.0	64.0	31%	14%	784	157	941	30%	60%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	87.2	48.9	17.5	31.2	21.5	59.0	5.0	64.0	31%	14%	784	157	941	30%	60%
1-3D	50% HVAC Energy Cost Reduction[5]	90.4	40.1	18.3	27.4	19.1	42.6	3.7	46.3	50%	38%	562	116	678	50%	71%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	90.4	40.1	18.3	27.4	19.1	42.6	3.7	46.3	50%	38%	562	116	678	50%	71%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions
1-Story w/ Basement - Boston MA

Alt.	Description	Real Energy Consumption (MMBtu/yr)					Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[7]	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	241.9	17.5	59.2	73.7	392.3	58,073	293.9	115.0	35,808	2,588	8,769	10,908	181.2	13.1	44.4	55.2	70.9	5.1	17.4	21.6
1-1B	30% HVAC Energy Cost Reduction[5]	201.8	10.1	59.2	73.7	344.8	51,042	258.3	101.0	29,867	1,499	8,768	10,908	151.2	7.6	44.4	55.2	59.1	3.0	17.4	21.6
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	201.8	10.1	59.2	73.7	344.8	51,042	258.3	101.0	29,867	1,499	8,768	10,908	151.2	7.6	44.4	55.2	59.1	3.0	17.4	21.6
1-1D	50% HVAC Energy Cost Reduction[5]	143.2	9.3	59.2	73.7	285.4	42,247	213.8	83.6	21,202	1,375	8,762	10,908	107.3	7.0	44.3	55.2	42.0	2.7	17.3	21.6
1-1C	17% Env/33% HVAC Energy Use Reduction[6]	143.2	9.3	59.2	73.7	285.4	42,247	213.8	83.6	21,202	1,375	8,762	10,908	107.3	7.0	44.3	55.2	42.0	2.7	17.3	21.6
1-2A	Baseline ASHP[1,3]	121.4	17.5	59.2	73.7	271.8	40,237	203.6	79.6	17,973	2,588	8,769	10,908	91.0	13.1	44.4	55.2	35.6	5.1	17.4	21.6
1-2B	30% HVAC Energy Cost Reduction[5]	97.1	14.6	59.2	73.7	244.6	36,221	183.3	71.7	14,379	2,168	8,766	10,908	72.8	11.0	44.4	55.2	28.5	4.3	17.4	21.6
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	97.1	14.6	59.2	73.7	244.6	36,221	183.3	71.7	14,379	2,168	8,766	10,908	72.8	11.0	44.4	55.2	28.5	4.3	17.4	21.6
1-2D	50% HVAC Energy Cost Reduction[5]	68.4	11.3	59.3	73.7	212.7	31,487	159.2	62.3	10,130	1,679	8,771	10,908	51.3	8.5	44.4	55.2	20.1	3.3	17.4	21.6
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	68.4	11.3	59.3	73.7	212.7	31,487	159.2	62.3	10,130	1,679	8,771	10,908	51.3	8.5	44.4	55.2	20.1	3.3	17.4	21.6
1-3A	Baseline NG[1,4]	95.8	18.1	27.9	73.7	215.5	27,346	74.1	44.9	10,723	2,673	3,042	10,908	5.4	13.5	-	55.2	14.2	5.3	3.8	21.6
1-3B	30% HVAC Energy Cost Reduction[5]	76.6	15.0	27.8	73.7	193.1	24,763	71.2	41.2	8,598	2,223	3,034	10,908	4.7	11.3	-	55.2	11.4	4.4	3.8	21.6
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	76.6	15.0	27.8	73.7	193.1	24,763	71.2	41.2	8,598	2,223	3,034	10,908	4.7	11.3	-	55.2	11.4	4.4	3.8	21.6
1-3D	50% HVAC Energy Cost Reduction[5]	55.7	11.0	28.0	73.7	168.4	21,814	66.2	36.8	6,225	1,628	3,053	10,908	2.8	8.2	-	55.2	8.2	3.2	3.8	21.6
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	55.7	11.0	28.0	73.7	168.4	21,814	66.2	36.8	6,225	1,628	3,053	10,908	2.8	8.2	-	55.2	8.2	3.2	3.8	21.6

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Boston MA

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	3,661	3,113	138,982	6,774	6,774	5,774	5,774	5,524	5,524	4,774	4,774
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	3,661	3,113	138,982	6,774	6,774	5,774	5,774	5,524	5,524	4,774	4,774
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	2,503	3,453	138,164	5,956	5,956	4,956	4,956	4,706	4,706	3,956	3,956
1-1C	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	2,503	3,453	138,164	5,956	5,956	4,956	4,956	4,706	4,706	3,956	3,956
1-2A	Baseline ASHP[1,3]	0%	45%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	62%	138,777	3,561	906	143,243	4,467	11,035	3,467	10,035	3,217	9,785	2,467	9,035
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	62%	138,777	3,561	906	143,243	4,467	11,035	3,467	10,035	3,217	9,785	2,467	9,035
1-2D	50% HVAC Energy Cost Reduction[5]	50%	73%	138,777	1,000	2,053	141,830	3,053	9,622	2,053	8,622	1,803	8,372	1,053	7,622
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	50%	73%	138,777	1,000	2,053	141,830	3,053	9,622	2,053	8,622	1,803	8,372	1,053	7,622
1-3A	Baseline NG[1,4]	0%	-24%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	31%	14%	134,926	1,503	2,310	138,739	3,813	6,531	2,813	5,531	2,563	5,281	1,813	4,531
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	31%	14%	134,926	1,503	2,310	138,739	3,813	6,531	2,813	5,531	2,563	5,281	1,813	4,531
1-3D	50% HVAC Energy Cost Reduction[5]	50%	38%	134,926	2,034	4,732	141,692	6,766	9,484	5,766	8,484	5,516	8,234	4,766	7,484
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	50%	38%	134,926	2,034	4,732	141,692	6,766	9,484	5,766	8,484	5,516	8,234	4,766	7,484

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - Boston MA

Alt.	Description	Ceiling Insul[7]		Ext. Wall Insul.[7]		Found. Insul.[7]		Floor Insul.[7]		Door Type[7]		Window Type[7]		Building Sealing[8]		Cost Premium	
		R38	R49	R19	R25	R10	R19	R19	R25	R2.80	Storm	U0.36	0.4SHGF	0.50ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	934	-	278	-	468	-	1,880	Incl.	100	Incl.	Incl.	Incl.	-	3,661	3,661
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	278	-	468	-	1,880	Incl.	100	Incl.	Incl.	Incl.	-	3,661	3,661
1-1D	50% HVAC Energy Cost Reduction[5]	-	934	Incl.	-	-	468	Incl.	-	Incl.	100	Incl.	Incl.	-	1,000	2,503	2,503
1-1C	17% Env/33% HVAC Energy Use Reduction[6]	-	934	Incl.	-	-	468	Incl.	-	Incl.	100	Incl.	Incl.	-	1,000	2,503	2,503
1-2A	Baseline ASHP[1,3]	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	934	-	278	-	468	-	1,880	Incl.	-	Incl.	Incl.	Incl.	-	3,561	3,561
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	278	-	468	-	1,880	Incl.	-	Incl.	Incl.	Incl.	-	3,561	3,561
1-2D	50% HVAC Energy Cost Reduction[5]	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,000	1,000
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,000	1,000
1-3A	Baseline NG[1,4]	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	934	Incl.	-	-	468	Incl.	-	-	100	Incl.	Incl.	Incl.	-	1,503	1,503
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	Incl.	-	-	468	Incl.	-	-	100	Incl.	Incl.	Incl.	-	1,503	1,503
1-3D	50% HVAC Energy Cost Reduction[5]	-	934	Incl.	-	Incl.	-	Incl.	-	-	100	Incl.	Incl.	-	1,000	2,034	2,034
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	934	Incl.	-	Incl.	-	Incl.	-	-	100	Incl.	Incl.	-	1,000	2,034	2,034

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC
1-Story w/ Basement - Boston MA

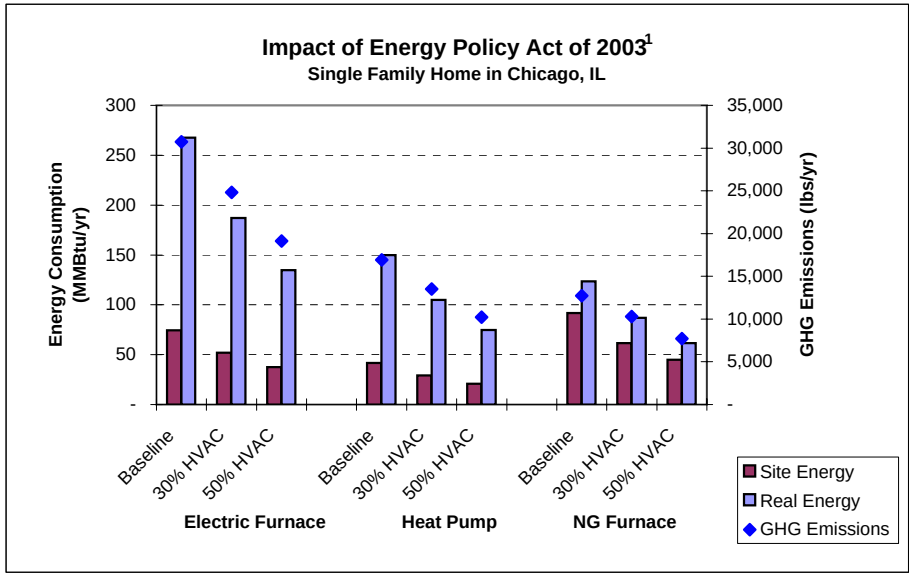
Alt.	Description	Duct Sealing[7]			Elec Furn.[7]	NG Furnace[7]			Air-Source Heat Pump[7]			Electric A/C[7]			Prog Stat	Cost Premium	
		Tape	Mastic	Aerosol	100% Eff.	78AFUE	85AFUE	95AFUE	10SEER	12SEER	16SEER	10SEER	12SEER	17SEER		Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	-	Incl.	-	-	-	-	-	-	Incl.	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1D	50% HVAC Energy Cost Reduction[5]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-1C	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	-	-	Incl.	-	-	-	-	-	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	-	566	-	-	-	-	-	906	906
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	-	566	-	-	-	-	-	906	906
1-2D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	-	-	1,613	-	-	-	100	2,053	2,053
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	-	-	1,613	-	-	-	100	2,053	2,053
1-3A	Baseline NG[1,4]	Incl.	-	-	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	1,150	-	-	-	-	-	720	-	100	2,310	2,310
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	1,150	-	-	-	-	-	720	-	100	2,310	2,310
1-3D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	1,619	-	-	-	-	-	2,673	100	4,732	4,732
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	1,619	-	-	-	-	-	2,673	100	4,732	4,732

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Chicago IL

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	65.6	8.7	74.3	0%	236.2	31.3	267.5	0%	1,650	220	1,870	0%	30,349	263.3	119.0	30,730.8	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	47.6	4.4	52.0	30%	171.4	15.8	187.2	30%	1,197	112	1,309	30%	24,509	212.7	96.1	24,817.9	19%
50% HVAC Energy Cost Reduction[6]	50% HVAC	33.5	3.9	37.4	50%	120.6	14.0	134.6	50%	841	98	939	50%	18,887	163.8	74.0	19,125.2	38%
Baseline ASHP[1,3]	Baseline	32.9	8.7	41.6	0%	118.4	31.3	149.8	0%	828	220	1,048	0%	16,713	145.0	65.6	16,923.8	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	22.7	6.4	29.1	30%	81.7	23.0	104.8	30%	570	161	731	30%	13,343	115.8	52.3	13,511.2	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	15.9	4.9	20.8	50%	57.2	17.6	74.9	50%	401	123	524	50%	10,101	87.7	39.6	10,228.0	40%
Baseline NG[1,4]	Baseline	82.9	9.0	91.9	0%	91.2	32.4	123.6	0%	799	225	1,024	0%	12,665	34.1	26.3	12,725.5	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	53.8	7.7	61.5	33%	59.2	27.7	86.9	30%	522	194	716	30%	10,232	32.7	22.9	10,287.8	19%
50% HVAC Energy Cost Reduction[6]	50% HVAC	40.1	4.9	45.0	51%	44.1	17.6	61.8	50%	389	123	512	50%	7,692	21.3	16.2	7,729.9	39%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Chicago IL

Description	Upgrade Cost			Annual Energy Cost ($/yr.)				Energy Use	Energy Cost	Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
	Env.	HVAC	Total	Heating	Cooling	SWH	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	-	-	-	1,650	220	403	1,870	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	4,259	3,113	7,372	1,197	112	403	1,309	30%	30%	6,372	6,372	6,122	6,122	5,372	5,372
10% Env/20% HVAC Energy Use Reduction[6]	4,259	3,113	7,372	1,197	112	403	1,309	30%	30%	6,372	6,372	6,122	6,122	5,372	5,372
50% HVAC Energy Cost Reduction[5]	4,106	3,453	7,559	841	98	403	939	50%	50%	6,559	6,559	6,309	6,309	5,559	5,559
17% Env/33% HVAC Energy Use Reduction[6]	4,106	3,453	7,559	841	98	403	939	50%	50%	6,559	6,559	6,309	6,309	5,559	5,559
Baseline ASHP[1,3]	-	-	-	828	220	403	1,048	0%	0%	-	5,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	4,259	906	5,165	570	161	403	731	30%	30%	4,165	10,733	3,915	10,483	3,165	9,733
10% Env/20% HVAC Energy Use Reduction[6]	4,259	906	5,165	570	161	403	731	30%	30%	4,165	10,733	3,915	10,483	3,165	9,733
50% HVAC Energy Cost Reduction[5]	1,000	1,986	2,986	401	123	403	524	50%	50%	1,986	8,555	1,736	8,305	986	7,555
17% Env/33% HVAC Energy Use Reduction[6]	1,000	1,986	2,986	401	123	403	524	50%	50%	1,986	8,555	1,736	8,305	986	7,555
Baseline NG[1,4]	-	-	-	799	225	234	1,024	0%	0%	-	1,718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	3,674	1,590	5,264	522	194	234	716	33%	30%	4,264	6,982	4,014	6,732	3,264	5,982
10% Env/20% HVAC Energy Use Reduction[6]	3,674	1,590	5,264	522	194	234	716	33%	30%	4,264	6,982	4,014	6,732	3,264	5,982
50% HVAC Energy Cost Reduction[5]	1,568	3,200	4,768	389	123	235	512	51%	50%	3,768	6,486	3,518	6,236	2,768	5,486
17% Env/33% HVAC Energy Use Reduction[6]	1,568	3,200	4,768	389	123	235	512	51%	50%	3,768	6,486	3,518	6,236	2,768	5,486

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - Chicago IL

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	75.4	65.6	25.6	44.2	28.1	65.6	8.7	74.3	0%	0%	1,650	220	1,870	0%	0%
1-1B	30% HVAC Energy Cost Reduction[b]	79.8	47.6	22.1	34.3	23.5	47.6	4.4	52.0	30%	30%	1,197	112	1,309	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[b]	79.8	47.6	22.1	34.3	23.5	47.6	4.4	52.0	30%	30%	1,197	112	1,309	30%	30%
1-1D	50% HVAC Energy Cost Reduction[b]	83.7	33.5	19.4	25.4	16.9	33.5	3.9	37.4	50%	50%	841	98	939	50%	50%
1-1E	17% Env/33% HVAC Energy Use Reduction[b]	83.7	33.5	19.4	25.4	16.9	33.5	3.9	37.4	50%	50%	841	98	939	50%	50%
1-2A	Baseline ASHP[1,3]	84.7	65.6	25.6	44.2	28.1	32.9	8.7	41.6	0%	44%	828	220	1,048	0%	44%
1-2B	30% HVAC Energy Cost Reduction[b]	87.2	49.8	22.6	34.8	23.7	22.7	6.4	29.1	30%	61%	570	161	731	30%	61%
1-2C	10% Env/20% HVAC Energy Use Reduction[b]	87.2	49.8	22.6	34.8	23.7	22.7	6.4	29.1	30%	61%	570	161	731	30%	61%
1-2D	50% HVAC Energy Cost Reduction[b]	89.7	42.0	22.9	31.4	20.3	15.9	4.9	20.8	50%	72%	401	123	524	50%	72%
1-2E	17% Env/33% HVAC Energy Use Reduction[b]	89.7	42.0	22.9	31.4	20.3	15.9	4.9	20.8	50%	72%	401	123	524	50%	72%
1-3A	Baseline NG[1,4]	84.7	63.0	26.2	42.1	28.3	82.9	9.0	91.9	0%	-24%	799	225	1,024	0%	45%
1-3B	30% HVAC Energy Cost Reduction[5]	87.8	47.0	22.6	33.9	23.8	53.8	7.7	61.5	33%	17%	522	194	716	30%	62%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	88.8	47.0	22.6	33.9	23.8	53.8	7.7	61.5	33%	17%	522	194	716	30%	62%
1-3D	50% HVAC Energy Cost Reduction[5]	90.0	33.1	20.0	25.1	17.2	40.1	4.9	45.0	51%	39%	389	123	512	50%	73%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	90.0	33.1	20.0	25.1	17.2	40.1	4.9	45.0	51%	39%	389	123	512	50%	73%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions

1-Story w/ Basement - Chicago IL

Alt.	Description	Real Energy Consumption (MMBtu/yr)					Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[7]	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	212.7	23.1	57.6	71.5	364.9	46,963	407.4	184.1	27,375	2,973	7,417	9,198	237.5	25.8	64.3	79.8	107.3	11.7	29.1	36.1
1-1B	30% HVAC Energy Cost Reduction[5]	177.0	13.4	57.6	71.5	319.5	41,121	356.7	161.2	22,785	1,724	7,414	9,198	197.7	15.0	64.3	79.8	89.3	6.8	29.1	36.1
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	177.0	13.4	57.6	71.5	319.5	41,121	356.7	161.2	22,785	1,724	7,414	9,198	197.7	15.0	64.3	79.8	89.3	6.8	29.1	36.1
1-1D	50% HVAC Energy Cost Reduction[5]	135.3	11.4	57.6	71.5	275.8	35,501	308.0	139.2	17,421	1,467	7,416	9,198	151.1	12.7	64.3	79.8	68.3	5.7	29.1	36.1
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	135.3	11.4	57.6	71.5	275.8	35,501	308.0	139.2	17,421	1,467	7,416	9,198	151.1	12.7	64.3	79.8	68.3	5.7	29.1	36.1
1-2A	Baseline ASHP[1,3]	106.7	23.1	57.6	71.5	258.9	33,328	289.1	130.7	13,740	2,973	7,417	9,198	119.2	25.8	64.3	79.8	53.9	11.7	29.1	36.1
1-2B	30% HVAC Energy Cost Reduction[5]	84.3	19.4	57.6	71.5	232.8	29,954	259.9	117.4	10,844	2,499	7,413	9,198	94.1	21.7	64.3	79.8	42.5	9.8	29.1	36.1
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	84.3	19.4	57.6	71.5	232.8	29,954	259.9	117.4	10,844	2,499	7,413	9,198	94.1	21.7	64.3	79.8	42.5	9.8	29.1	36.1
1-2D	50% HVAC Energy Cost Reduction[5]	64.2	14.3	57.6	71.5	207.6	26,715	231.8	104.7	8,261	1,839	7,417	9,198	71.7	16.0	64.3	79.8	32.4	7.2	29.1	36.1
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	64.2	14.3	57.6	71.5	207.6	26,715	231.8	104.7	8,261	1,839	7,417	9,198	71.7	16.0	64.3	79.8	32.4	7.2	29.1	36.1
1-3A	Baseline NG[1,4]	86.8	23.8	27.9	71.5	210.0	24,902	113.9	66.2	9,607	3,058	3,039	9,198	7.6	26.5	-	79.8	14.3	12.0	3.8	36.1
1-3B	30% HVAC Energy Cost Reduction[5]	65.2	23.3	27.9	71.5	187.9	22,469	112.5	62.7	7,227	3,005	3,039	9,198	6.6	26.1	-	79.8	11.1	11.8	3.8	36.1
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	65.2	23.3	27.9	71.5	187.9	22,469	112.5	62.7	7,227	3,005	3,039	9,198	6.6	26.1	-	79.8	11.1	11.8	3.8	36.1
1-3D	50% HVAC Energy Cost Reduction[5]	52.7	14.4	27.8	71.5	166.4	19,922	101.1	56.0	5,840	1,853	3,032	9,198	5.2	16.1	-	79.8	8.9	7.3	3.8	36.1
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	52.7	14.4	27.8	71.5	166.4	19,922	101.1	56.0	5,840	1,853	3,032	9,198	5.2	16.1	-	79.8	8.9	7.3	3.8	36.1

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Chicago IL

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	4,259	3,113	139,580	7,372	7,372	6,372	6,372	6,122	6,122	5,372	5,372
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	4,259	3,113	139,580	7,372	7,372	6,372	6,372	6,122	6,122	5,372	5,372
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	4,106	3,453	139,767	7,559	7,559	6,559	6,559	6,309	6,309	5,559	5,559
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	4,106	3,453	139,767	7,559	7,559	6,559	6,559	6,309	6,309	5,559	5,559
1-2A	Baseline ASHP[1,3]	0%	44%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	61%	138,777	4,259	906	143,941	5,165	11,733	4,165	10,733	3,915	10,483	3,165	9,733
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	61%	138,777	4,259	906	143,941	5,165	11,733	4,165	10,733	3,915	10,483	3,165	9,733
1-2D	50% HVAC Energy Cost Reduction[5]	50%	72%	138,777	1,000	1,986	141,763	2,986	9,555	1,986	8,555	1,736	8,305	986	7,555
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	50%	72%	138,777	1,000	1,986	141,763	2,986	9,555	1,986	8,555	1,736	8,305	986	7,555
1-3A	Baseline NG[1,4]	0%	-24%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	33%	17%	134,926	3,674	1,590	140,190	5,264	7,982	4,264	6,982	4,014	6,732	3,264	5,982
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	33%	17%	134,926	3,674	1,590	140,190	5,264	7,982	4,264	6,982	4,014	6,732	3,264	5,982
1-3D	50% HVAC Energy Cost Reduction[5]	51%	39%	134,926	1,568	3,200	139,694	4,768	7,486	3,768	6,486	3,518	6,236	2,768	5,486
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	51%	39%	134,926	1,568	3,200	139,694	4,768	7,486	3,768	6,486	3,518	6,236	2,768	5,486

Notes:

2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - Chicago IL

Alt.	Description	Ceiling Insul[7]	Ext. Wall Insul.[7]			Found. Insul.[7]				Floor Insul.[7]			Door Type[7]			Window Type[7]		Building Sealing[8]		Cost Premium	
		R49	R22	R25	R30	R10	R19	R25	R30	R19	R25	R30	R2.80	R4.40	Storm	U0.33	0.4SHGF	0.5ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	Incl.	-	-	649	-	-	-	1,041	-	-	2,469	Incl.	-	100	Incl.	Incl.	Incl.	-	4,259	4,259
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	Incl.	-	-	649	-	-	-	1,041	-	-	2,469	Incl.	-	100	Incl.	Incl.	Incl.	-	4,259	4,259
1-1D	50% HVAC Energy Cost Reduction[5]	Incl.	Incl.	-	-	-	468	-		-	2,288	-	-	250	100	Incl.	Incl.	-	1,000	4,106	4,106
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	Incl.	-	-	-	468	-		-	2,288	-	-	250	100	Incl.	Incl.	-	1,000	4,106	4,106
1-2A	Baseline ASHP[1,3]	Incl.	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	Incl.	-	-	649	-	-	-	1,041	-	-	2,469	Incl.	-	100	Incl.	Incl.	Incl.	-	4,259	4,259
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	Incl.	-	-	649	-	-	-	1,041	-	-	2,469	Incl.	-	100	Incl.	Incl.	Incl.	-	4,259	4,259
1-2D	50% HVAC Energy Cost Reduction[5]	Incl.	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	-	1,000	1,000	1,000
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	-	1,000	1,000	1,000
1-3A	Baseline NG[1,4]	Incl.	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	Incl.	-	324	-	-	-	781	-	-	-	2,469	Incl.	-	100	Incl.	Incl.	Incl.	-	3,674	3,674
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	Incl.	-	324	-	-	-	781	-	-	-	2,469	Incl.	-	100	Incl.	Incl.	Incl.	-	3,674	3,674
1-3D	50% HVAC Energy Cost Reduction[5]	Incl.	Incl.	-	-	-	468	-		Incl.	-	-	Incl.	-	100	Incl.	Incl.	-	1,000	1,568	1,568
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	Incl.	-	-	-	468	-		Incl.	-	-	Incl.	-	100	Incl.	Incl.	-	1,000	1,568	1,568

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC
1-Story w/ Basement - Chicago IL

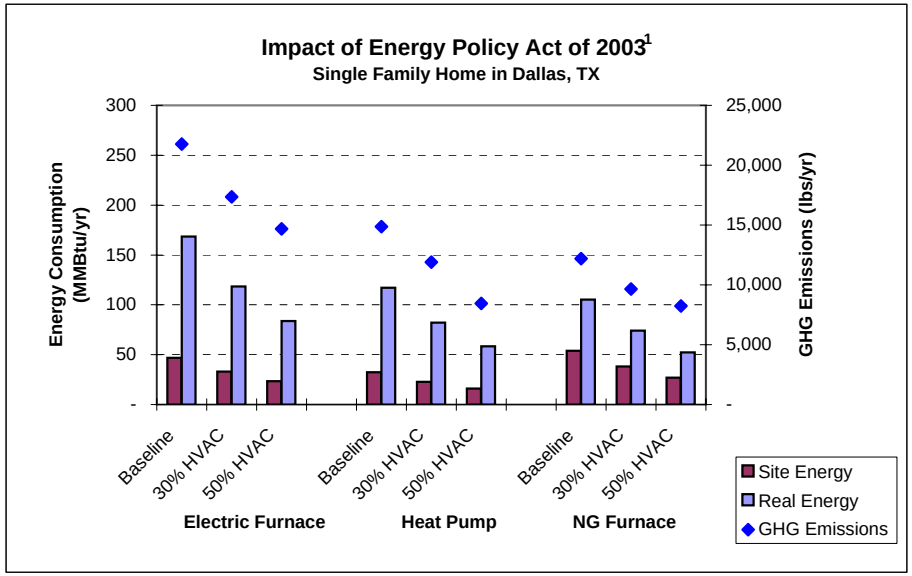
Alt.	Description	Duct Sealing[7]			Elec Furn.[7]	NG Furnace[7]			Air-Source Heat Pump[7]			Electric A/C[7]			Prog Stat	Cost Premium	
		Tape	Mastic	Aerosol	100% Eff.	78AFUE	85AFUE	90AFUE	10SEER	12SEER	14SEER	10SEER	14SEER	16SEER		Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	-	Incl.	-	-	-	-	-	-	Incl.	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1D	50% HVAC Energy Cost Reduction[5]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	-	-	Incl.	-	-	-	-	-	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	-	566	-	-	-	-	-	906	906
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	-	566	-	-	-	-	-	906	906
1-2D	50% HVAC Energy Cost Reduction[5]	-	-	680	-	-	-	-	-	-	1,206	-	-	-	100	1,986	1,986
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	-	-	-	-	-	-	1,206	-	-	-	100	1,986	1,986
1-3A	Baseline NG[1,4]	Incl.	-	-	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	1,150	-	-	-	Incl.	-	-	100	1,590	1,590
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	1,150	-	-	-	Incl.	-	-	100	1,590	1,590
1-3D	50% HVAC Energy Cost Reduction[5]	-	-	680	-	-	900	-	-	-	-	-	1,520	-	100	3,200	3,200
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	-	-	900	-	-	-	-	-	1,520	-	100	3,200	3,200

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Dallas, TX

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	28.7	18.1	46.8	0%	103.3	65.2	168.5	0%	680	429	1,109	0%	21,649	62.4	51.7	21,763.2	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	20.2	12.7	32.9	30%	72.7	45.7	118.4	30%	479	300	779	30%	17,268	49.8	41.2	17,359.4	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	14.9	8.4	23.3	50%	53.6	30.2	83.9	50%	353	198	551	50%	14,610	42.2	34.9	14,687.2	33%
Baseline ASHP[1,3]	Baseline	14.4	18.1	32.5	0%	51.8	65.2	117.0	0%	341	429	770	0%	14,789	42.6	35.3	14,866.8	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	9.9	12.9	22.8	30%	35.6	46.4	82.1	30%	235	305	540	30%	11,841	34.1	28.3	11,902.9	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	6.5	9.7	16.2	50%	23.4	34.9	58.3	50%	155	231	386	50%	8,401	24.3	20.1	8,445.0	43%
Baseline NG[1,4]	Baseline	35.7	18.3	54.0	0%	39.3	65.9	105.2	0%	338	434	772	0%	12,134	24.4	24.8	12,183.5	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	25.4	12.8	38.2	29%	27.9	46.1	74.0	30%	237	302	539	30%	9,608	19.0	19.5	9,646.4	21%
50% HVAC Energy Cost Reduction[6]	50% HVAC	17.7	9.1	26.8	50%	19.5	32.8	52.2	50%	169	216	385	50%	8,194	16.5	16.8	8,226.9	32%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Dallas, TX

Description	Upgrade Cost			Annual Energy Cost ($/yr.)			Energy Use	Energy Cost	Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
	Env.	HVAC	Total	Heating	Cooling	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	-	-	-	680	429	1,109	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	2,420	1,662	4,081	479	300	779	30%	30%	3,081	3,081	2,831	2,831	2,081	2,081
10% Env/20% HVAC Energy Use Reduction[6]	2,420	1,662	4,081	479	300	779	30%	30%	3,081	3,081	2,831	2,831	2,081	2,081
50% HVAC Energy Cost Reduction[5]	3,483	2,474	5,957	353	198	552	50%	50%	4,957	4,957	4,707	4,707	3,957	3,957
17% Env/33% HVAC Energy Use Reduction[6]	3,483	2,474	5,957	353	198	552	50%	50%	4,957	4,957	4,707	4,707	3,957	3,957
									-	-	-	-	-	-
Baseline ASHP[1,3]	-	-	-	341	429	770	0%	0%	-	5,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	2,114	1,179	3,293	235	305	540	30%	30%	2,293	8,862	2,043	8,612	1,293	7,862
10% Env/20% HVAC Energy Use Reduction[6]	2,114	1,179	3,293	235	305	540	30%	30%	2,293	8,862	2,043	8,612	1,293	7,862
50% HVAC Energy Cost Reduction[5]	6,961	2,466	9,428	155	231	386	50%	50%	8,428	14,996	8,178	14,746	7,428	13,996
17% Env/33% HVAC Energy Use Reduction[6]	6,961	2,466	9,428	155	231	386	50%	50%	8,428	14,996	8,178	14,746	7,428	13,996
									-	-	-	-	-	-
Baseline NG[1,4]	-	-	-	338	434	772	0%	0%	-	1,718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	1,393	1,662	3,055	237	302	539	29%	30%	2,055	4,773	1,805	4,523	1,055	3,773
10% Env/20% HVAC Energy Use Reduction[6]	1,393	1,662	3,055	237	302	539	29%	30%	2,055	4,773	1,805	4,523	1,055	3,773
50% HVAC Energy Cost Reduction[5]	6,197	3,417	9,614	169	216	385	50%	50%	8,614	11,332	8,364	11,082	7,614	10,332
17% Env/33% HVAC Energy Use Reduction[6]	6,197	3,417	9,614	169	216	385	50%	50%	8,614	11,332	8,364	11,082	7,614	10,332

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - Dallas, TX

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	80.5	28.7	53.1	35.9	36.6	28.7	18.1	46.8	0%	0%	680	429	1,109	0%	0%
1-1B	30% HVAC Energy Cost Reduction[5]	83.9	20.2	44.5	27.8	29.6	20.2	12.7	32.9	30%	30%	479	300	779	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	83.9	20.2	44.5	27.8	29.6	20.2	12.7	32.9	30%	30%	479	300	779	30%	30%
1-1D	50% HVAC Energy Cost Reduction[5]	86.1	14.9	36.8	21.6	24.0	14.9	8.4	23.3	50%	50%	353	198	552	50%	50%
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	86.1	14.9	36.8	21.6	24.0	14.9	8.4	23.3	50%	50%	353	198	552	50%	50%
1-2A	Baseline ASHP[1,3]	85.0	28.7	53.1	35.9	36.6	14.4	18.1	32.5	0%	31%	341	429	770	0%	31%
1-2B	30% HVAC Energy Cost Reduction[5]	87.4	21.8	45.4	28.5	30.1	9.9	12.9	22.8	30%	51%	235	305	540	30%	51%
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	87.4	21.8	45.4	28.5	30.1	9.9	12.9	22.8	30%	51%	235	305	540	30%	51%
1-2D	50% HVAC Energy Cost Reduction[5]	90.2	16.3	42.8	24.2	27.4	6.5	9.7	16.2	50%	65%	155	231	386	50%	65%
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	90.2	16.3	42.8	24.2	27.4	6.5	9.7	16.2	50%	65%	155	231	386	50%	65%
1-3A	Baseline NG[1,4]	85.2	27.1	53.8	34.0	36.8	35.7	18.3	54.0	0%	-15%	338	434	772	0%	30%
1-3B	30% HVAC Energy Cost Reduction[5]	87.7	19.9	44.9	27.3	30.1	25.4	12.8	38.2	29%	18%	237	302	539	30%	51%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	87.7	19.9	44.9	27.3	30.1	25.4	12.8	38.2	29%	18%	237	302	539	30%	51%
1-3D	50% HVAC Energy Cost Reduction[5]	89.4	14.6	37.4	21.3	24.4	17.7	9.1	26.8	50%	43%	169	216	385	50%	65%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	89.4	14.6	37.4	21.3	24.4	17.7	9.1	26.8	50%	43%	169	216	385	50%	65%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions

1-Story w/ Basement - Dallas, TX

Alt.	Description	Real Energy Consumption (MMBtu/yr)					Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[7]	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	91.1	52.1	49.1	71.2	263.5	39,843	114.9	95.2	13,773	7,876	7,426	10,768	39.7	22.7	21.4	31.1	32.9	18.8	17.7	25.7
1-1B	30% HVAC Energy Cost Reduction[5]	72.8	41.4	49.1	71.2	234.5	35,458	102.3	84.7	11,012	6,256	7,421	10,768	31.8	18.0	21.4	31.1	26.3	14.9	17.7	25.7
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	72.8	41.4	49.1	71.2	234.5	35,458	102.3	84.7	11,012	6,256	7,421	10,768	31.8	18.0	21.4	31.1	26.3	14.9	17.7	25.7
1-1D	50% HVAC Energy Cost Reduction[5]	64.2	32.4	49.1	71.2	216.9	32,802	94.6	78.4	9,703	4,907	7,424	10,768	28.0	14.2	21.4	31.1	23.2	11.7	17.7	25.7
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	64.2	32.4	49.1	71.2	216.9	32,802	94.6	78.4	9,703	4,907	7,424	10,768	28.0	14.2	21.4	31.1	23.2	11.7	17.7	25.7
1-2A	Baseline ASHP[1,3]	45.7	52.1	49.1	71.2	218.1	32,983	95.1	78.8	6,913	7,876	7,426	10,768	19.9	22.7	21.4	31.1	16.5	18.8	17.7	25.7
1-2B	30% HVAC Energy Cost Reduction[5]	36.0	42.3	49.1	71.2	198.6	30,032	86.6	71.8	5,448	6,393	7,424	10,768	15.7	18.4	21.4	31.1	13.0	15.3	17.7	25.7
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	36.0	42.3	49.1	71.2	198.6	30,032	86.6	71.8	5,448	6,393	7,424	10,768	15.7	18.4	21.4	31.1	13.0	15.3	17.7	25.7
1-2D	50% HVAC Energy Cost Reduction[5]	23.8	31.8	49.1	71.2	175.9	26,595	76.7	63.6	3,598	4,802	7,426	10,768	10.4	13.9	21.4	31.1	8.6	11.5	17.7	25.7
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	23.8	31.8	49.1	71.2	175.9	26,595	76.7	63.6	3,598	4,802	7,426	10,768	10.4	13.9	21.4	31.1	8.6	11.5	17.7	25.7
1-3A	Baseline NG[1,4]	36.8	52.8	24.0	71.2	184.8	25,519	55.5	53.8	4,151	7,983	2,617	10,768	1.4	23.0	-	31.1	5.7	19.1	3.3	25.7
1-3B	30% HVAC Energy Cost Reduction[5]	29.4	41.8	24.0	71.2	166.4	22,996	50.1	48.5	3,284	6,324	2,620	10,768	0.8	18.2	-	31.1	4.4	15.1	3.3	25.7
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	29.4	41.8	24.0	71.2	166.4	22,996	50.1	48.5	3,284	6,324	2,620	10,768	0.8	18.2	-	31.1	4.4	15.1	3.3	25.7
1-3D	50% HVAC Energy Cost Reduction[5]	25.1	35.4	23.9	71.2	155.6	21,574	47.6	45.8	2,841	5,353	2,612	10,768	1.1	15.4	-	31.1	4.0	12.8	3.3	25.7
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	25.1	35.4	23.9	71.2	155.6	21,574	47.6	45.8	2,841	5,353	2,612	10,768	1.1	15.4	-	31.1	4.0	12.8	3.3	25.7

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Dallas, TX

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	2,420	1,662	136,289	4,081	4,081	3,081	3,081	2,831	2,831	2,081	2,081
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	2,420	1,662	136,289	4,081	4,081	3,081	3,081	2,831	2,831	2,081	2,081
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	3,483	2,474	138,165	5,957	5,957	4,957	4,957	4,707	4,707	3,957	3,957
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	3,483	2,474	138,165	5,957	5,957	4,957	4,957	4,707	4,707	3,957	3,957
1-2A	Baseline ASHP[1,3]	0%	31%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	51%	138,777	2,114	1,179	142,070	3,293	9,862	2,293	8,862	2,043	8,612	1,293	7,862
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	51%	138,777	2,114	1,179	142,070	3,293	9,862	2,293	8,862	2,043	8,612	1,293	7,862
1-2D	50% HVAC Energy Cost Reduction[5]	50%	65%	138,777	6,961	2,466	148,204	9,428	15,996	8,428	14,996	8,178	14,746	7,428	13,996
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	50%	65%	138,777	6,961	2,466	148,204	9,428	15,996	8,428	14,996	8,178	14,746	7,428	13,996
1-3A	Baseline NG[1,4]	0%	-15%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	29%	18%	134,926	1,393	1,662	137,981	3,055	5,773	2,055	4,773	1,805	4,523	1,055	3,773
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	29%	18%	134,926	1,393	1,662	137,981	3,055	5,773	2,055	4,773	1,805	4,523	1,055	3,773
1-3D	50% HVAC Energy Cost Reduction[5]	50%	43%	134,926	6,197	3,417	144,540	9,614	12,332	8,614	11,332	8,364	11,082	7,614	10,332
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	50%	43%	134,926	6,197	3,417	144,540	9,614	12,332	8,614	11,332	8,364	11,082	7,614	10,332

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - Dallas, TX

Alt.	Description	Ceiling Insul.[7]			Ext. Wall Insul.[7]					Found. Insul.[7]				Floor Insul.[7]			Door Type[7]		Window Type[7]		Building Sealing[8]		Cost Premium	
		R30	R38	R49	R13	R15	R19	R22	R25	R5	R7	R11	R19	R11	R19	R25	R2.8	Storm	U0.34	0.4SHGF	0.5ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	-	-	Incl.	-	-	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	680	-	-	-	1,282	-	-	-	-	458	-	Incl.	-	-	Incl.	-	Incl.	Incl.	Incl.	-	2,420	2,420
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	680	-	-	-	1,282	-	-	-	-	458	-	Incl.	-	-	Incl.	-	Incl.	Incl.	Incl.	-	2,420	2,420
1-1D	50% HVAC Energy Cost Reduction[5]	-	680	-	-	-	1,282	-	-	-	-	-	1,068	-	453	-	Incl.	-	Incl.	Incl.	Incl.	-	3,483	3,483
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	680	-	-	-	1,282	-	-	-	-	-	1,068	-	453	-	Incl.	-	Incl.	Incl.	Incl.	-	3,483	3,483
1-2A	Baseline ASHP[1,3]	Incl.	-	-	Incl.	-	-	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	680	-	-	-	1,282	-	-	-	153	-	-	Incl.	-	-	Incl.	-	Incl.	Incl.	Incl.	-	2,114	2,114
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	680	-	-	-	1,282	-	-	-	153	-	-	Incl.	-	-	Incl.	-	Incl.	Incl.	Incl.	-	2,114	2,114
1-2D	50% HVAC Energy Cost Reduction[5]	-	-	1,614	-	-	-	-	1,607	-	-	-	1,068	-	-	2,673	Incl.	-	Incl.	Incl.	Incl.	-	6,961	6,961
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	1,614	-	-	-	-	1,607	-	-	-	1,068	-	-	2,673	Incl.	-	Incl.	Incl.	Incl.	-	6,961	6,961
1-3A	Baseline NG[1,4]	Incl.	-	-	Incl.	-	-	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	680	-	-	108	-	-	-	-	153	-	-	-	453	-	Incl.	-	Incl.	Incl.	Incl.	-	1,393	1,393
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	680	-	-	108	-	-	-	-	153	-	-	-	453	-	Incl.	-	Incl.	Incl.	Incl.	-	1,393	1,393
1-3D	50% HVAC Energy Cost Reduction[5]	-	680	-	-	-	-	1,777	-	-	-	-	1,068	-	-	2,673	Incl.	-	Incl.	Incl.	Incl.	-	6,197	6,197
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	680	-	-	-	-	1,777	-	-	-	-	1,068	-	-	2,673	Incl.	-	Incl.	Incl.	Incl.	-	6,197	6,197

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC
1-Story w/ Basement - Dallas, TX

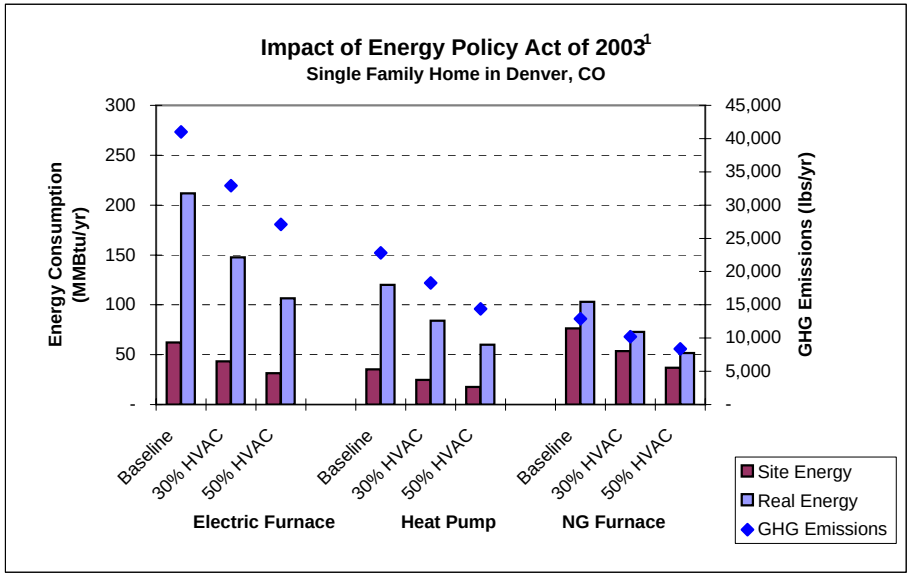
Alt.	Description	Duct Sealing[7]			Elec Furn.[7]	NG Furnace[7]		Air-Source Heat Pump[7]			Electric A/C[7]			Prog Stat	Cost Premium	
		Tape	Mastic	Aerosol	100% Eff.	78AFUE	90AFUE	10SEER	12SEER	15SEER	10SEER	12SEER	15SEER		Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	-	1,222	-	100	1,662	1,662
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	-	1,222	-	100	1,662	1,662
1-1D	50% HVAC Energy Cost Reduction[5]	-	-	680	Incl.	-	-	-	-	-	-	-	1,694	100	2,474	2,474
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	Incl.	-	-	-	-	-	-	-	1,694	100	2,474	2,474
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	839	-	-	-	-	-	1,179	1,179
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	839	-	-	-	-	-	1,179	1,179
1-2D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	-	2,026	-	-	-	100	2,466	2,466
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	-	2,026	-	-	-	100	2,466	2,466
1-3A	Baseline NG[1,4]	Incl.	-	-	-	Incl.	-	-	-	-	Incl.	-	-	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	Incl.	-	-	-	-	-	1,222	-	100	1,662	1,662
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	Incl.	-	-	-	-	-	1,222	-	100	1,662	1,662
1-3D	50% HVAC Energy Cost Reduction[5]	-	-	680	-	-	943	-	-	-	-	-	1,694	100	3,417	3,417
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	-	-	943	-	-	-	-	-	1,694	100	3,417	3,417

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Denver, CO

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	54.2	8.1	62.3	0%	184.3	27.5	211.8	0%	1,235	184	1,419	0%	40,792	99.0	109.4	41,000.7	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	39.3	4.1	43.4	30%	133.6	13.9	147.6	30%	897	94	991	30%	32,760	79.5	87.8	32,927.6	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	26.8	4.5	31.3	50%	91.1	15.3	106.4	50%	611	102	713	50%	26,948	65.4	72.2	27,085.6	34%
Baseline ASHP[1,3]	Baseline	27.2	8.1	35.3	0%	92.5	27.5	120.0	0%	620	184	804	0%	22,700	55.1	60.9	22,816.1	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	18.8	5.9	24.7	30%	63.9	20.1	84.0	30%	430	134	564	30%	18,177	44.2	48.7	18,269.8	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	12.6	5.0	17.6	50%	42.8	17.0	59.8	50%	289	114	403	50%	14,321	34.7	38.4	14,393.8	37%
Baseline NG[1,4]	Baseline	68.2	8.2	76.4	0%	75.0	27.9	102.9	0%	717	188	905	0%	12,850	14.4	24.5	12,889.1	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	47.7	6.0	53.7	30%	52.5	20.4	72.9	29%	496	137	633	30%	10,174	11.1	19.3	10,204.1	21%
50% HVAC Energy Cost Reduction[6]	50% HVAC	32.1	4.8	36.9	52%	35.3	16.3	51.6	50%	342	110	452	50%	8,351	9.8	16.2	8,377.3	35%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Denver, CO

Description	Upgrade Cost			Annual Energy Cost ($/yr.)			Energy Use	Energy Cost	Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
	Env.	HVAC	Total	Heating	Cooling	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	-	-	-	1,235	184	1,419	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	3,023	3,113	6,136	897	94	991	30%	30%	4,136	4,136	4,886	4,886	4,136	4,136
10% Env/20% HVAC Energy Use Reduction[6]	3,023	3,113	6,136	897	94	991	30%	30%	4,136	4,136	4,886	4,886	4,136	4,136
50% HVAC Energy Cost Reduction[5]	5,509	3,113	8,622	611	102	713	50%	50%	6,622	6,622	7,372	7,372	6,622	6,622
17% Env/33% HVAC Energy Use Reduction[6]	5,509	3,113	8,622	611	102	713	50%	50%	6,622	6,622	7,372	7,372	6,622	6,622
Baseline ASHP[1,3]	-	-	-	620	184	804	0%	0%	-	4,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	3,262	969	4,231	430	134	564	30%	30%	2,231	8,799	2,981	9,549	2,231	8,799
10% Env/20% HVAC Energy Use Reduction[6]	3,262	969	4,231	430	134	564	30%	30%	2,231	8,799	2,981	9,549	2,231	8,799
50% HVAC Energy Cost Reduction[5]	3,448	1,960	5,408	289	114	403	50%	50%	3,408	9,977	4,158	10,727	3,408	9,977
17% Env/33% HVAC Energy Use Reduction[6]	3,448	1,960	5,408	289	114	403	50%	50%	3,408	9,977	4,158	10,727	3,408	9,977
Baseline NG[1,4]	-	-	-	717	188	905	0%	0%	-	718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	3,085	1,160	4,245	496	137	633	30%	30%	2,245	4,963	2,995	5,713	2,245	4,963
10% Env/20% HVAC Energy Use Reduction[6]	3,085	1,160	4,245	496	137	633	30%	30%	2,245	4,963	2,995	5,713	2,245	4,963
50% HVAC Energy Cost Reduction[5]	4,349	4,732	9,081	342	110	452	52%	50%	7,081	9,799	7,831	10,549	7,081	9,799
17% Env/33% HVAC Energy Use Reduction[6]	4,349	4,732	9,081	342	110	452	52%	50%	7,081	9,799	7,831	10,549	7,081	9,799

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - Denver, CO

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	76.7	54.2	23.6	41.0	22.1	54.2	8.1	62.3	0%	0%	1,235	184	1,419	0%	0%
1-1B	30% HVAC Energy Cost Reduction[b]	80.1	39.3	20.5	32.2	18.4	39.3	4.1	43.4	30%	30%	897	94	991	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[b]	80.1	39.3	20.5	32.2	18.4	39.3	4.1	43.4	30%	30%	897	94	991	30%	30%
1-1D	50% HVAC Energy Cost Reduction[b]	83.5	26.8	22.2	25.2	17.4	26.8	4.5	31.3	50%	50%	611	102	713	50%	50%
1-1E	17% Env/33% HVAC Energy Use Reduction[b]	83.5	26.8	22.2	25.2	17.4	26.8	4.5	31.3	50%	50%	611	102	713	50%	50%
1-2A	Baseline ASHP[1,3]	85.1	54.2	23.6	41.0	22.1	27.2	8.1	35.3	0%	43%	620	184	804	0%	43%
1-2B	30% HVAC Energy Cost Reduction[b]	87.4	41.4	20.7	32.8	18.6	18.8	5.9	24.7	30%	60%	430	134	564	30%	60%
1-2C	10% Env/20% HVAC Energy Use Reduction[b]	87.4	41.4	20.7	32.8	18.6	18.8	5.9	24.7	30%	60%	430	134	564	30%	60%
1-2D	50% HVAC Energy Cost Reduction[b]	89.4	31.4	22.0	28.0	18.1	12.6	5.0	17.6	50%	72%	289	114	403	50%	72%
1-2E	17% Env/33% HVAC Energy Use Reduction[b]	89.4	31.4	22.0	28.0	18.1	12.6	5.0	17.6	50%	72%	289	114	403	50%	72%
1-3A	Baseline NG[1,4]	85.2	51.7	24.2	38.9	22.3	68.2	8.2	76.4	0%	-23%	717	188	905	0%	36%
1-3B	30% HVAC Energy Cost Reduction[5]	87.6	37.4	21.1	30.7	18.6	47.7	6.0	53.7	30%	14%	496	137	633	30%	55%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	87.6	37.4	21.1	30.7	18.6	47.7	6.0	53.7	30%	14%	496	137	633	30%	55%
1-3D	50% HVAC Energy Cost Reduction[5]	90.2	29.6	22.5	27.1	18.2	32.1	4.8	36.9	52%	41%	342	110	452	50%	68%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	90.2	29.6	22.5	27.1	18.2	32.1	4.8	36.9	52%	41%	342	110	452	50%	68%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions
1-Story w/ Basement - Denver, CO

Alt.	Description	Real Energy Consumption (MMBtu/yr)					Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[7]	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	161.2	19.8	55.7	67.7	304.4	68,623	166.6	183.9	36,323	4,469	12,560	15,271	88.2	10.8	30.5	37.1	97.4	12.0	33.7	40.9
1-1B	30% HVAC Energy Cost Reduction[5]	133.7	11.6	55.7	67.7	268.7	60,588	147.1	162.4	30,145	2,615	12,557	15,271	73.2	6.3	30.5	37.1	80.8	7.0	33.7	40.9
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	133.7	11.6	55.7	67.7	268.7	60,588	147.1	162.4	30,145	2,615	12,557	15,271	73.2	6.3	30.5	37.1	80.8	7.0	33.7	40.9
1-1D	50% HVAC Energy Cost Reduction[5]	107.4	12.1	55.7	67.7	242.9	54,772	133.0	146.8	24,216	2,732	12,553	15,271	58.8	6.6	30.5	37.1	64.9	7.3	33.6	40.9
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	107.4	12.1	55.7	67.7	242.9	54,772	133.0	146.8	24,216	2,732	12,553	15,271	58.8	6.6	30.5	37.1	64.9	7.3	33.6	40.9
1-2A	Baseline ASHP[1,3]	80.9	19.8	55.7	67.7	224.1	50,531	122.7	135.4	18,231	4,469	12,560	15,271	44.3	10.8	30.5	37.1	48.9	12.0	33.7	40.9
1-2B	30% HVAC Energy Cost Reduction[5]	64.1	16.6	55.7	67.7	204.1	46,009	111.7	123.2	14,443	3,734	12,561	15,271	35.1	9.1	35.1	40.9	38.7	10.0	33.7	40.9
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	64.1	16.6	55.7	67.7	204.1	46,009	111.7	123.2	14,443	3,734	12,561	15,271	35.1	9.1	35.1	40.9	38.7	10.0	33.7	40.9
1-2D	50% HVAC Energy Cost Reduction[5]	49.9	13.6	55.7	67.7	186.9	42,149	102.3	113.0	11,256	3,065	12,558	15,271	27.3	7.4	30.5	37.1	30.2	8.2	33.7	40.9
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	49.9	13.6	55.7	67.7	186.9	42,149	102.3	113.0	11,256	3,065	12,558	15,271	27.3	7.4	30.5	37.1	30.2	8.2	33.7	40.9
1-3A	Baseline NG[1,4]	69.6	20.4	28.5	67.7	186.2	31,226	51.4	69.3	8,252	4,598	3,106	15,271	3.2	11.2	-	37.1	12.2	12.3	3.9	40.9
1-3B	30% HVAC Energy Cost Reduction[5]	54.7	17.0	28.4	67.7	167.8	28,537	48.2	64.0	6,342	3,832	3,093	15,271	1.8	9.3	-	37.1	9.0	10.3	3.9	40.9
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	54.7	17.0	28.4	67.7	167.8	28,537	48.2	64.0	6,342	3,832	3,093	15,271	1.8	9.3	-	37.1	9.0	10.3	3.9	40.9
1-3D	50% HVAC Energy Cost Reduction[5]	44.4	13.1	28.5	67.7	153.7	26,729	46.9	61.0	5,401	2,951	3,107	15,271	2.6	7.2	-	37.1	8.3	7.9	3.9	40.9
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	44.4	13.1	28.5	67.7	153.7	26,729	46.9	61.0	5,401	2,951	3,107	15,271	2.6	7.2	-	37.1	8.3	7.9	3.9	40.9

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Denver, CO

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	3,023	3,113	138,344	6,136	6,136	5,136	5,136	4,886	4,886	4,136	4,136
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	3,023	3,113	138,344	6,136	6,136	5,136	5,136	4,886	4,886	4,136	4,136
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	5,509	3,113	140,830	8,622	8,622	7,622	7,622	7,372	7,372	6,622	6,622
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	5,509	3,113	140,830	8,622	8,622	7,622	7,622	7,372	7,372	6,622	6,622
1-2A	Baseline ASHP[1,3]	0%	43%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	60%	138,777	3,262	969	143,007	4,231	10,799	3,231	9,799	2,981	9,549	2,231	8,799
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	60%	138,777	3,262	969	143,007	4,231	10,799	3,231	9,799	2,981	9,549	2,231	8,799
1-2D	50% HVAC Energy Cost Reduction[5]	50%	72%	138,777	3,448	1,960	144,185	5,408	11,977	4,408	10,977	4,158	10,727	3,408	9,977
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	50%	72%	138,777	3,448	1,960	144,185	5,408	11,977	4,408	10,977	4,158	10,727	3,408	9,977
1-3A	Baseline NG[1,4]	0%	-23%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	30%	14%	134,926	3,085	1,160	139,171	4,245	6,963	3,245	5,963	2,995	5,713	2,245	4,963
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	30%	14%	134,926	3,085	1,160	139,171	4,245	6,963	3,245	5,963	2,995	5,713	2,245	4,963
1-3D	50% HVAC Energy Cost Reduction[5]	52%	41%	134,926	4,349	4,732	144,007	9,081	11,799	8,081	10,799	7,831	10,549	7,081	9,799
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	52%	41%	134,926	4,349	4,732	144,007	9,081	11,799	8,081	10,799	7,831	10,549	7,081	9,799

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - Denver, CO

Alt.	Description	Ceiling Insul[7]	Ext. Wall Insul.[7]			Found. Wall Insul.[7]				Floor Insul.[7]			Door Type[7]			Window Type[7]		Building Sealing[8]		Cost Premium	
		R49	R22	R25	R30	R10	R19	R25	R30	R19	R25	R30	R2.8	R4.4	Storm	U0.33	0.45SHGF	0.5ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	Incl.	-	324	-	-	468	-	-	-	1,880	-	-	250	100	Incl.	Incl.	Incl.	-	3,023	3,023
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	Incl.	-	324	-	-	468	-	-	-	1,880	-	-	250	100	Incl.	Incl.	Incl.	-	3,023	3,023
1-1D	50% HVAC Energy Cost Reduction[5]	Incl.	-	-	649	-	-	-	1,041	-	-	2,469	-	250	100	Incl.	Incl.	-	1,000	5,509	5,509
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	-	-	649	-	-	-	1,041	-	-	2,469	-	250	100	Incl.	Incl.	-	1,000	5,509	5,509
1-2A	Baseline ASHP[1,3]	Incl.	Incl.	-		Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	Incl.	-	324	-	-	468	-	-	-	-	2,469	Incl.	-	-	Incl.	Incl.	Incl.	-	3,262	3,262
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	Incl.	-	324	-	-	468	-	-	-	-	2,469	Incl.	-	-	Incl.	Incl.	Incl.	-	3,262	3,262
1-2D	50% HVAC Energy Cost Reduction[5]	Incl.	Incl.	-		-	468	-	-	-	1,880	-	Incl.	-	100	Incl.	Incl.	-	1,000	3,448	3,448
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	Incl.	-		-	468	-	-	-	1,880	-	Incl.	-	100	Incl.	Incl.	-	1,000	3,448	3,448
1-3A	Baseline NG[1,4]	Incl.	Incl.	-		Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	Incl.	-	324	-	-	-	781	-	-	1,880	-	Incl.	-	100	Incl.	Incl.	Incl.	-	3,085	3,085
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	Incl.	-	324	-	-	-	781	-	-	1,880	-	Incl.	-	100	Incl.	Incl.	Incl.	-	3,085	3,085
1-3D	50% HVAC Energy Cost Reduction[5]	Incl.	Incl.	-		-	-	781	-	-	-	2,469	Incl.	-	100	Incl.	Incl.	-	1,000	4,349	4,349
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	Incl.	-		-	-	781	-	-	-	2,469	Incl.	-	100	Incl.	Incl.	-	1,000	4,349	4,349

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC
1-Story w/ Basement - Denver, CO

Alt.	Description	Duct Sealing[11]		Elec Furn.[11]	NG Furnace[11]		Air-Source Heat Pump[11]			Electric A/C[11]			Prog Stat	Cost Premium	
		Tape	Mastic	100% Eff.	78AFUE	90AFUE	10SEER	12SEER	15SEER	10SEER	12SEER	17SEER		Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	340	Incl.	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	Incl.	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1D	50% HVAC Energy Cost Reduction[5]	-	340	Incl.	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	Incl.	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	Incl.	-	-	-	-	-	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	629	-	-	-	-	-	969	969
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	629	-	-	-	-	-	969	969
1-2D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	1,520	-	-	-	100	1,960	1,960
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	1,520	-	-	-	100	1,960	1,960
1-3A	Baseline NG[1,4]	Incl.	-	-	Incl.	-	-	-	-	Incl.	-	-	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	720	-	100	1,160	1,160
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	720	-	100	1,160	1,160
1-3D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	1,619	-	-	-	-	-	2,673	100	4,732	4,732
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	1,619	-	-	-	-	-	2,673	100	4,732	4,732

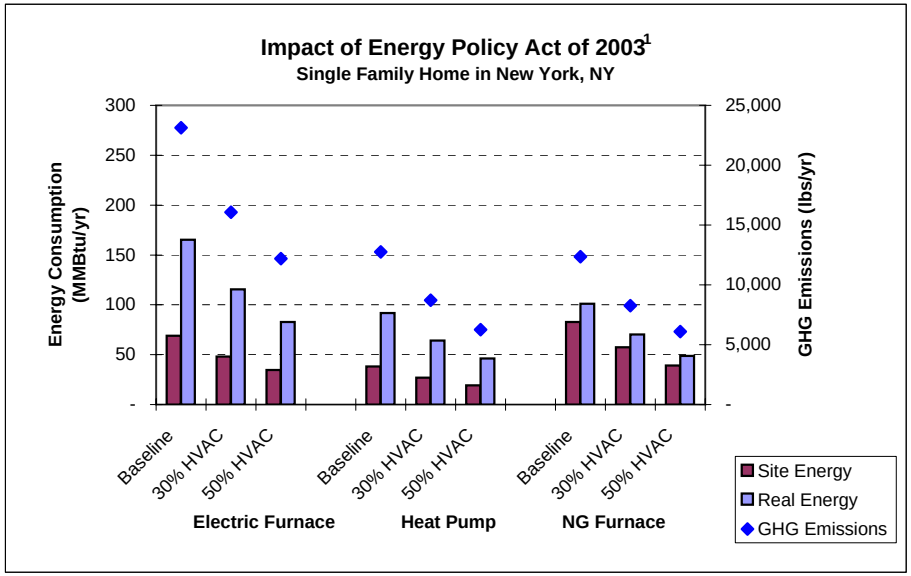
Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - New York, NY

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	61.6	7.3	68.9	0%	147.8	17.5	165.4	0%	2,484	296	2,780	0%	22,960	108.7	49.4	23,118.0	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	44.4	3.7	48.1	30%	106.6	8.9	115.4	30%	1,792	149	1,941	30%	15,954	75.6	34.3	16,064.3	31%
50% HVAC Energy Cost Reduction[6]	50% HVAC	31.1	3.4	34.5	50%	74.6	8.2	82.8	50%	1,256	135	1,391	50%	12,111	57.4	34.1	12,202.5	47%
Baseline ASHP[1,3]	Baseline	30.9	7.3	38.2	0%	74.2	17.5	91.7	0%	1,247	296	1,543	0%	12,675	60.0	27.3	12,762.3	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	21.4	5.4	26.8	30%	51.4	13.0	64.3	30%	865	218	1,083	30%	8,645	41.0	18.5	8,704.3	32%
50% HVAC Energy Cost Reduction[6]	50% HVAC	15.2	4.0	19.2	50%	36.5	9.6	46.1	50%	613	161	774	50%	6,204	29.4	13.4	6,246.7	51%
Baseline NG[1,4]	Baseline	75.4	7.5	82.9	0%	82.9	18.0	100.9	0%	920	304	1,224	0%	12,327	14.1	18.1	12,359.0	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	51.9	5.5	57.4	31%	57.1	13.2	70.3	30%	636	220	856	30%	8,229	8.2	11.9	8,249.3	33%
50% HVAC Energy Cost Reduction[6]	50% HVAC	35.1	4.2	39.3	53%	38.6	10.1	48.7	52%	442	169	611	50%	6,072	6.9	8.9	6,087.3	51%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary

1-Story w/ Basement - New York, NY

Description	Upgrade Cost			Annual Energy Cost ($/yr.)			Energy Use	Energy Cost	Premium (w/ $1000 Credit)		Premium (w/ $1250 Credit)		Premium (w/ $2000 Credit)	
	Env.	HVAC	Total	Heating	Cooling	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	-	-	-	2,484	296	2,780	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	3,817	3,113	6,930	1,792	149	1,941	30%	30%	5,930	5,930	5,680	5,680	4,930	4,930
10% Env/20% HVAC Energy Use Reduction[6]	3,817	3,114	6,931	1,792	149	1,941	30%	30%	5,931	5,931	5,681	5,681	4,931	4,931
50% HVAC Energy Cost Reduction[5]	1,170	3,453	4,623	1,256	135	1,391	50%	50%	3,623	3,623	3,373	3,373	2,623	2,623
17% Env/33% HVAC Energy Use Reduction[6]	1,170	3,453	4,623	1,256	135	1,391	50%	50%	3,623	3,623	3,373	3,373	2,623	2,623
									-	-	-	-	-	-
Baseline ASHP[1,3]	-	-	-	1,247	296	1,543	0%	0%	-	5,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	3,817	969	4,786	865	218	1,083	30%	30%	3,786	10,355	3,536	10,105	2,786	9,355
10% Env/20% HVAC Energy Use Reduction[6]	3,817	969	4,786	865	218	1,083	30%	30%	3,786	10,355	3,536	10,105	2,786	9,355
50% HVAC Energy Cost Reduction[5]	6,623	1,960	8,583	613	161	774	50%	50%	7,583	14,151	7,333	13,901	6,583	13,151
17% Env/33% HVAC Energy Use Reduction[6]	6,623	1,960	8,583	613	161	774	50%	50%	7,583	14,151	7,333	13,901	6,583	13,151
									-	-	-	-	-	-
Baseline NG[1,4]	-	-	-	785	242	1,669	0%	0%	-	1,718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	3,817	1,160	4,977	528	206	1,375	31%	30%	3,977	6,695	3,727	6,445	2,977	5,695
10% Env/20% HVAC Energy Use Reduction[6]	3,817	1,160	4,977	389	207	1,237	31%	30%	3,977	6,695	3,727	6,445	2,977	5,695
50% HVAC Energy Cost Reduction[5]	2,455	3,450	5,905	656	147	1,445	53%	50%	4,905	7,623	4,655	7,373	3,905	6,623
17% Env/33% HVAC Energy Use Reduction[6]	2,455	3,450	5,905	656	147	1,445	53%	50%	4,905	7,623	4,655	7,373	3,905	6,623

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - New York, NY

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	70.6	61.6	21.5	38.8	28.5	61.6	7.3	68.9	0%	0%	2,484	296	2,780	0%	0%
1-1B	30% HVAC Energy Cost Reduction[5]	79.0	44.4	18.5	29.9	23.5	44.4	3.7	48.1	30%	30%	1,792	149	1,941	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	79.0	44.4	18.5	29.9	23.5	44.4	3.7	48.1	30%	30%	1,792	149	1,941	30%	30%
1-1D	50% HVAC Energy Cost Reduction[5]	83.3	31.1	16.7	22.1	17.3	31.1	3.4	34.5	50%	50%	1,256	135	1,391	50%	50%
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	84.3	31.1	16.7	22.1	17.3	31.1	3.4	34.5	50%	50%	1,256	135	1,391	50%	50%
1-2A	Baseline ASHP[1,3]	81.9	61.6	21.5	38.3	28.5	30.9	7.3	38.2	0%	45%	1,247	296	1,543	0%	44%
1-2B	30% HVAC Energy Cost Reduction[5]	86.8	47.1	19.0	30.7	23.8	21.4	5.4	26.8	30%	61%	865	218	1,083	30%	61%
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	86.8	47.1	19.0	30.7	23.8	21.4	5.4	26.8	30%	61%	865	218	1,083	30%	61%
1-2D	50% HVAC Energy Cost Reduction[5]	89.7	40.1	18.8	27.7	23.0	15.2	4.0	19.2	50%	72%	613	161	774	50%	72%
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	89.7	40.1	18.8	27.7	23.0	15.2	4.0	19.2	50%	72%	613	161	774	50%	72%
1-3A	Baseline NG[1,4]	84.8	59.3	22.1	37.1	28.7	75.4	7.5	82.9	0%	-20%	920	304	1,224	0%	56%
1-3B	30% HVAC Energy Cost Reduction[5]	87.3	40.8	19.2	27.7	23.5	51.9	5.5	57.4	31%	17%	636	220	856	30%	69%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	87.3	40.8	19.2	27.7	23.5	51.9	5.5	57.4	31%	17%	636	220	856	30%	69%
1-3D	50% HVAC Energy Cost Reduction[5]	90.3	30.6	17.2	21.8	17.3	35.1	4.2	39.3	53%	43%	442	169	611	50%	78%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	90.3	30.6	17.2	21.8	17.3	35.1	4.2	39.3	53%	43%	442	169	611	50%	78%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions

1-Story w/ Basement - New York, NY

Alt.	Description	Real Energy Consumption (MMBtu/yr)					Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[7]	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	155.3	17.4	37.5	47.6	257.8	34,278	162.4	73.6	20,649	2,311	4,984	6,335	97.8	10.9	23.6	30.0	44.4	5.0	10.7	13.6
1-1B	30% HVAC Energy Cost Reduction[5]	112.7	7.3	35.1	47.6	202.7	27,272	129.2	58.6	14,987	968	4,983	6,335	71.0	4.6	23.6	30.0	32.2	2.1	10.7	13.6
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	112.7	7.3	35.1	47.6	202.7	27,272	129.2	58.6	14,987	968	4,983	6,335	71.0	4.6	23.6	30.0	32.2	2.1	10.7	13.6
1-1D	50% HVAC Energy Cost Reduction[5]	84.6	6.5	37.5	47.6	176.2	23,430	111.0	50.3	11,249	862	4,984	6,335	53.3	4.1	23.6	30.0	31.1	3.0	10.7	13.6
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	84.6	6.5	37.5	47.6	176.2	23,430	111.0	50.3	11,249	862	4,984	6,335	53.3	4.1	23.6	30.0	31.1	3.0	10.7	13.6
1-2A	Baseline ASHP[1,3]	77.9	17.4	37.5	47.6	180.4	23,994	113.7	51.5	10,364	2,311	4,984	6,335	49.1	10.9	23.6	30.0	22.3	5.0	10.7	13.6
1-2B	30% HVAC Energy Cost Reduction[5]	54.4	10.6	37.5	47.6	150.1	19,961	94.6	42.9	7,233	1,412	4,982	6,335	34.3	6.7	23.6	30.0	15.5	3.0	10.7	13.6
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	54.4	10.6	37.5	47.6	150.1	19,961	94.6	42.9	7,233	1,412	4,982	6,335	34.3	6.7	23.6	30.0	15.5	3.0	10.7	13.6
1-2D	50% HVAC Energy Cost Reduction[5]	38.8	7.9	37.5	47.6	131.8	17,519	83.0	37.6	5,155	1,049	4,981	6,335	24.4	5.0	23.6	30.0	11.1	2.3	10.7	13.6
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	38.8	7.9	37.5	47.6	131.8	17,519	83.0	37.6	5,155	1,049	4,981	6,335	24.4	5.0	23.6	30.0	11.1	2.3	10.7	13.6
1-3A	Baseline NG[1,4]	90.3	17.9	27.2	47.6	183.0	21,634	44.1	35.4	9,953	2,374	2,972	6,335	2.9	11.2	-	30.0	13.0	5.1	3.7	13.6
1-3B	30% HVAC Energy Cost Reduction[5]	61.7	10.8	27.1	47.6	147.2	17,523	38.3	29.2	6,790	1,439	2,959	6,335	1.4	6.8	-	30.0	8.8	3.1	3.7	13.6
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	61.7	10.8	27.1	47.6	147.2	17,523	38.3	29.2	6,790	1,439	2,959	6,335	1.4	6.8	-	30.0	8.8	3.1	3.7	13.6
1-3D	50% HVAC Energy Cost Reduction[5]	45.1	8.2	27.2	47.6	128.1	15,372	36.9	26.2	4,985	1,086	2,966	6,335	1.8	5.1	-	30.0	6.6	2.3	3.7	13.6
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	45.1	8.2	27.2	47.6	128.1	15,372	36.9	26.2	4,985	1,086	2,966	6,335	1.8	5.1	-	30.0	6.6	2.3	3.7	13.6

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - New York, NY

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1000 Credit)		Premium (w/ $1250 Credit)		Premium (w/ $2000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	3,817	3,113	139,138	6,930	6,930	5,930	5,930	5,680	5,680	4,930	4,930
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	3,817	3,114	139,139	6,931	6,931	5,931	5,931	5,681	5,681	4,931	4,931
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	1,170	3,453	136,831	4,623	4,623	3,623	3,623	3,373	3,373	2,623	2,623
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	1,170	3,453	136,831	4,623	4,623	3,623	3,623	3,373	3,373	2,623	2,623
1-2A	Baseline ASHP[1,3]	0%	45%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	61%	138,777	3,817	969	143,563	4,786	11,355	3,786	10,355	3,536	10,105	2,786	9,355
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	61%	138,777	3,817	969	143,563	4,786	11,355	3,786	10,355	3,536	10,105	2,786	9,355
1-2D	50% HVAC Energy Cost Reduction[5]	50%	72%	138,777	6,623	1,960	147,359	8,583	15,151	7,583	14,151	7,333	13,901	6,583	13,151
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	50%	72%	138,777	6,623	1,960	147,359	8,583	15,151	7,583	14,151	7,333	13,901	6,583	13,151
1-3A	Baseline NG[1,4]	0%	-20%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	31%	17%	134,926	3,817	1,160	139,903	4,977	7,695	3,977	6,695	3,727	6,445	2,977	5,695
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	31%	17%	134,926	3,817	1,160	139,903	4,977	7,695	3,977	6,695	3,727	6,445	2,977	5,695
1-3D	50% HVAC Energy Cost Reduction[5]	53%	43%	134,926	2,455	3,450	140,831	5,905	8,623	4,905	7,623	4,655	7,373	3,905	6,623
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	53%	43%	134,926	2,455	3,450	140,831	5,905	8,623	4,905	7,623	4,655	7,373	3,905	6,623

Notes:

1 Economy class residence where materials and workmanship are sufficient to satisfy building codes. Wood siding on wood frame exterior walls, unfinished basement (RS Means 2003 Residential Cost Data).
2 Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3 Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4 Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5 Baseline building modified to achieve 20% energy reduction through envelope upgrades only - primarily improved envelope insulation and reduced infiltration.
6 Baseline building modified to achieve 30% energy reduction through envelope upgrades only - primarily improved envelope insulation and reduced infiltration.
7 Baseline building modified to achieve energy reduction through space heating and cooling upgrades only.
8 Baseline building modified to achieve energy reduction through space heating/cooling and service water heating upgrades only.
9 Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
10 Unable to meet 20% energy reduction targets.
11 Unable to meet 30% energy reduction targets.
12 Includes electric appliances and miscellaneous plug loads.
13 "Catagory" referes to the group of alternatives sharing a common space heating system.
14 "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - New York, NY

Alt.	Description	Ceiling Insul[7]		Ext. Wall Insul.[7]			Found. Insul.[7]				Floor Insul.[7]			Door Type[7]			Window Type[7]		Building Sealing[8]		Cost Premium	
		R38	R49	R15	R19	R30	R9	R19	R25	R30	R19	R25	R30	R2.80	R4.40	Storm	U0.36	0.45SHGF	0.50ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	-	Incl.	-	-	Incl.	-	-		Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	934	-	170	-	-	-	833		-	1,880	-	Incl.	-	-	Incl.	Incl.	Incl.	-	3,817	3,817
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	170	-	-	-	833		-	1,880	-	Incl.	-	-	Incl.	Incl.	Incl.	-	3,817	3,817
1-1D	50% HVAC Energy Cost Reduction[5]	Incl.	-	-	170	-	Incl.	-	-		Incl.	-	-	Incl.	-	-	Incl.	Incl.	-	1,000	1,170	1,170
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	-	-	170	-	Incl.	-	-		Incl.	-	-	Incl.	-	-	Incl.	Incl.	-	1,000	1,170	1,170
1-2A	Baseline ASHP[1,3]	Incl.	-	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	934	-	170	-	-	-	833	-	-	1,880	-	Incl.	-	-	Incl.	Incl.	Incl.	-	3,817	3,817
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	170	-	-	-	833	-	-	1,880	-	-	-	-	Incl.	Incl.	Incl.	-	3,817	3,817
1-2D	50% HVAC Energy Cost Reduction[5]	-	934	-	-	1,777	Incl.	-	-	1,093	-	-	2,469	-	250	100	Incl.	Incl.	Incl.	-	6,623	6,623
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	934	-	-	1,777	Incl.	-	-	1,093	-	-	2,469	-	250	100	Incl.	Incl.	Incl.	-	6,623	6,623
1-3A	Baseline NG[1,4]	Incl.	-	Incl.	-	-	Incl.	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	934	-	170	-	-	-	833		-	1,880	-	Incl.	-	-	Incl.	Incl.	Incl.	-	3,817	3,817
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	170	-	-	-	833		-	1,880	-	Incl.	-	-	Incl.	Incl.	Incl.	-	3,817	3,817
1-3D	50% HVAC Energy Cost Reduction[5]	-	934	Incl.	-	-	-	520	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	-	1,000	2,455	2,455
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	934	Incl.	-	-	-	520	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	-	1,000	2,455	2,455

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC

1-Story w/ Basement - New York, NY

Alt.	Description	Duct Sealing[7]			Elec Furn.[7]	NG Furnace[7]		Air-Source Heat Pump[7]			Electric A/C[7]				Prog Stat	Cost Premium	
		Tape	Mastic	Aerosol	100% Eff.	80AFUE	90AFUE	10SEER	12SEER	16SEER	10SEER	12SEER	14SEER	17SEER		Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-	-
1-1B	20% Electric Envelope Upgrade[5]	-	340	-	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1C	30% Electric Envelope Upgrade[6]	-	340	-	Incl.	-	-	-	-	-	-	-	-	2,673	101	3,114	3,114
1-1D	20% Electric HVAC Upgrade[7]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-1E	30% Electric HVAC Upgrade[7]	-	-	680	Incl.	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-	-	-	-	-
1-2B	20% ASHP Envelope Upgrade[5]	-	340	-	-	-	-	-	629	-	-	-	-	-	-	969	969
1-2C	30% ASHP Envelope Upgrade[6]	-	340	-	-	-	-	-	629	-	-	-	-	-	-	969	969
1-2D	20% ASHP HVAC Upgrade[7]	-	340	-	-	-	-	-	-	1,520	-	-	-	-	100	1,960	1,960
1-2E	30% ASHP HVAC Upgrade[7]	-	340	-	-	-	-	-	-	1,520	-	-	-	-	100	1,960	1,960
1-3A	Baseline NG[1,4]	Incl.	-	-	-	Incl.	-	-	-	-	Incl.	-	-	-	-	-	-
1-3B	20% NG Envelope Upgrade[5]	-	340	-	-	Incl.	-	-	-	-	-	720	-	-	100	1,160	1,160
1-3C	30% NG Envelope Upgrade[6]	-	340	-	-	Incl.	-	-	-	-	-	720	-	-	100	1,160	1,160
1-3D	20% NG HVAC Upgrade[7]	-	-	680	-	-	1,150	-	-	-	-	-	1,520	-	100	3,450	3,450
1-3E	30% NG HVAC Upgrade[7]	-	-	680	-	-	1,150	-	-	-	-	-	1,520	-	100	3,450	3,450

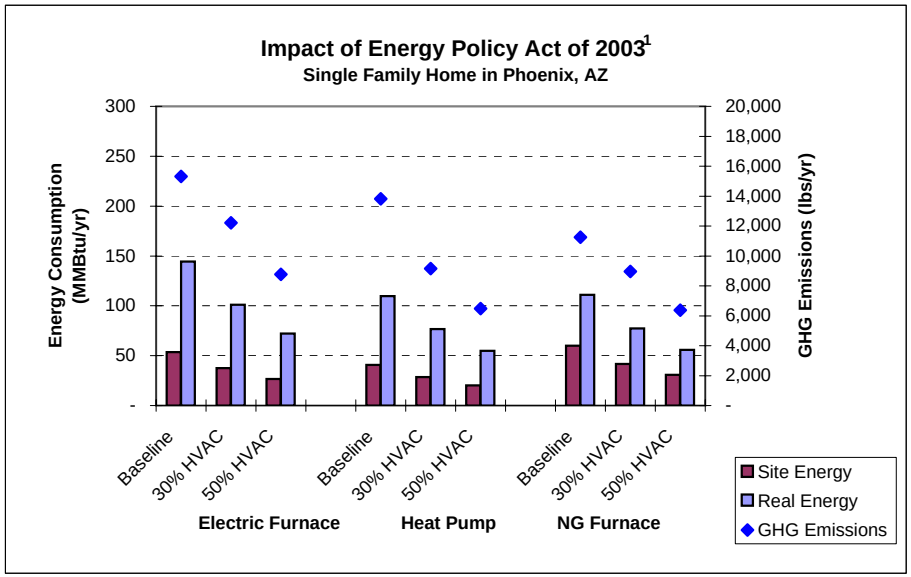
Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Phoenix, AZ

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	25.6	27.9	53.5	0%	69.1	75.3	144.5	0%	673	733	1,406	0%	15,235	46.8	39.9	15,321.6	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	18.6	18.8	37.4	30%	50.2	50.8	101.0	30%	488	494	982	30%	12,145	37.3	31.8	12,214.4	20%
50% HVAC Energy Cost Reduction[5]	50% HVAC	14.3	12.4	26.7	50%	38.6	33.5	72.1	50%	377	327	704	50%	8,711	26.8	22.8	8,760.4	43%
Baseline ASHP[1,3]	Baseline	12.8	27.9	40.7	0%	34.6	75.3	109.9	0%	338	733	1,071	0%	13,745	42.3	36.0	13,823.3	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	8.8	19.6	28.4	30%	23.8	52.9	76.7	30%	233	515	748	30%	9,113	28.1	23.9	9,165.4	34%
50% HVAC Energy Cost Reduction[5]	50% HVAC	6.0	14.3	20.3	50%	16.2	38.6	54.8	50%	157	376	533	50%	6,445	19.8	16.9	6,481.9	53%
Baseline NG[1,4]	Baseline	32.0	28.1	60.1	0%	35.2	75.9	111.1	0%	361	738	1,099	0%	11,193	24.3	24.8	11,242.2	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	22.2	19.6	41.8	30%	24.4	52.9	77.3	30%	252	517	769	30%	8,924	19.4	19.8	8,962.7	20%
50% HVAC Energy Cost Reduction[5]	50% HVAC	17.3	13.6	30.9	49%	19.0	36.7	55.8	50%	194	357	551	50%	6,350	13.3	13.8	6,377.2	43%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Phoenix, AZ

Description	Upgrade Cost			Annual Energy Cost ($/yr.)			Energy Use	Energy Cost	Premium (w/ $1000 Credit)		Premium (w/ $1250 Credit)		Premium (w/ $2000 Credit)	
	Env.	HVAC	Total	Heating	Cooling	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	-	-	-	673	733	1,406	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	1,696	2,871	4,567	488	494	982	30%	30%	3,567	3,567	3,317	3,317	2,567	2,567
10% Env/20% HVAC Energy Use Reduction[6]	1,696	2,871	4,567	488	494	982	30%	30%	3,567	3,567	3,317	3,317	2,567	2,567
50% HVAC Energy Cost Reduction[5]	5,798	4,004	9,802	377	327	704	50%	50%	8,802	8,802	8,552	8,552	7,802	7,802
17% Env/33% HVAC Energy Use Reduction[6]	5,798	4,004	9,802	377	327	704	50%	50%	8,802	8,802	8,552	8,552	7,802	7,802
Baseline ASHP[1,3]	-	-	-	338	733	1,071	0%	0%	-	5,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	1,220	1,389	2,609	233	515	748	30%	30%	1,609	8,177	1,359	7,927	609	7,177
10% Env/20% HVAC Energy Use Reduction[6]	1,220	1,389	2,609	233	515	748	30%	30%	1,609	8,177	1,359	7,927	609	7,177
50% HVAC Energy Cost Reduction[5]	4,022	2,973	6,994	157	376	533	50%	50%	5,994	12,563	5,744	12,313	4,994	11,563
17% Env/33% HVAC Energy Use Reduction[6]	4,022	2,973	6,994	157	376	533	50%	50%	5,994	12,563	5,744	12,313	4,994	11,563
Baseline NG[1,4]	-	-	-	361	738	1,099	0%	0%	-	1,718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	1,990	2,771	4,761	252	517	769	30%	30%	3,761	6,479	3,511	6,229	2,761	5,479
10% Env/20% HVAC Energy Use Reduction[6]	1,990	2,771	4,761	252	517	769	30%	30%	3,761	6,479	3,511	6,229	2,761	5,479
50% HVAC Energy Cost Reduction[5]	4,863	4,004	8,867	194	357	551	49%	50%	7,867	10,585	7,617	10,335	6,867	9,585
17% Env/33% HVAC Energy Use Reduction[6]	4,863	4,004	8,867	194	357	551	49%	50%	7,867	10,585	7,617	10,335	6,867	9,585

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - Phoenix, AZ

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	80.8	25.6	81.6	33.8	44.2	25.6	27.9	53.5	0%	0%	673	733	1,406	0%	0%
1-1B	30% HVAC Energy Cost Reduction[5]	84.4	18.6	66.1	26.4	35.1	18.6	18.8	37.4	30%	30%	488	494	982	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	84.4	18.6	66.1	26.4	35.1	18.6	18.8	37.4	30%	30%	488	494	982	30%	30%
1-1D	50% HVAC Energy Cost Reduction[5]	88.4	14.3	61.9	22.7	31.4	14.3	12.4	26.7	50%	50%	377	327	704	50%	50%
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	88.4	14.3	61.9	22.7	31.4	14.3	12.4	26.7	50%	50%	377	327	704	50%	50%
1-2A	Baseline ASHP[1,3]	84.3	25.6	81.6	33.8	44.2	12.8	27.9	40.7	0%	24%	338	733	1,071	0%	24%
1-2B	30% HVAC Energy Cost Reduction[5]	87.0	19.4	68.9	27.2	36.2	8.8	19.6	28.4	30%	47%	233	515	748	30%	47%
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	87.0	19.4	68.9	27.2	36.2	8.8	19.6	28.4	30%	47%	233	515	748	30%	47%
1-2D	50% HVAC Energy Cost Reduction[5]	90.2	14.8	62.9	23.3	32.3	6.0	14.3	20.3	50%	62%	157	376	533	50%	62%
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	90.2	14.8	62.9	23.3	32.3	6.0	14.3	20.3	50%	62%	157	376	533	50%	62%
1-3A	Baseline NG[1,4]	84.4	24.3	82.3	32.5	44.3	32.0	28.1	60.1	0%	-12%	361	738	1,099	0%	22%
1-3B	30% HVAC Energy Cost Reduction[5]	87.2	16.9	69.1	24.9	35.5	22.2	19.6	41.8	30%	22%	252	517	769	30%	45%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	87.2	16.9	69.1	24.9	35.5	22.2	19.6	41.8	30%	22%	252	517	769	30%	45%
1-3D	50% HVAC Energy Cost Reduction[5]	90.4	13.5	63.7	22.2	32.3	17.3	13.6	30.9	49%	42%	194	357	551	50%	61%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	90.4	13.5	63.7	22.2	32.3	17.3	13.6	30.9	49%	42%	194	357	551	50%	61%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions

1-Story w/ Basement - Phoenix, AZ

Alt.	Description	Real Energy Consumption (MMBtu/yr)					Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[7]	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	60.4	60.5	33.7	53.3	207.9	26,196	80.6	68.6	7,614	7,621	4,242	6,719	23.4	23.4	13.0	20.7	19.9	20.0	11.1	17.6
1-1B	30% HVAC Energy Cost Reduction[5]	50.1	46.3	33.7	53.3	183.4	23,105	71.1	60.5	6,310	5,836	4,240	6,719	19.4	17.9	13.0	20.7	16.5	15.3	11.1	17.6
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	50.1	46.3	33.7	53.3	183.4	23,105	71.1	60.5	6,310	5,836	4,240	6,719	19.4	17.9	13.0	20.7	16.5	15.3	11.1	17.6
1-1D	50% HVAC Energy Cost Reduction[5]	38.7	30.4	33.7	53.3	156.1	19,670	60.5	51.5	4,876	3,834	4,240	6,719	15.0	11.8	13.0	20.7	12.8	10.0	11.1	17.6
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	38.7	30.4	33.7	53.3	156.1	19,670	60.5	51.5	4,876	3,834	4,240	6,719	15.0	11.8	13.0	20.7	12.8	10.0	11.1	17.6
1-2A	Baseline ASHP[1,3]	34.4	74.7	33.7	53.3	196.1	24,707	76.0	64.7	4,330	9,415	4,242	6,719	13.3	29.0	13.0	20.7	11.3	24.7	11.1	17.6
1-2B	30% HVAC Energy Cost Reduction[5]	23.9	48.4	33.7	53.3	159.3	20,072	61.7	52.6	3,010	6,103	4,240	6,719	9.3	18.8	13.0	20.7	7.9	16.0	11.1	17.6
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	23.9	48.4	33.7	53.3	159.3	20,072	61.7	52.6	3,010	6,103	4,240	6,719	9.3	18.8	13.0	20.7	7.9	16.0	11.1	17.6
1-2D	50% HVAC Energy Cost Reduction[5]	16.1	35.1	33.7	53.3	138.2	17,404	53.5	45.6	2,025	4,420	4,240	6,719	6.2	13.6	13.0	20.7	5.3	11.6	11.1	17.6
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	16.1	35.1	33.7	53.3	138.2	17,404	53.5	45.6	2,025	4,420	4,240	6,719	6.2	13.6	13.0	20.7	5.3	11.6	11.1	17.6
1-3A	Baseline NG[1,4]	31.9	61.0	22.1	53.3	168.3	20,326	45.0	45.4	3,509	7,684	2,414	6,719	0.7	23.6	-	20.7	4.7	20.1	3.0	17.6
1-3B	30% HVAC Energy Cost Reduction[5]	25.4	48.6	22.0	53.3	149.3	18,042	40.2	40.4	2,800	6,124	2,399	6,719	0.6	18.8	-	20.7	3.8	16.0	3.0	17.6
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	25.4	48.6	22.0	53.3	149.3	18,042	40.2	40.4	2,800	6,124	2,399	6,719	0.6	18.8	-	20.7	3.8	16.0	3.0	17.6
1-3D	50% HVAC Energy Cost Reduction[5]	19.5	33.4	22.0	53.3	128.2	15,466	34.0	34.4	2,146	4,204	2,397	6,719	0.4	12.9	-	20.7	2.8	11.0	3.0	17.6
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	19.5	33.4	22.0	53.3	128.2	15,466	34.0	34.4	2,146	4,204	2,397	6,719	0.4	12.9	-	20.7	2.8	11.0	3.0	17.6

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Phoenix, AZ

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1000 Credit)		Premium (w/ $1250 Credit)		Premium (w/ $2000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	1,696	2,871	136,775	4,567	4,567	3,567	3,567	3,317	3,317	2,567	2,567
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	1,696	2,871	136,775	4,567	4,567	3,567	3,567	3,317	3,317	2,567	2,567
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	5,798	4,004	142,010	9,802	9,802	8,802	8,802	8,552	8,552	7,802	7,802
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	5,798	4,004	142,010	9,802	9,802	8,802	8,802	8,552	8,552	7,802	7,802
1-2A	Baseline ASHP[1,3]	0%	24%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	47%	138,777	1,220	1,389	141,385	2,609	9,177	1,609	8,177	1,359	7,927	609	7,177
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	47%	138,777	1,220	1,389	141,385	2,609	9,177	1,609	8,177	1,359	7,927	609	7,177
1-2D	50% HVAC Energy Cost Reduction[5]	50%	62%	138,777	4,022	2,973	145,771	6,994	13,563	5,994	12,563	5,744	12,313	4,994	11,563
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	50%	62%	138,777	4,022	2,973	145,771	6,994	13,563	5,994	12,563	5,744	12,313	4,994	11,563
1-3A	Baseline NG[1,4]	0%	-12%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	30%	22%	134,926	1,990	2,771	139,687	4,761	7,479	3,761	6,479	3,511	6,229	2,761	5,479
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	30%	22%	134,926	1,990	2,771	139,687	4,761	7,479	3,761	6,479	3,511	6,229	2,761	5,479
1-3D	50% HVAC Energy Cost Reduction[5]	49%	42%	134,926	4,863	4,004	143,793	8,867	11,585	7,867	10,585	7,617	10,335	6,867	9,585
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	49%	42%	134,926	4,863	4,004	143,793	8,867	11,585	7,867	10,585	7,617	10,335	6,867	9,585

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - Phoenix, AZ

Alt.	Description	Ceiling Insul.[7]				Ext. Wall Insul.[7]				Found. Insul.[7]					Floor Insul.[7]			Door Type[7]			Window Type[7]		Building Sealing[8]		Cost Premium	
		R26	R30	R38	R49	R13	R15	R19	R25	R0	R9	R11	R19	R25	R11	R19	R30	R2.8	R4.4	Storm	U0.7	0.4SHGF	0.5ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	-	-	-	Incl.	-	-	-	Incl.	-	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	-	1,019	-	-	108	-	-	-	468	-	-	-	Incl.	-	-	Incl.	-	100	Incl.	Incl.	Incl.	-	1,696	1,696
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	-	1,019	-	-	108	-	-	-	468	-	-	-	Incl.	-	-	Incl.	-	100	Incl.	Incl.	Incl.	-	1,696	1,696
1-1D	50% HVAC Energy Cost Reduction[5]	-	-	-	1,954	-	-	278	-	-	-	-	-	1,301	-	-	2,265	Incl.	-	-	Incl.	Incl.	Incl.	-	5,798	5,798
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	-	1,954	-	-	278	-	-	-	-	-	1,301	-	-	2,265	Incl.	-	-	Incl.	Incl.	Incl.	-	5,798	5,798
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	Incl.	-	-	-	Incl.	-	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	108	-	-	-	-	572	-	-	Incl.	-	-	-	100	100	Incl.	Incl.	Incl.	-	1,220	1,220
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	108	-	-	-	-	572	-	-	Incl.	-	-	-	100	100	Incl.	Incl.	Incl.	-	1,220	1,220
1-2D	50% HVAC Energy Cost Reduction[5]	-	-	1,019	-	-	-	-	1,560	-	-	-	989	-	-	453	-	Incl.	-	-	Incl.	Incl.	Incl.	-	4,022	4,022
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	1,019	-	-	-	-	1,560	-	-	-	989	-	-	453	-	Incl.	-	-	Incl.	Incl.	Incl.	-	4,022	4,022
1-3A	Baseline NG[1,4]	Incl.	-	-	-	Incl.	-	-	-	Incl.	-	-	-	-	Incl.	-	-	Incl.	-	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	108	-	-	-	-	-	989	-	-	453	-	Incl.	-	100	Incl.	Incl.	Incl.	-	1,990	1,990
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	108	-	-	-	-	-	989	-	-	453	-	Incl.	-	100	Incl.	Incl.	Incl.	-	1,990	1,990
1-3D	50% HVAC Energy Cost Reduction[5]	-	-	1,019	-	-	-	278	-	-	-	-	-	1,301	-	-	2,265	Incl.	-	-	Incl.	Incl.	Incl.	-	4,863	4,863
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	1,019	-	-	-	278	-	-	-	-	-	1,301	-	-	2,265	Incl.	-	-	Incl.	Incl.	Incl.	-	4,863	4,863

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC
1-Story w/ Basement - Phoenix, AZ

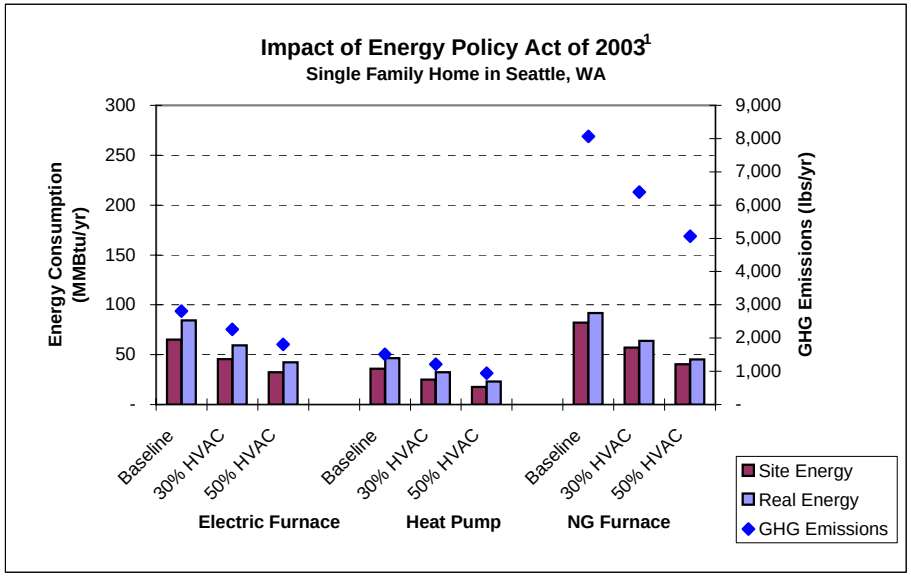
Alt.	Description	Duct Sealing[7]		Elec Furn.[7]	NG Furnace[7]		Air-Source Heat Pump[7]			Electric A/C[7]			Prog Stat	Cost Premium	
		Tape	Mastic	100% Eff.	78AFUE	80AFUE	10SEER	12SEER	15SEER	10SEER	12SEER	17SEER		Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	340	Incl.	-	-	-	-	-	-	2,431	-	100	2,871	2,871
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	Incl.	-	-	-	-	-	-	2,431	-	100	2,871	2,871
1-1D	50% HVAC Energy Cost Reduction[5]	-	340	Incl.	-	-	-	-	-	-	-	3,564	100	4,004	4,004
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	Incl.	-	-	-	-	-	-	-	3,564	100	4,004	4,004
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	Incl.	-	-	-	-	-	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	1,049	-	-	-	-	-	1,389	1,389
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	1,049	-	-	-	-	-	1,389	1,389
1-2D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	2,533	-	-	-	100	2,973	2,973
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	2,533	-	-	-	100	2,973	2,973
1-3A	Baseline NG[1,4]	Incl.	-	-	Incl.	-	-	-	-	Incl.	-	-	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	2,431	-	-	2,771	2,771
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	2,431	-	-	2,771	2,771
1-3D	50% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	-	3,564	100	4,004	4,004
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	-	3,564	100	4,004	4,004

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Seattle, WA

Description	Chart Label	Site HVAC Energy Use (MMBtu/yr)				Real HVAC Energy Use (MMBtu/yr)				Annual HVAC Energy Cost ($/yr.)				Total Emissions (lbs/yr)				
		Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	Heating	Cooling	Total	Reduction	CO2	SO2	NOx	Total	Reduction
Baseline Electric[1,2]	Baseline	58.7	6.3	65.0	0%	76.3	8.2	84.5	0%	1,115	119	1,234	0%	2,780	19.4	6.8	2,806.6	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	42.1	3.5	45.6	30%	54.7	4.6	59.3	30%	800	66	866	30%	2,242	15.6	5.5	2,262.8	19%
50% HVAC Energy Cost Reduction[6]	50% HVAC	29.5	3.0	32.5	50%	38.4	3.9	42.3	50%	560	58	618	50%	1,797	12.5	4.4	1,814.1	35%
Baseline ASHP[1,3]	Baseline	29.5	6.3	35.8	0%	38.4	8.2	46.5	0%	560	119	679	0%	1,501	10.5	3.7	1,515.5	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	20.3	4.7	25.0	30%	26.4	6.1	32.5	30%	385	89	474	30%	1,197	8.4	2.9	1,208.1	20%
50% HVAC Energy Cost Reduction[6]	50% HVAC	13.9	3.8	17.7	51%	18.1	4.9	23.0	51%	264	73	337	50%	935	6.5	2.3	943.3	38%
Baseline NG[1,4]	Baseline	75.8	6.4	82.2	0%	83.4	8.3	91.7	0%	770	122	892	0%	8,051	2.2	10.4	8,063.9	0%
30% HVAC Energy Cost Reduction[5]	30% HVAC	52.6	4.6	57.2	30%	57.9	6.0	63.8	30%	536	88	624	30%	6,378	1.9	8.2	6,388.4	21%
50% HVAC Energy Cost Reduction[6]	50% HVAC	36.6	3.8	40.4	51%	40.3	4.9	45.2	51%	373	72	445	50%	5,053	1.5	6.5	5,060.5	37%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction through a combination of envelope upgrades (10% min.) and space heating and cooling upgrades.
6. Baseline building modified to achieve a 50% annual heating and cooing energy cost reduction through a combination of envelope upgrades (17% min.) and space heating and cooling upgrades.



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

REM/Rate Results - Energy Cost Summary
1-Story w/ Basement - Seattle, WA

Description	Upgrade Cost			Annual Energy Cost ($/yr.)			Energy Use	Energy Cost	Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
	Env.	HVAC	Total	Heating	Cooling	Total	Reduction	Reduction	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
Baseline Electric[1,2]	-	-	-	1,115	119	1,234	0%	0%	-	-	-	-	-	-
30% HVAC Energy Cost Reduction[5]	5,296	3,113	8,409	800	66	866	30%	30%	7,409	7,409	7,159	7,159	6,409	6,409
10% Env/20% HVAC Energy Use Reduction[6]	5,296	3,113	8,409	800	66	866	30%	30%	7,409	7,409	7,159	7,159	6,409	6,409
50% HVAC Energy Cost Reduction[5]	1,316	3,453	4,769	560	58	618	50%	50%	3,769	3,769	3,519	3,519	2,769	2,769
17% Env/33% HVAC Energy Use Reduction[6]	1,316	3,453	4,769	560	58	618	50%	50%	3,769	3,769	3,519	3,519	2,769	2,769
Baseline ASHP[1,3]	-	-	-	560	119	679	0%	0%	-	5,569	-	5,319	-	4,569
30% HVAC Energy Cost Reduction[5]	5,296	969	6,265	385	89	474	30%	30%	5,265	11,833	5,015	11,583	4,265	10,833
10% Env/20% HVAC Energy Use Reduction[6]	5,296	969	6,265	385	89	474	30%	30%	5,265	11,833	5,015	11,583	4,265	10,833
50% HVAC Energy Cost Reduction[5]	1,520	1,960	3,480	264	73	337	51%	50%	2,480	9,049	2,230	8,799	1,480	8,049
17% Env/33% HVAC Energy Use Reduction[6]	1,520	1,960	3,480	264	73	337	51%	50%	2,480	9,049	2,230	8,799	1,480	8,049
Baseline NG[1,4]	-	-	-	770	122	892	0%	0%	-	1,718	-	1,468	-	718
30% HVAC Energy Cost Reduction[5]	1,035	2,310	3,345	536	88	624	30%	30%	2,345	5,063	2,095	4,813	1,345	4,063
10% Env/20% HVAC Energy Use Reduction[6]	1,036	2,310	3,346	536	88	624	30%	30%	2,346	5,064	2,096	4,814	1,346	4,064
50% HVAC Energy Cost Reduction[5]	1,520	3,200	4,720	373	72	445	51%	50%	3,720	6,438	3,470	6,188	2,720	5,438
17% Env/33% HVAC Energy Use Reduction[6]	1,520	3,200	4,720	373	72	445	51%	50%	3,720	6,438	3,470	6,188	2,720	5,438

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Quick Analysis Summary
1-Story w/ Basement - Seattle, WA

Alt.	Description	HERS	Annual Load (MMBtu/yr)		Design Load (kBtu/hr)		Annual Consumption (MMBtu/yr)			Energy Reduction		Annual Energy Cost ($/yr.)			Cost Reduction	
		Rating	Heating	Cooling	Heating	Cooling	Heating	Cooling	Total	Catagory[7]	Overall[8]	Heating	Cooling	Total	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	73.4	58.7	18.4	30.3	24.9	58.7	6.3	65.0	0%	0%	1,115	119	1,234	0%	0%
1-1B	30% HVAC Energy Cost Reduction[b]	78.0	42.1	16.2	23.2	20.9	42.1	3.5	45.6	30%	30%	800	66	866	30%	30%
1-1C	10% Env/20% HVAC Energy Use Reduction[b]	78.0	42.1	16.2	23.2	20.9	42.1	3.5	45.6	30%	30%	800	66	866	30%	30%
1-1D	50% HVAC Energy Cost Reduction[b]	81.7	29.5	15.1	17.0	17.5	29.5	3.0	32.5	50%	50%	560	58	618	50%	50%
1-1E	17% Env/33% HVAC Energy Use Reduction[b]	81.7	29.5	15.1	17.0	17.5	29.5	3.0	32.5	50%	50%	560	58	618	50%	50%
1-2A	Baseline ASHP[1,3]	83.6	58.7	18.4	30.3	24.9	29.5	6.3	35.8	0%	45%	560	119	679	0%	45%
1-2B	30% HVAC Energy Cost Reduction[b]	86.2	44.6	16.5	23.8	21.1	20.3	4.7	25.0	30%	62%	385	89	474	30%	62%
1-2C	10% Env/20% HVAC Energy Use Reduction[b]	86.2	44.6	16.5	23.8	21.1	20.3	4.7	25.0	30%	62%	385	89	474	30%	62%
1-2D	50% HVAC Energy Cost Reduction[b]	88.4	36.7	18.0	20.9	21.0	13.9	3.8	17.7	51%	73%	264	73	337	50%	73%
1-2E	17% Env/33% HVAC Energy Use Reduction[b]	88.4	36.7	18.0	20.9	21.0	13.9	3.8	17.7	51%	73%	264	73	337	50%	73%
1-3A	Baseline NG[1,4]	83.7	57.5	18.8	30.1	25.1	75.8	6.4	82.2	0%	-26%	770	122	892	0%	28%
1-3B	30% HVAC Energy Cost Reduction[5]	87.0	45.9	16.2	25.0	21.4	52.6	4.6	57.2	30%	12%	536	88	624	30%	49%
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	87.0	45.9	16.2	25.0	21.4	52.6	4.6	57.2	30%	12%	536	88	624	30%	49%
1-3D	50% HVAC Energy Cost Reduction[5]	88.8	30.1	15.5	17.4	17.9	36.6	3.8	40.4	51%	38%	373	72	445	50%	64%
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	88.8	30.1	15.5	17.4	17.9	36.6	3.8	40.4	51%	38%	373	72	445	50%	64%

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

REM/Rate Results - Real Energy & Emissions
1-Story w/ Basement - Seattle, WA

Alt.	Description	Real Energy Consumption (MMBtu/yr)						Total Emissions (lbs/yr)			CO2 Emissions by End-Use (lbs/yr)				SO2 Emissions by End-Use (lbs/yr)				NOx Emissions by End-Use (lbs/yr)			
		Heating	Cooling	SWH	Lights[7]	PV	Total	CO2	SO2	NOx	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]	Heating	Cooling	SWH	Lights[7]
1-1A	Baseline Electric[1,2]	66.8	5.5	21.1	26.0	-	119.4	4,592	32.0	11.3	2,568	212	811	1,001	17.9	1.5	5.7	7.0	6.3	0.5	2.0	2.5
1-1B	30% HVAC Energy Cost Reduction[5]	54.8	3.5	21.1	26.0	-	105.4	4,053	28.3	10.0	2,107	135	811	1,001	14.7	0.9	5.7	7.0	5.2	0.3	2.0	2.5
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	54.8	3.5	21.1	26.0	-	105.4	4,053	28.3	10.0	2,107	135	811	1,001	14.7	0.9	5.7	7.0	5.2	0.3	2.0	2.5
1-1D	50% HVAC Energy Cost Reduction[5]	43.8	3.0	21.1	26.0	-	93.9	3,609	25.2	8.9	1,684	114	811	1,001	11.7	0.8	5.7	7.0	4.1	0.3	2.0	2.5
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	43.8	3.0	21.1	26.0	-	93.9	3,609	25.2	8.9	1,684	114	811	1,001	11.7	0.8	5.7	7.0	4.1	0.3	2.0	2.5
1-2A	Baseline ASHP[1,3]	33.5	5.5	21.1	26.0	-	86.1	3,313	23.1	8.2	1,289	212	811	1,001	9.0	1.5	5.7	7.0	3.2	0.5	2.0	2.5
1-2B	30% HVAC Energy Cost Reduction[5]	26.4	4.7	21.1	26.0	-	78.2	3,008	21.0	7.4	1,014	183	810	1,001	7.1	1.3	5.6	7.0	2.5	0.4	2.0	2.5
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	26.4	4.7	21.1	26.0	-	78.2	3,008	21.0	7.4	1,014	183	810	1,001	7.1	1.3	5.6	7.0	2.5	0.4	2.0	2.5
1-2D	50% HVAC Energy Cost Reduction[5]	20.6	3.7	21.1	26.0	-	71.4	2,745	19.1	6.8	791	143	810	1,001	5.5	1.0	5.6	7.0	1.9	0.4	2.0	2.5
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	20.6	3.7	21.1	26.0	-	71.4	2,745	19.1	6.8	791	143	810	1,001	5.5	1.0	5.6	7.0	1.9	0.4	2.0	2.5
1-3A	Baseline NG[1,4]	73.3	5.7	28.3	26.0	-	133.3	12,143	9.2	16.8	7,833	218	3,091	1,001	0.7	1.5	-	7.0	9.9	0.5	3.9	2.5
1-3B	30% HVAC Energy Cost Reduction[5]	58.2	4.7	28.4	26.0	-	117.3	10,472	8.8	14.6	6,199	180	3,093	1,001	0.6	1.3	-	7.0	7.8	0.4	3.9	2.5
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	58.2	4.7	28.4	26.0	-	117.3	10,472	8.8	14.6	6,199	180	3,093	1,001	0.6	1.3	-	7.0	7.8	0.4	3.9	2.5
1-3D	50% HVAC Energy Cost Reduction[5]	46.1	3.7	28.2	26.0	-	104.0	9,132	8.4	12.9	4,911	142	3,079	1,001	0.5	1.0	-	7.0	6.2	0.3	3.8	2.5
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	46.1	3.7	28.2	26.0	-	104.0	9,132	8.4	12.9	4,911	142	3,079	1,001	0.5	1.0	-	7.0	6.2	0.3	3.8	2.5

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. Includes electric appliances and miscellaneous plug loads.

REM/Rate Results - First Cost Summary
1-Story w/ Basement - Seattle, WA

Alt.	Description	Energy Reduction		Base Cost	Upgrade Cost		Adj. Cost	Premium (w/o Credit)		Premium (w/ $1,000 Credit)		Premium (w/ $1,250 Credit)		Premium (w/ $2,000 Credit)	
		Catagory[7]	Overall[8]	($)	Env.	HVAC	($)	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]	Catagory[7]	Overall[8]
1-1A	Baseline Electric[1,2]	0%	0%	132,208	-	-	132,208	-	-	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	30%	30%	132,208	5,296	3,113	140,617	8,409	8,409	7,409	7,409	7,159	7,159	6,409	6,409
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	30%	30%	132,208	5,296	3,113	140,617	8,409	8,409	7,409	7,409	7,159	7,159	6,409	6,409
1-1D	50% HVAC Energy Cost Reduction[5]	50%	50%	132,208	1,316	3,453	136,977	4,769	4,769	3,769	3,769	3,519	3,519	2,769	2,769
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	50%	50%	132,208	1,316	3,453	136,977	4,769	4,769	3,769	3,769	3,519	3,519	2,769	2,769
1-2A	Baseline ASHP[1,3]	0%	45%	138,777	-	-	138,777	-	6,569	-	5,569	-	5,319	-	4,569
1-2B	30% HVAC Energy Cost Reduction[5]	30%	62%	138,777	5,296	969	145,041	6,265	12,833	5,265	11,833	5,015	11,583	4,265	10,833
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	30%	62%	138,777	5,296	969	145,041	6,265	12,833	5,265	11,833	5,015	11,583	4,265	10,833
1-2D	50% HVAC Energy Cost Reduction[5]	51%	73%	138,777	1,520	1,960	142,257	3,480	10,049	2,480	9,049	2,230	8,799	1,480	8,049
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	51%	73%	138,777	1,520	1,960	142,257	3,480	10,049	2,480	9,049	2,230	8,799	1,480	8,049
1-3A	Baseline NG[1,4]	0%	-26%	134,926	-	-	134,926	-	2,718	-	1,718	-	1,468	-	718
1-3B	30% HVAC Energy Cost Reduction[5]	30%	12%	134,926	1,035	2,310	138,271	3,345	6,063	2,345	5,063	2,095	4,813	1,345	4,063
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	30%	12%	134,926	1,036	2,310	138,272	3,346	6,064	2,346	5,064	2,096	4,814	1,346	4,064
1-3D	50% HVAC Energy Cost Reduction[5]	51%	38%	134,926	1,520	3,200	139,646	4,720	7,438	3,720	6,438	3,470	6,188	2,720	5,438
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	51%	38%	134,926	1,520	3,200	139,646	4,720	7,438	3,720	6,438	3,470	6,188	2,720	5,438

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. "Catagory" referes to the group of alternatives sharing a common space heating system.
8. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - Envelope
1-Story w/ Basement - Seattle, WA

Alt.	Description	Ceiling Insul[7]		Ext. Wall Insul.[7]			Found. Insul.[7]			Floor Insul.[7]		Door Type[7]		Window Type[7]		Building Sealing[8]		Cost Premium	
		R38	R49	R16	R19	R22	R9	R19	R25	R19	R30	R2.8	Storm	U0.37	0.73SHGF	0.5ACH	6ACH50	Catagory[9]	Overall[10]
1-1A	Baseline Electric[1,2]	Incl.	-	Incl.	-	-	Incl.	-	-	Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	934	-	-	1,128	-	-	833	-	2,401	Incl.	-	Incl.	Incl.	Incl.	-	5,296	5,296
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	-	1,128	-	-	833	-	2,401	Incl.	-	Incl.	Incl.	Incl.	-	5,296	5,296
1-1D	50% HVAC Energy Cost Reduction[5]	Incl.	-	-	216	-	Incl.	-		Incl.	-	Incl.	100	Incl.	Incl.	-	1,000	1,316	1,316
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	-	-	216	-	Incl.	-		Incl.	-	Incl.	100	Incl.	Incl.	-	1,000	1,316	1,316
1-2A	Baseline ASHP[1,3]	Incl.	-	Incl.	-		Incl.	-		Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	934	-	-	1,128	-	-	833	-	2,401	Incl.	-	Incl.	Incl.	Incl.	-	5,296	5,296
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	-	-	1,128	-	-	833	-	2,401	Incl.	-	Incl.	Incl.	Incl.	-	5,296	5,296
1-2D	50% HVAC Energy Cost Reduction[5]	Incl.	-	Incl.	-	-	-	520	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,520	1,520
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	-	Incl.	-	-	-	520	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,520	1,520
1-3A	Baseline NG[1,4]	Incl.	-	Incl.	-		Incl.	-		Incl.	-	Incl.	-	Incl.	Incl.	Incl.	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	934	Incl.	-		Incl.	1.00		Incl.	-	Incl.	100	Incl.	Incl.	Incl.	-	1,035	1,035
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	934	Incl.	-		Incl.	2.00		Incl.	-	Incl.	100	Incl.	Incl.	Incl.	-	1,036	1,036
1-3D	50% HVAC Energy Cost Reduction[5]	Incl.	-	Incl.	-		-	520	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,520	1,520
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	Incl.	-	Incl.	-		-	520	-	Incl.	-	Incl.	-	Incl.	Incl.	-	1,000	1,520	1,520

Notes:
1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each envelope element, the first column represents the minimum insulation level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. Baseline building infiltration is assumed to be 0.50 air changes per hour, the maximum level allowed by the 2000 IECC. Tighter building levels are achieved primarily with better construction techniques which may or may not carry a cost premium.
9. "Catagory" referes to the group of alternatives sharing a common space heating system.
10. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

First Cost Summary - HVAC
1-Story w/ Basement - Seattle, WA

Alt.	Description	Duct Sealing[7]			Elec Furn.[7]	NG Furnace[7]			Air-Source Heat Pump[7]			Electric A/C[7]				Prog Stat	Cost Premium	
		Tape	Mastic	Aerosol	100% Eff.	78AFUE	85AFUE	90AFUE	10SEER	12SEER	16SEER	10SEER	12SEER	14SEER	16SEER		Catagory[8]	Overall[9]
1-1A	Baseline Electric[1,2]	Incl.	-	-	Incl.	-	-	-	-	-	-	Incl.	-	-	-	-	-	-
1-1B	30% HVAC Energy Cost Reduction[5]	-	340	-	Incl.	-	-	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	Incl.	-	-	-	-	-	-	-	-	-	2,673	100	3,113	3,113
1-1D	50% HVAC Energy Cost Reduction[5]	-	-	680	Incl.	-	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-1E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	Incl.	-	-	-	-	-	-	-	-	-	2,673	100	3,453	3,453
1-2A	Baseline ASHP[1,3]	Incl.	-	-	-	-	-	-	Incl.	-	-	-	-	-	-	-	-	-
1-2B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	-	629	-	-	-	-	-	-	969	969
1-2C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	-	629	-	-	-	-	-	-	969	969
1-2D	50% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	-	-	-	1,520	-	-	-	-	100	1,960	1,960
1-2E	17% Env/33% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	-	-	-	1,520	-	-	-	-	100	1,960	1,960
1-3A	Baseline NG[1,4]	Incl.	-	-	-	Incl.	-	-	-	-	-	Incl.	-	-	-	-	-	-
1-3B	30% HVAC Energy Cost Reduction[5]	-	340	-	-	-	-	1,150	-	-	-	-	720	-	-	100	2,310	2,310
1-3C	10% Env/20% HVAC Energy Use Reduction[6]	-	340	-	-	-	-	1,150	-	-	-	-	720	-	-	100	2,310	2,310
1-3D	50% HVAC Energy Cost Reduction[5]	-	-	680	-	-	900	-	-	-	-	-	-	1,520	-	100	3,200	3,200
1-3E	17% Env/33% HVAC Energy Use Reduction[6]	-	-	680	-	-	900	-	-	-	-	-	-	1,520	-	100	3,200	3,200

Notes:

1. Economy class residence where materials and workmanship are sufficient to satisfy building codes.
2. Electric resistance space heating (100% Eff.), electric split system air conditioning (10SEER), and electric resistance service water heating (0.92EF).
3. Electric air-source heat pump space heating (6.8HSPF) and cooling (10SEER), and electric resistance service water heating (0.92EF).
4. Natural gas furnace space heating (78AFUE), electric split system air conditioning (10SEER), and natural gas service water heating (0.59EF).
5. Baseline building modified to achieve a 30% annual heating and cooing energy cost reduction.
6. Baseline building modified to achieve energy reduction through envelope upgrades (10% min.) and space heating and cooling upgrades.
7. For each system listed, the first column represents the minimum equipment efficiency level required by the 2000 IECC. Additional columns indicate the cost premium for various upgrades.
8. "Catagory" referes to the group of alternatives sharing a common space heating system.
9. "Overall" refers to the group of all alternatives with electric resistance space heating as the baseline.

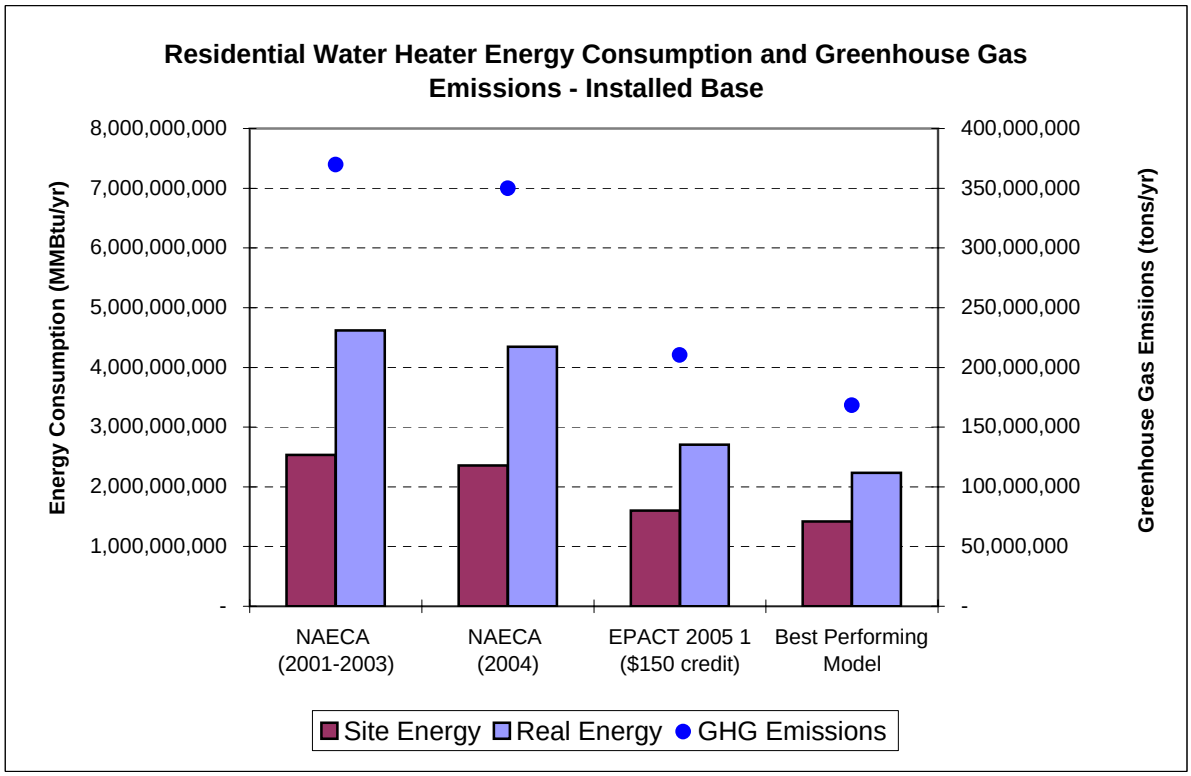
Appendix D

Residential Appliance Energy Consumption and Greenhouse Gas Emissions

Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	2,532,896,953	4,616,461,114	369,812,614
NAECA (2004)	2,360,041,922	4,346,510,235	349,840,089
EPACT 2005 [1] ($150 credit)	1,600,711,314	2,707,938,308	210,446,418
Best Performing Model	1,421,187,705	2,237,099,937	168,381,377

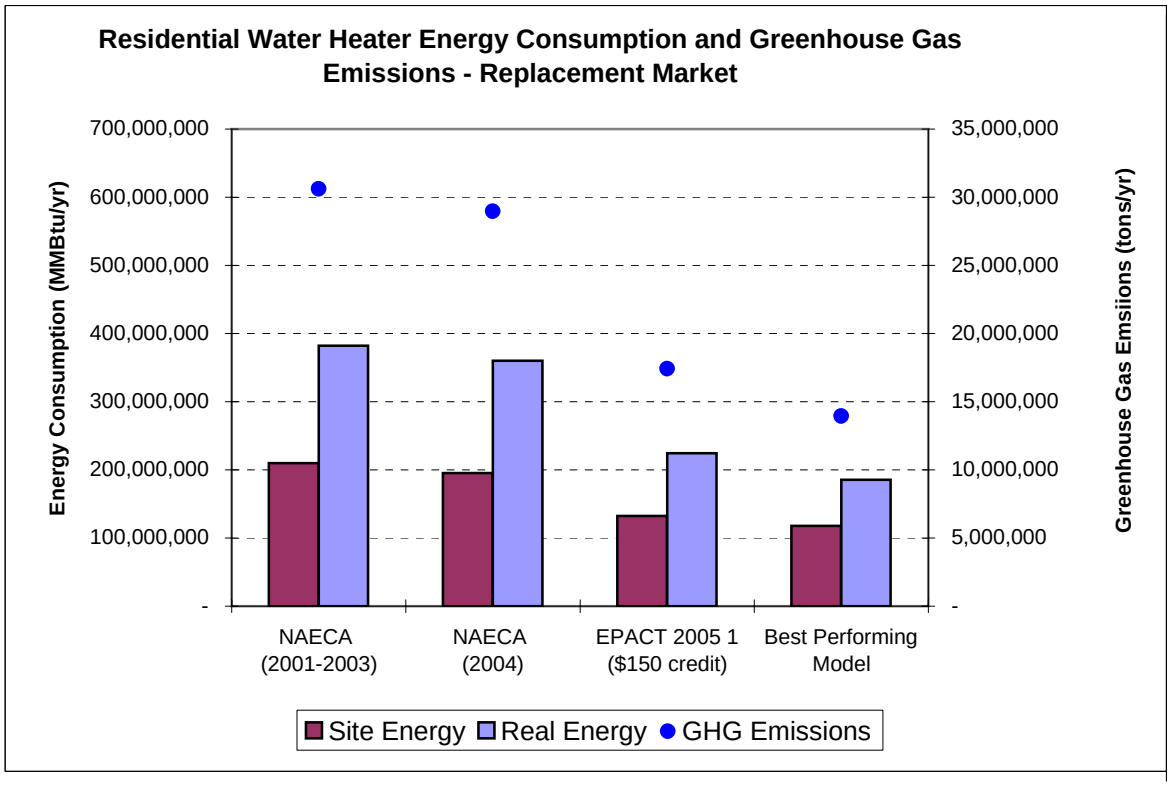


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	209,728,580	382,251,569	30,621,172
NAECA (2004)	195,415,862	359,899,134	28,967,410
EPACT 2005 [1] ($150 credit)	132,541,875	224,222,330	17,425,355
Best Performing Model	117,676,986	185,236,037	13,942,291



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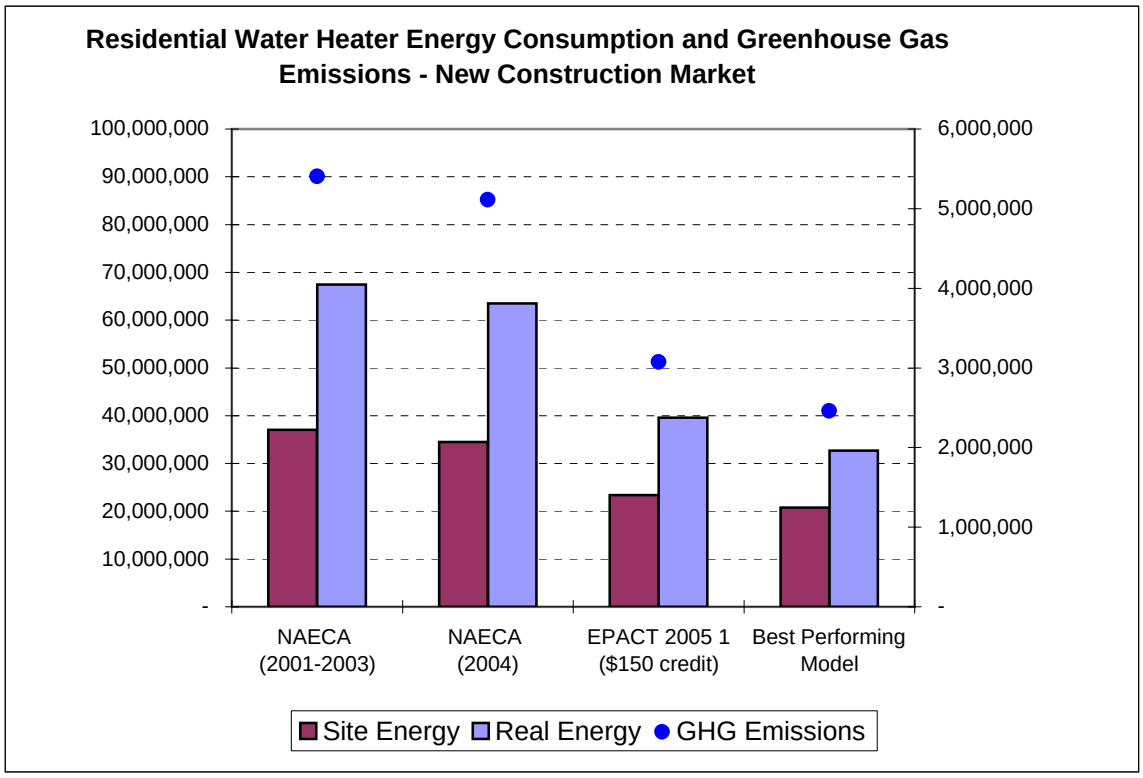
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	37,010,926	67,456,159	5,403,736
NAECA (2004)	34,485,152	63,511,612	5,111,896
EPACT 2005 [1] ($150 credit)	23,389,743	39,568,646	3,075,063
Best Performing Model	20,766,527	32,688,712	2,460,404



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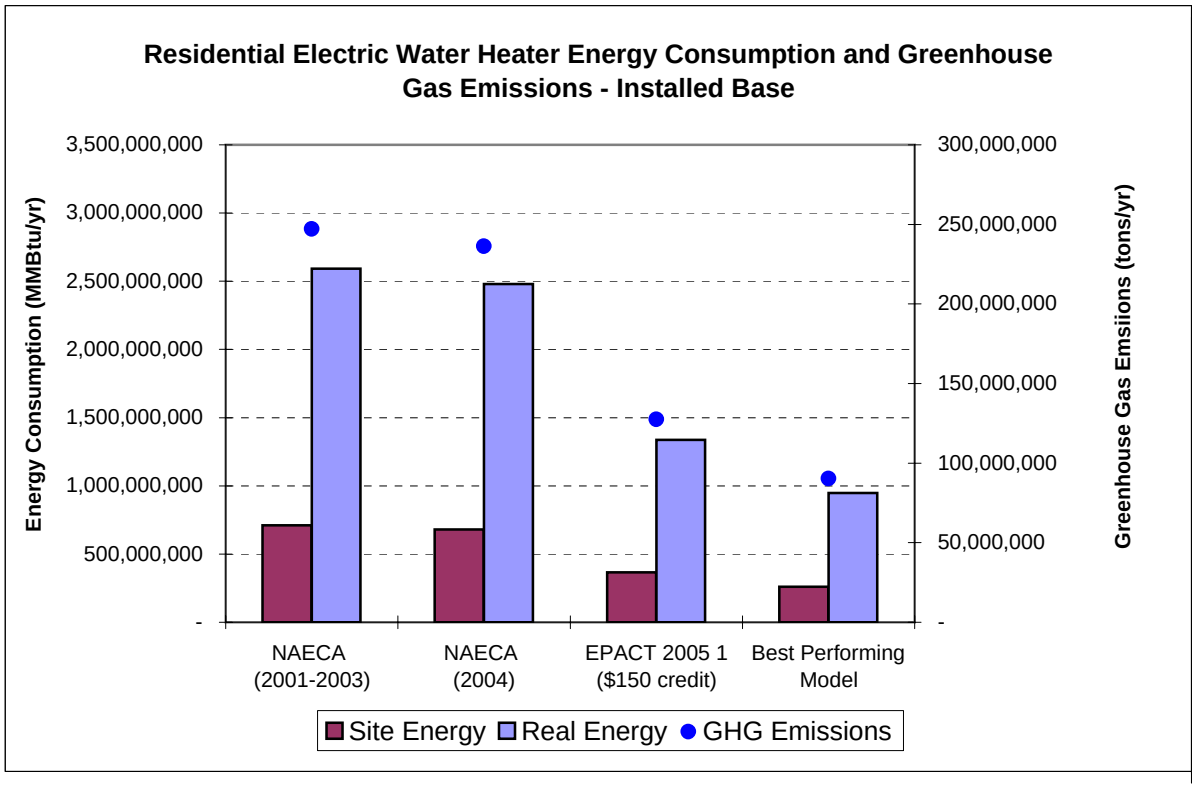
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	710,496,956	2,593,054,586	247,079,206
NAECA (2004)	679,511,481	2,479,968,908	236,303,837
EPACT 2005 [1] ($150 credit)	366,616,430	1,338,016,166	127,492,870
Best Performing Model	259,686,638	947,761,451	90,307,450



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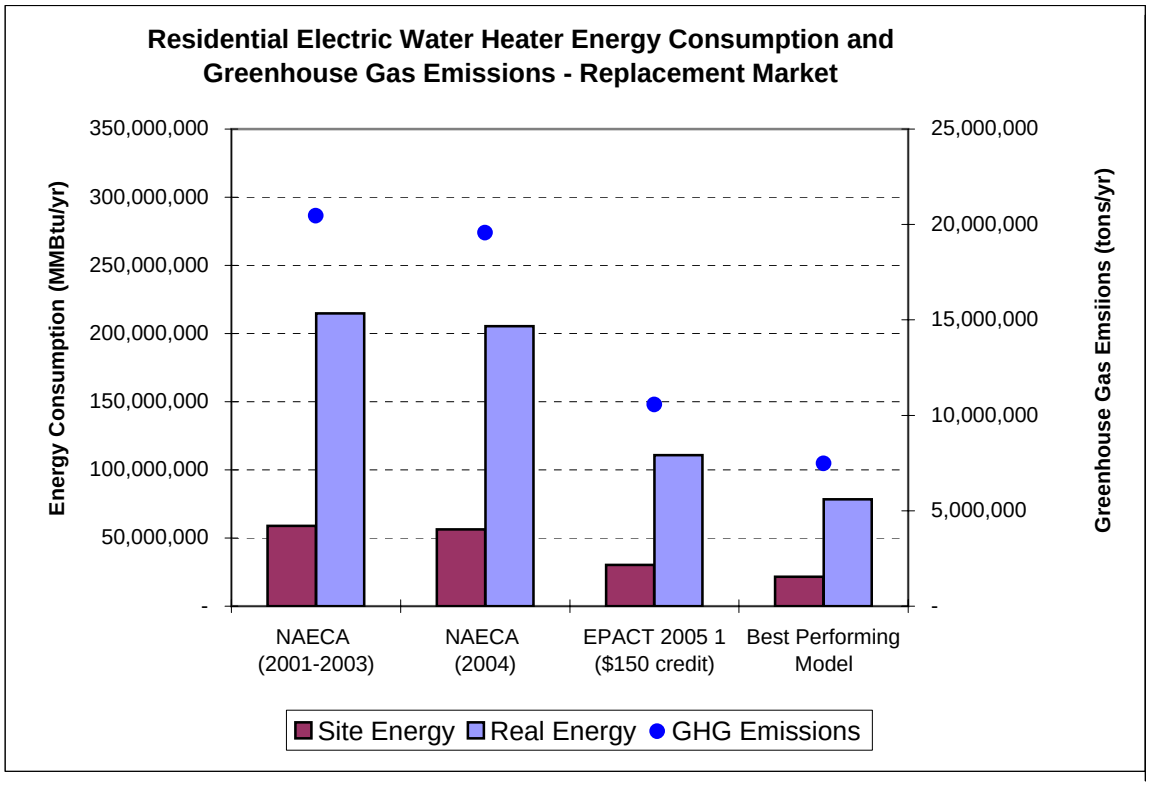
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	58,830,470	214,709,744	20,458,618
NAECA (2004)	56,264,815	205,346,039	19,566,397
EPACT 2005 [1] ($150 credit)	30,356,522	110,790,228	10,556,647
Best Performing Model	21,502,537	78,476,411	7,477,625



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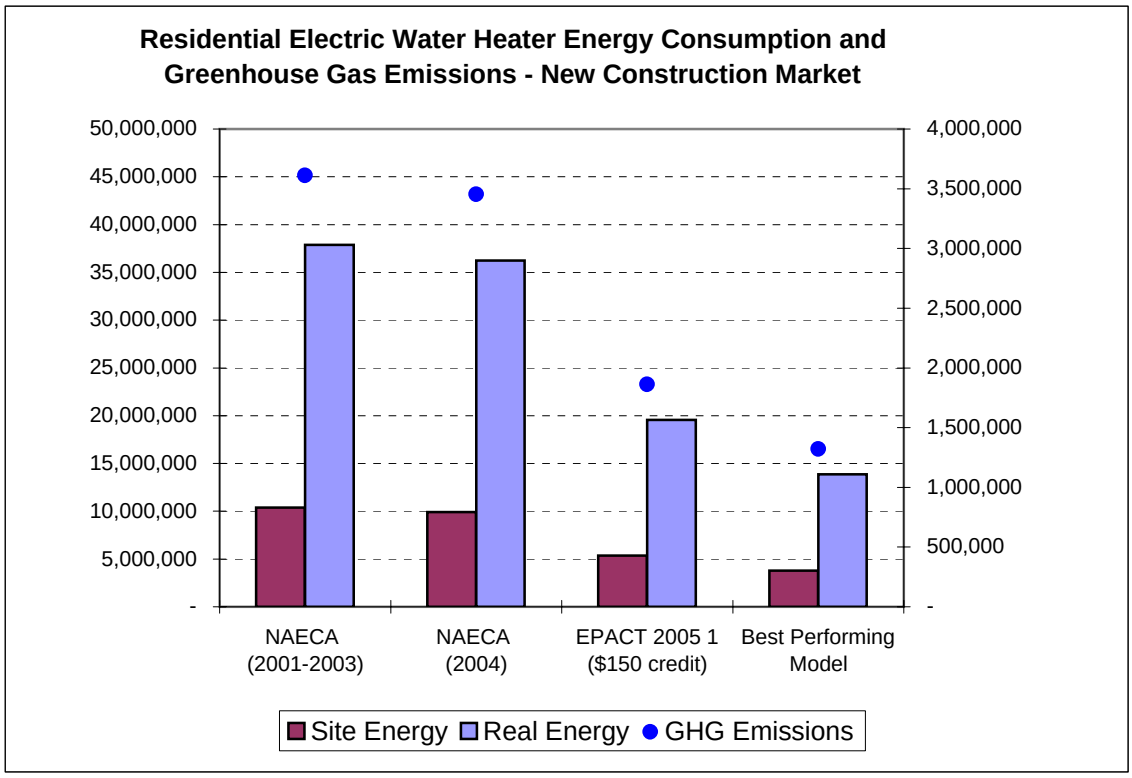
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	10,381,848	37,889,955	3,610,344
NAECA (2004)	9,929,085	36,237,536	3,452,894
EPACT 2005 [1] ($150 credit)	5,357,033	19,551,217	1,862,938
Best Performing Model	3,794,565	13,848,778	1,319,581



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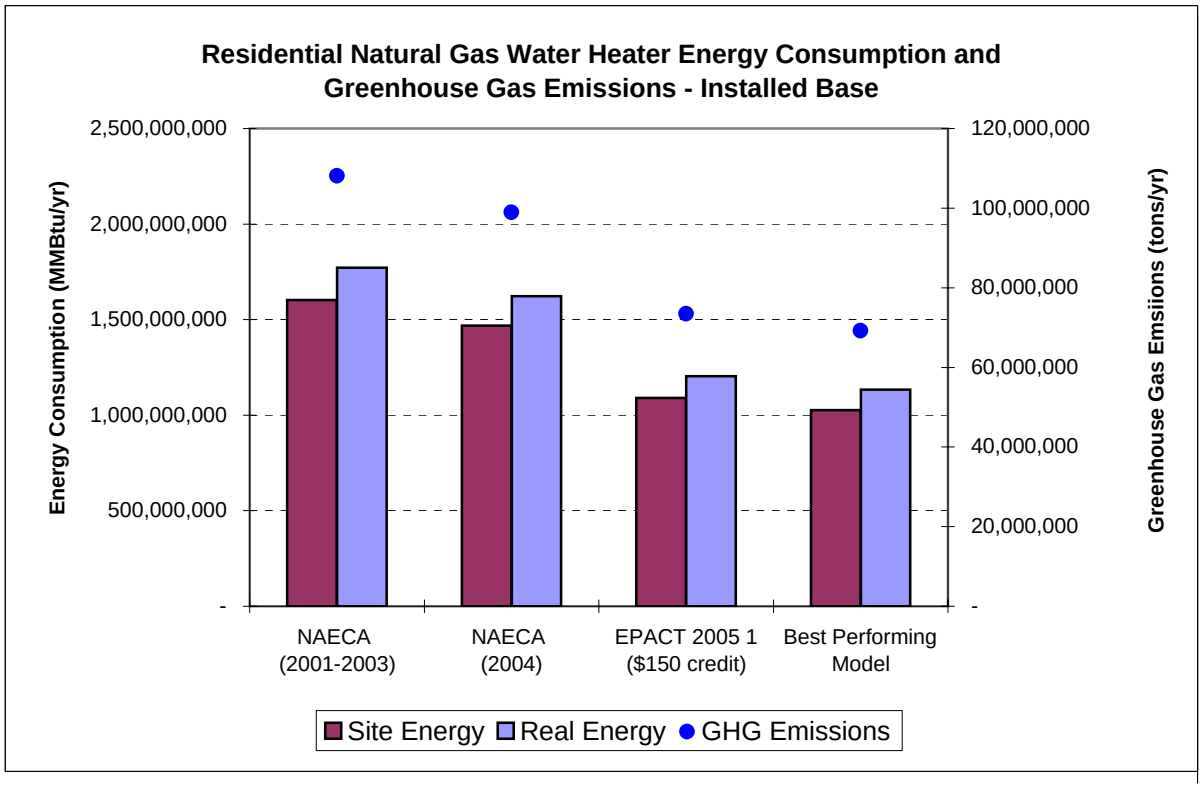
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	1,602,792,160	1,771,041,061	108,077,781
NAECA (2004)	1,467,876,995	1,621,963,530	98,980,324
EPACT 2005 [1] ($150 credit)	1,089,898,669	1,204,307,921	73,492,891
Best Performing Model	1,025,786,982	1,133,466,279	69,169,780



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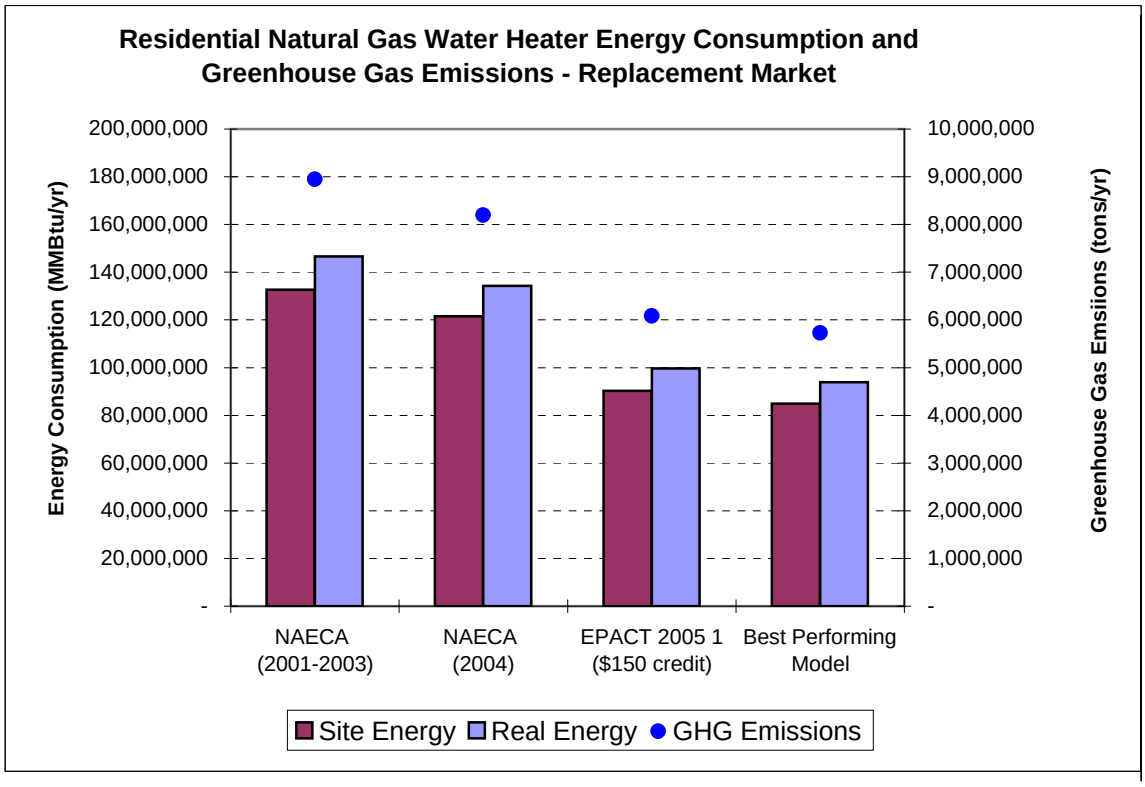
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	132,714,173	146,645,495	8,949,041
NAECA (2004)	121,542,946	134,301,598	8,195,755
EPACT 2005 [1] ($150 credit)	90,245,637	99,718,936	6,085,348
Best Performing Model	84,937,071	93,853,117	5,727,386



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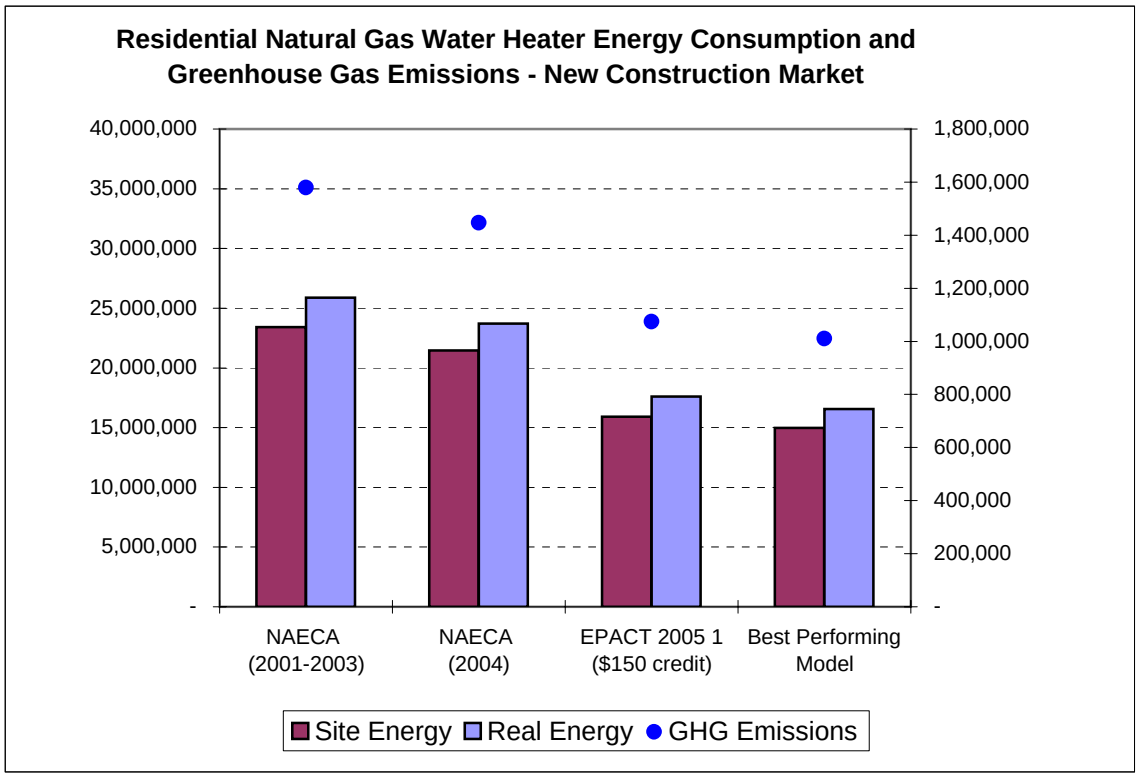
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	23,420,148	25,878,617	1,579,243
NAECA (2004)	21,448,755	23,700,282	1,446,310
EPACT 2005 [1] ($150 credit)	15,925,701	17,597,459	1,073,885
Best Performing Model	14,988,895	16,562,315	1,010,715



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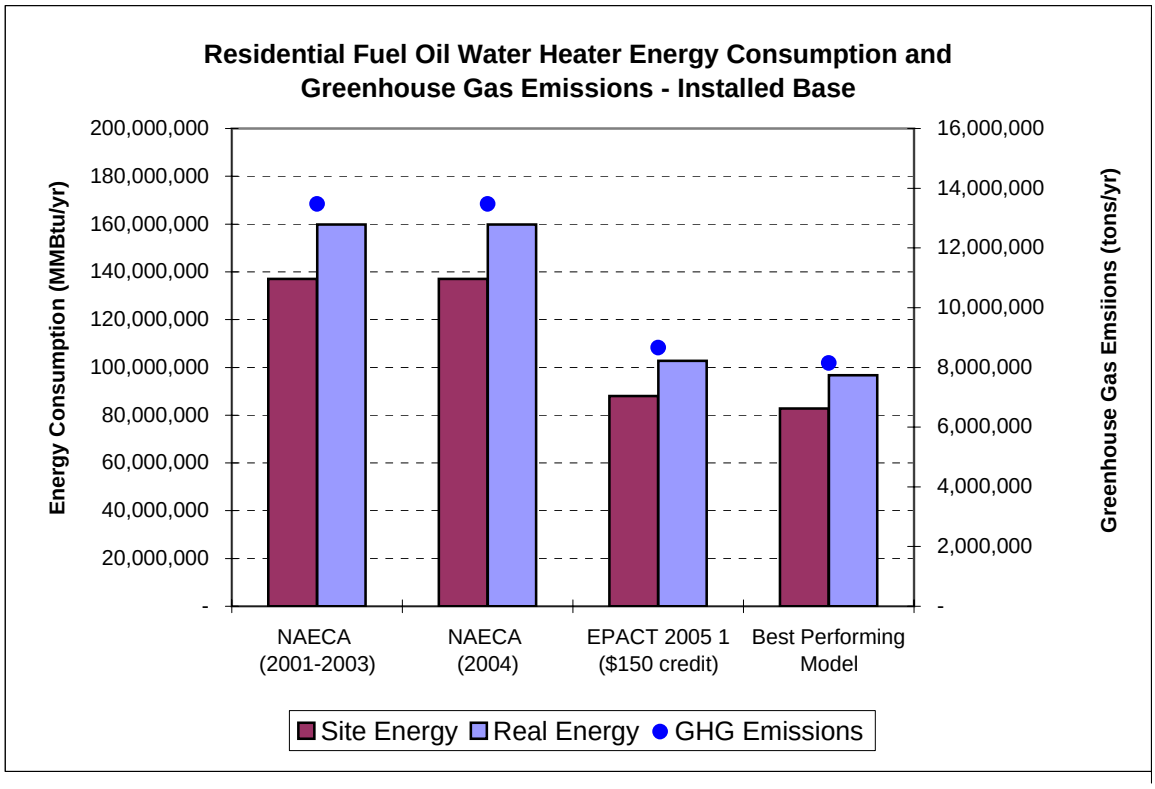
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	136,989,684	159,847,939	13,471,185
NAECA (2004)	136,989,684	159,847,939	13,471,185
EPACT 2005 [1] ($150 credit)	88,015,872	102,702,301	8,655,236
Best Performing Model	82,838,468	96,660,989	8,146,105



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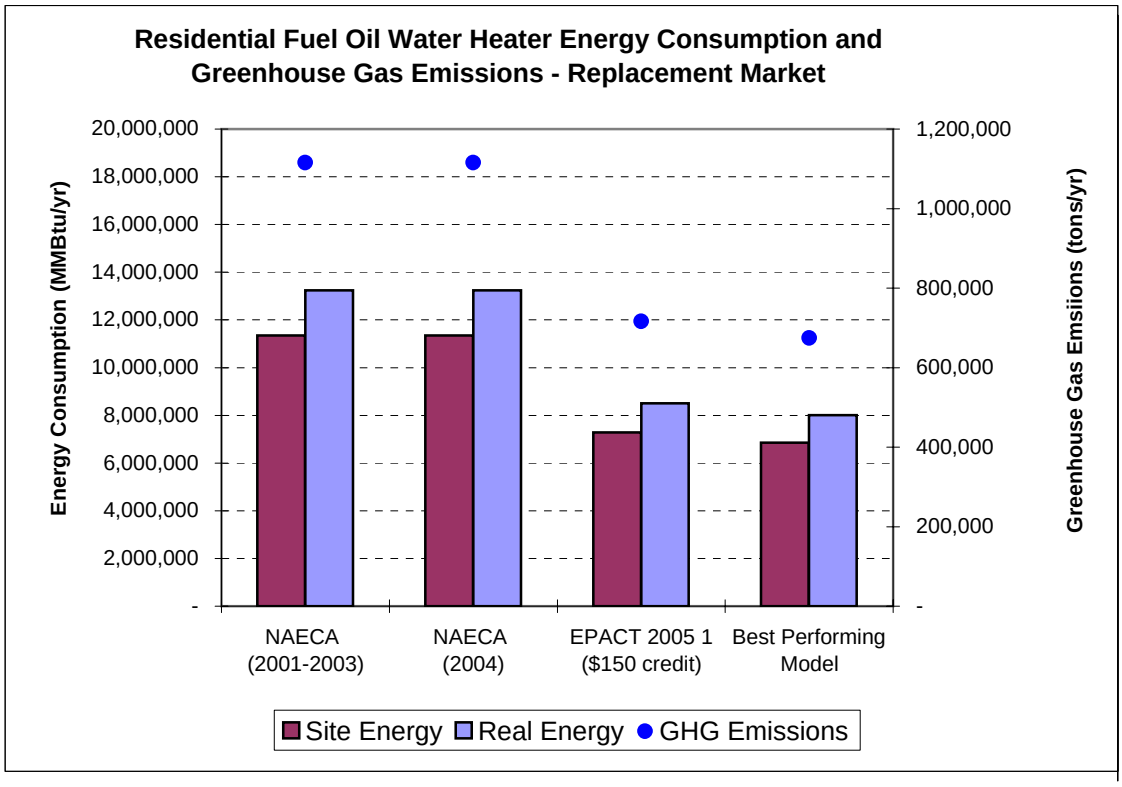
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	11,343,001	13,235,707	1,115,439
NAECA (2004)	11,343,001	13,235,707	1,115,439
EPACT 2005 [1] ($150 credit)	7,287,878	8,503,942	716,670
Best Performing Model	6,859,179	8,003,710	674,513



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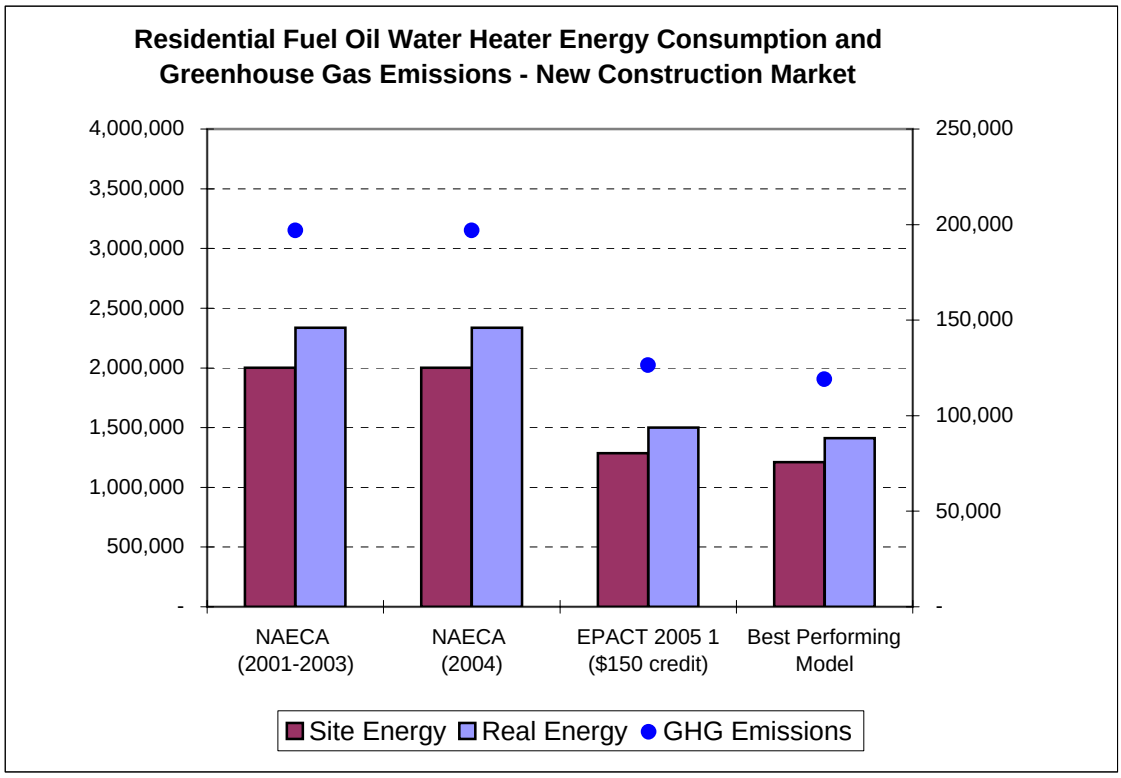
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	2,001,706	2,335,713	196,842
NAECA (2004)	2,001,706	2,335,713	196,842
EPACT 2005 [1] ($150 credit)	1,286,096	1,500,696	126,471
Best Performing Model	1,210,443	1,412,419	119,032



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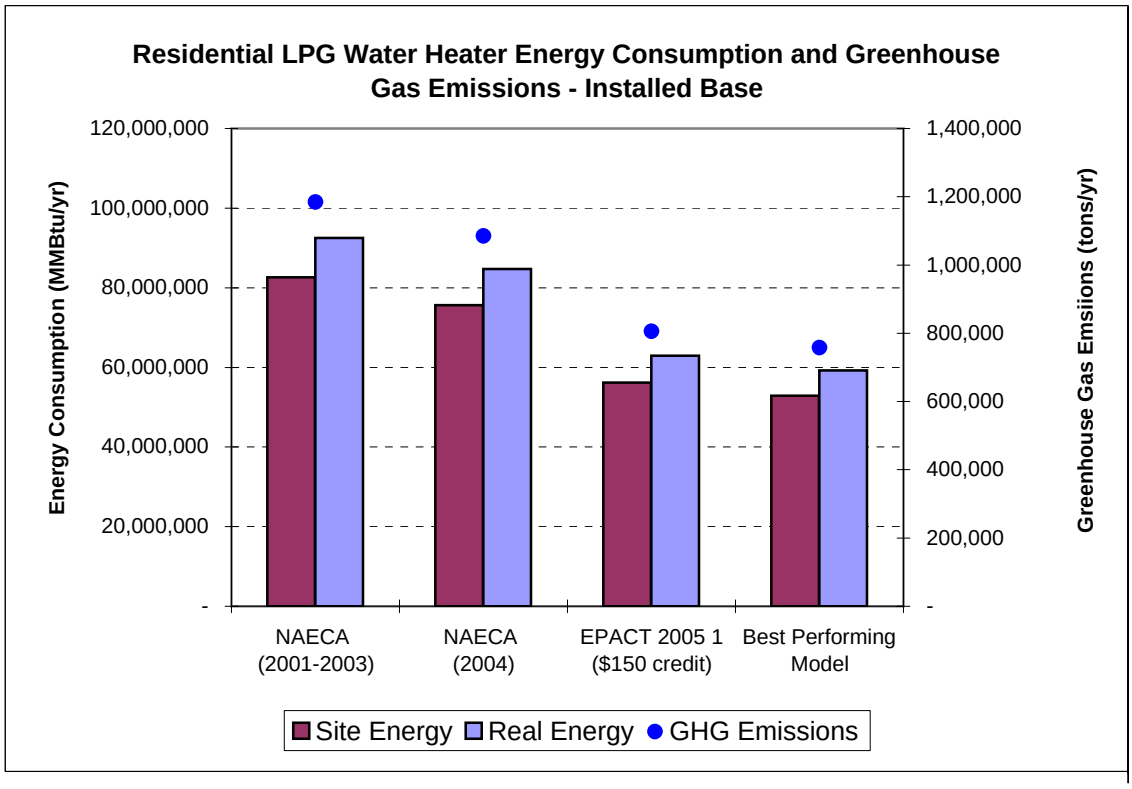
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	82,618,153	92,517,528	1,184,442
NAECA (2004)	75,663,763	84,729,857	1,084,742
EPACT 2005 [1] ($150 credit)	56,180,344	62,911,919	805,421
Best Performing Model	52,875,618	59,211,218	758,043



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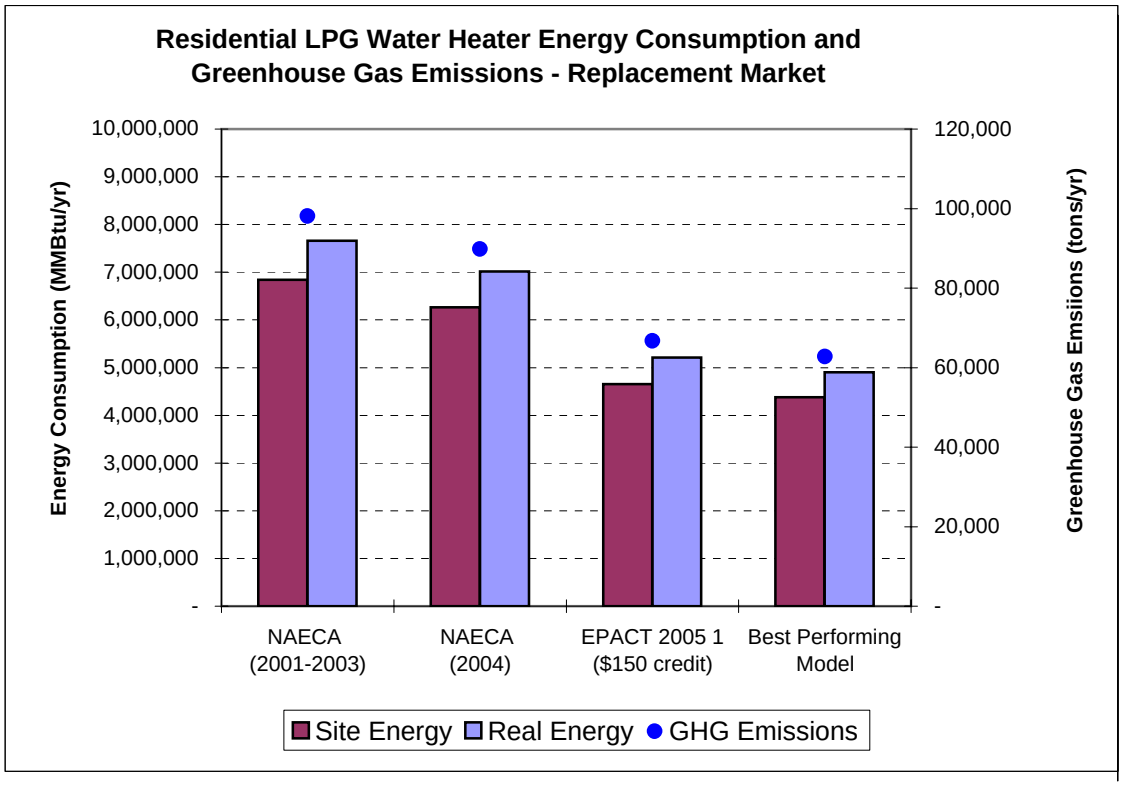
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	6,840,937	7,660,623	98,074
NAECA (2004)	6,265,100	7,015,790	89,819
EPACT 2005 [1] ($150 credit)	4,651,837	5,209,224	66,690
Best Performing Model	4,378,200	4,902,799	62,767



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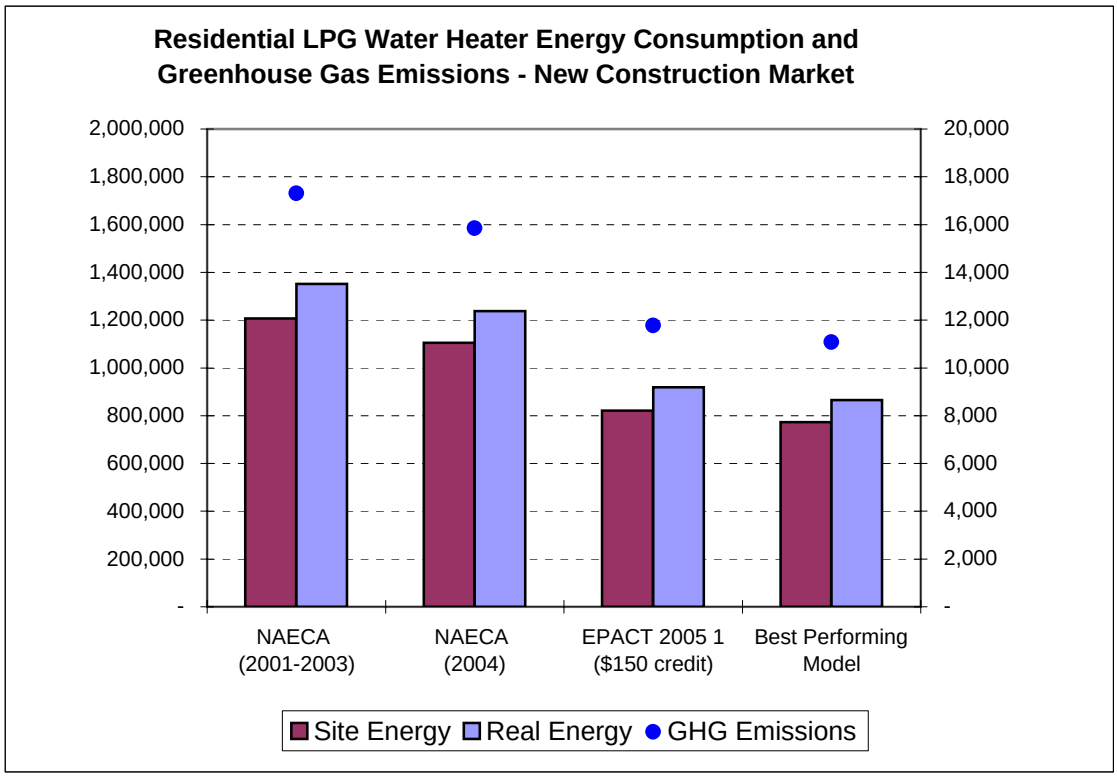
Residential Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001-2003)	1,207,224	1,351,875	17,307
NAECA (2004)	1,105,606	1,238,081	15,850
EPACT 2005 [1] ($150 credit)	820,912	919,275	11,769
Best Performing Model	772,623	865,200	11,077



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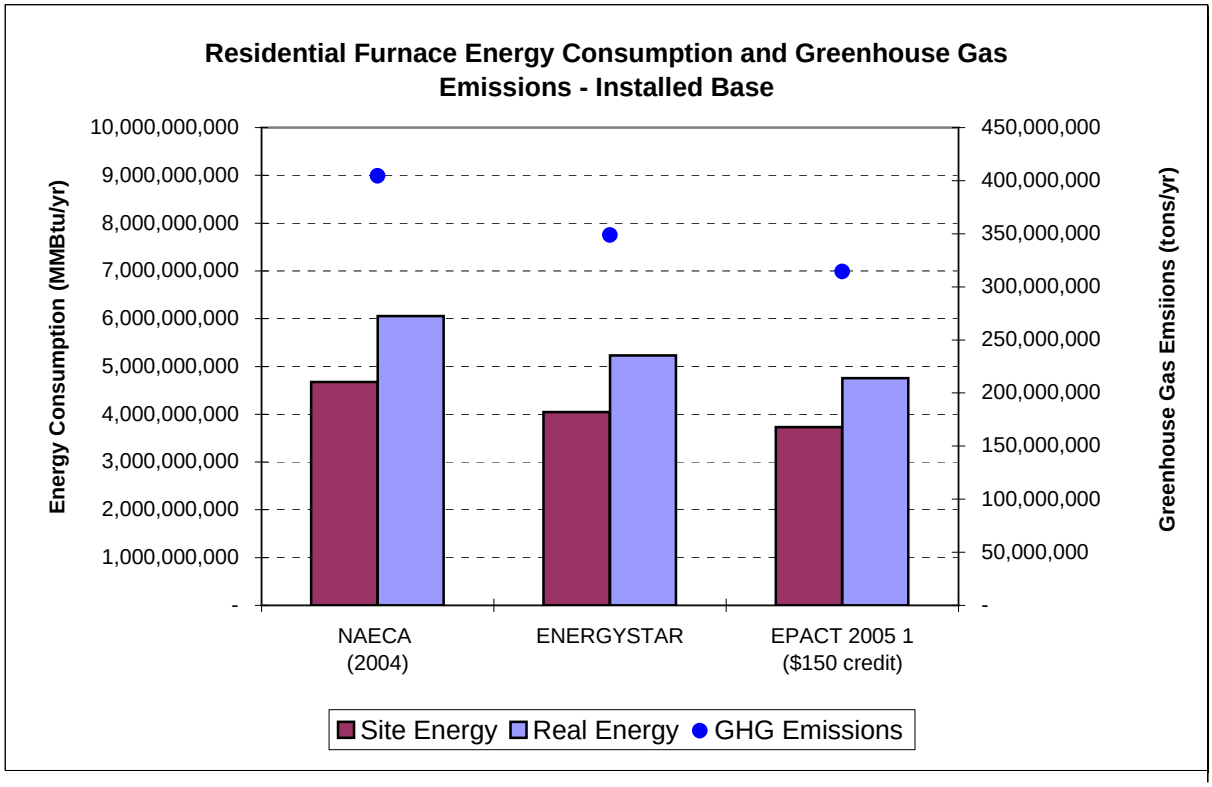
Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

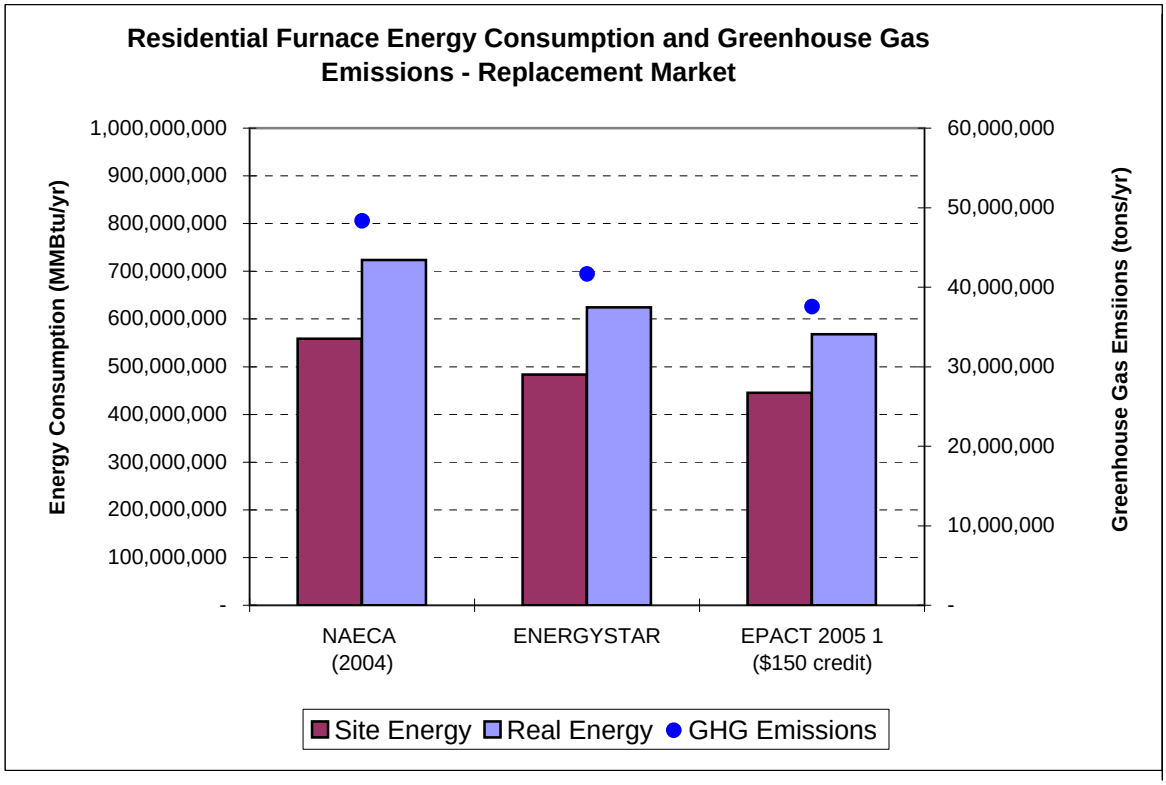
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	4,673,706,334	6,057,093,086	404,537,686
ENERGYSTAR	4,044,838,418	5,228,651,947	348,614,663
EPACT 2005 [1] ($150 credit)	3,730,135,558	4,756,423,082	314,353,665



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

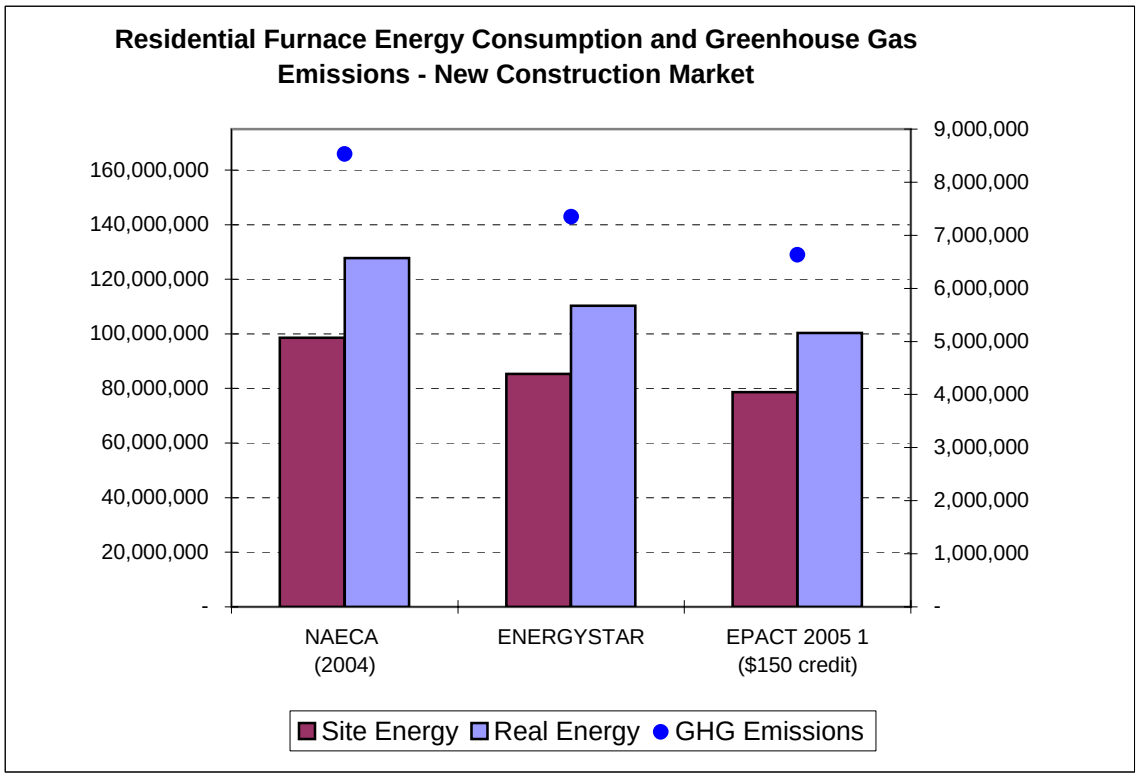
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	558,410,669	723,696,604	48,333,837
ENERGYSTAR	483,274,037	624,715,124	41,652,199
EPACT 2005 [1] ($150 credit)	445,673,592	568,293,599	37,558,723



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

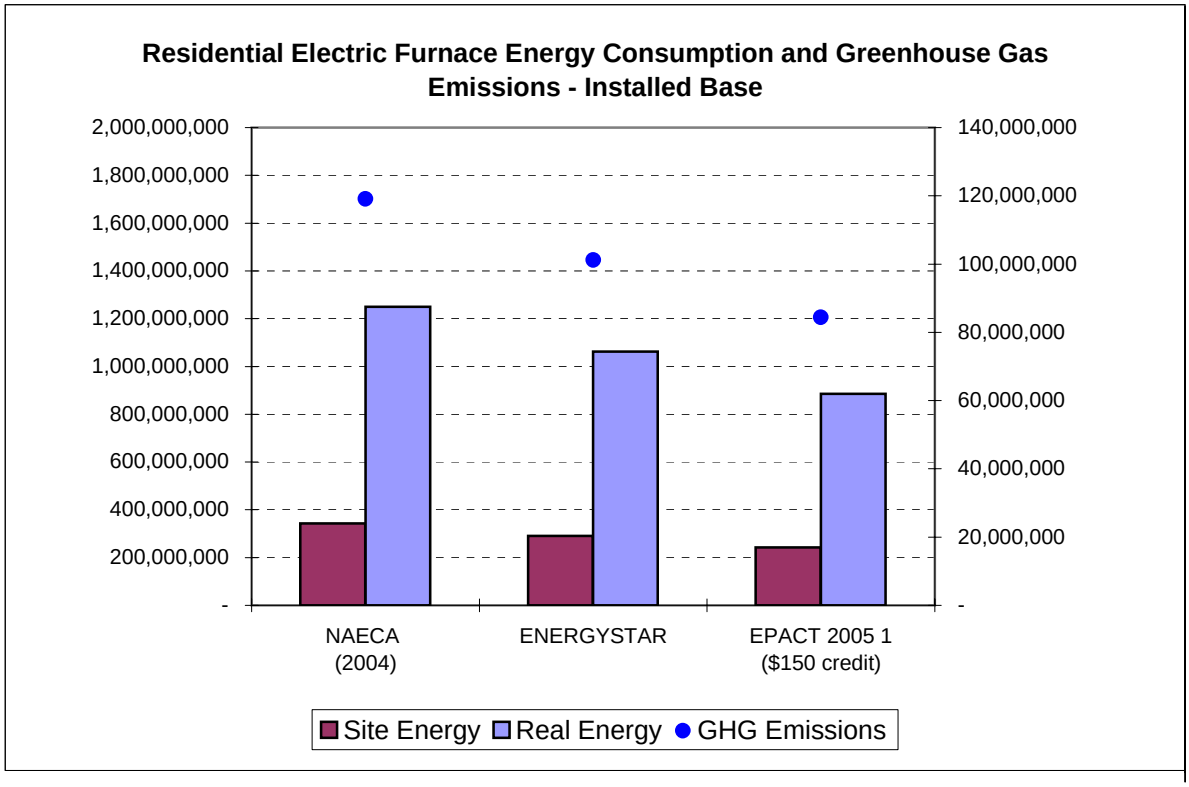
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	98,543,059	127,711,165	8,529,501
ENERGYSTAR	85,283,654	110,243,845	7,350,388
EPACT 2005 [1] ($150 credit)	78,648,281	100,287,106	6,628,010



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

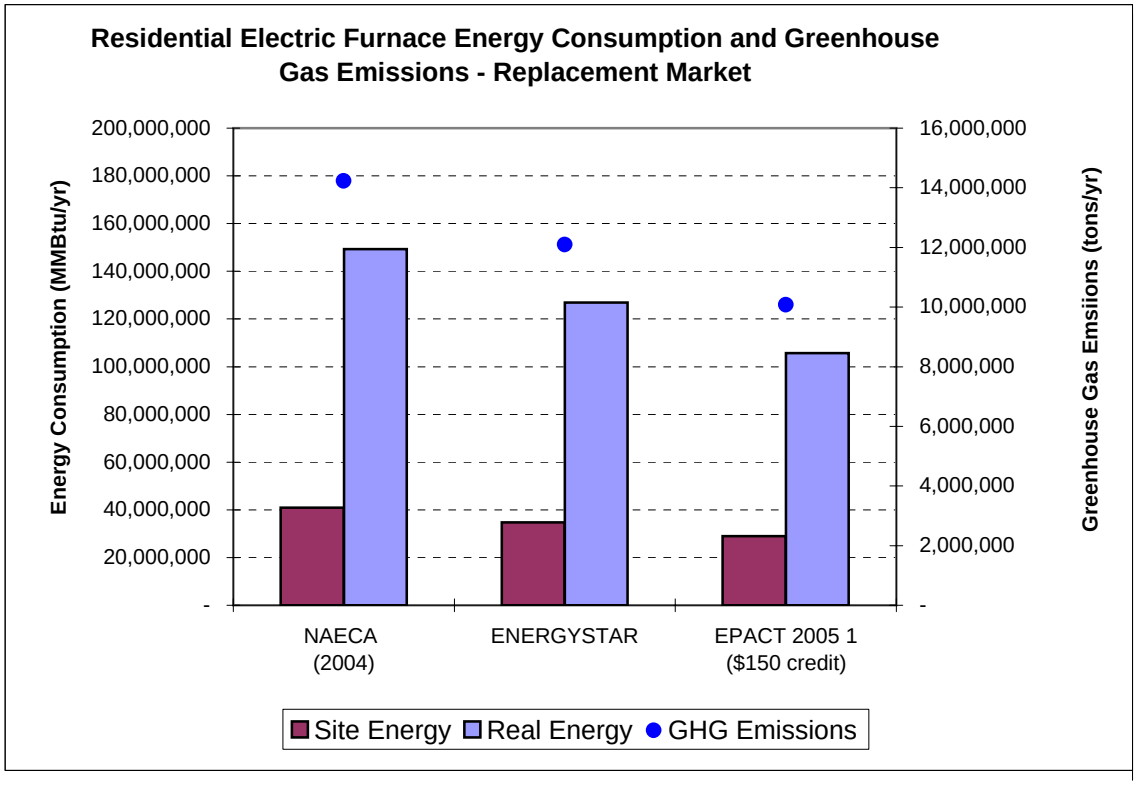
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	342,424,282	1,249,723,658	119,079,919
ENERGYSTAR	291,060,640	1,062,265,109	101,217,931
EPACT 2005 [1] ($150 credit)	242,550,533	885,220,925	84,348,276



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

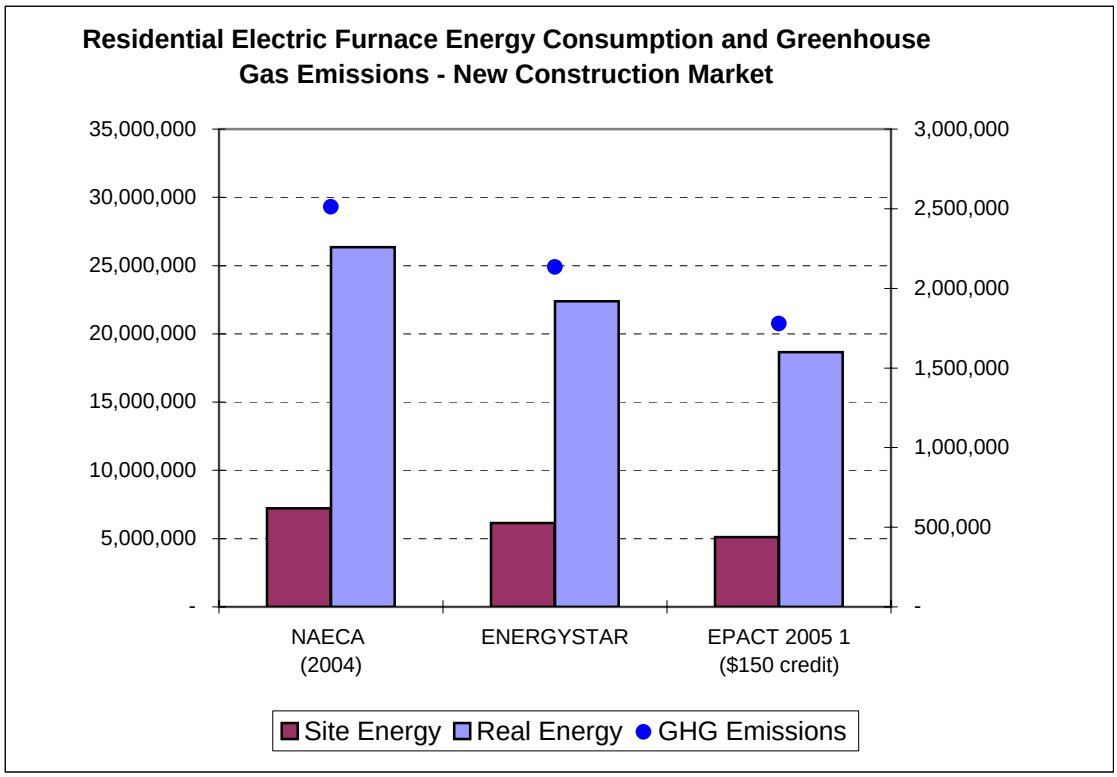
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	40,912,577	149,315,976	14,227,573
ENERGYSTAR	34,775,691	126,918,580	12,093,437
EPACT 2005 [1] ($150 credit)	28,979,742	105,765,483	10,077,864



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

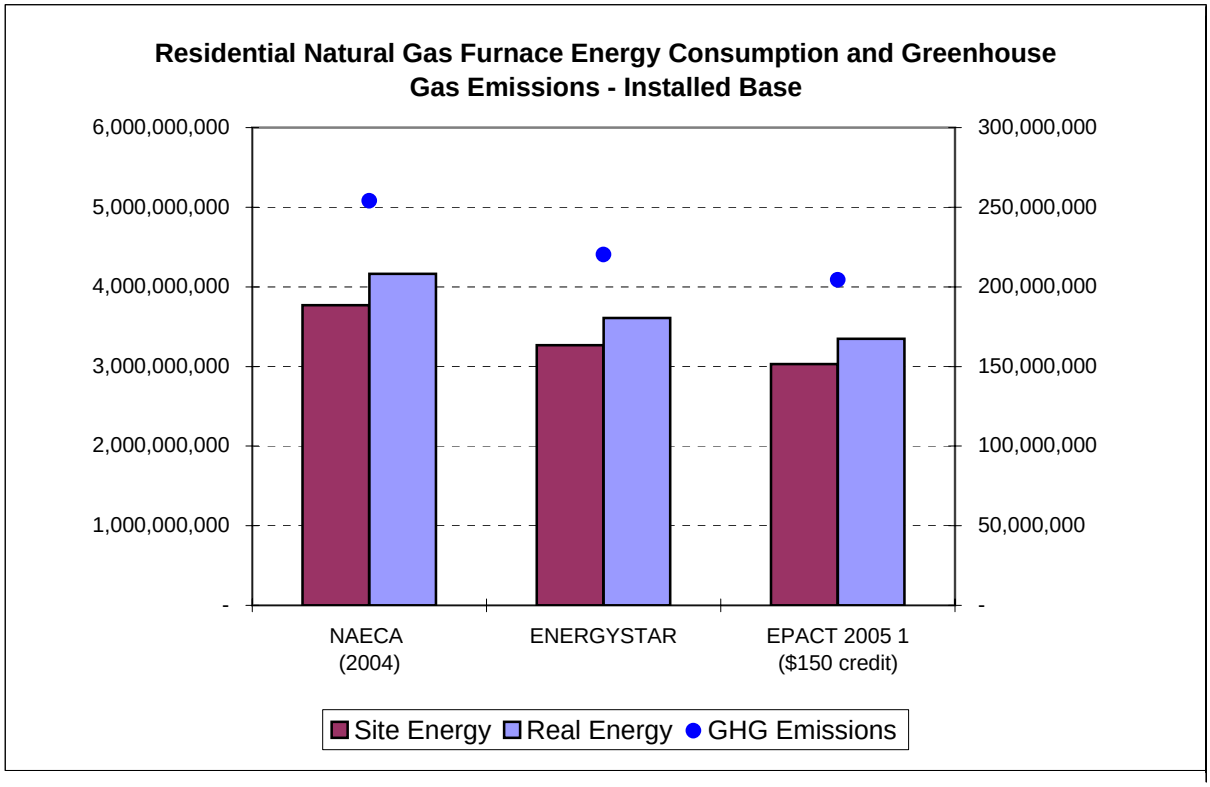
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	7,219,867	26,349,878	2,510,748
ENERGYSTAR	6,136,887	22,397,396	2,134,136
EPACT 2005 [1] ($150 credit)	5,114,072	18,664,497	1,778,447



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

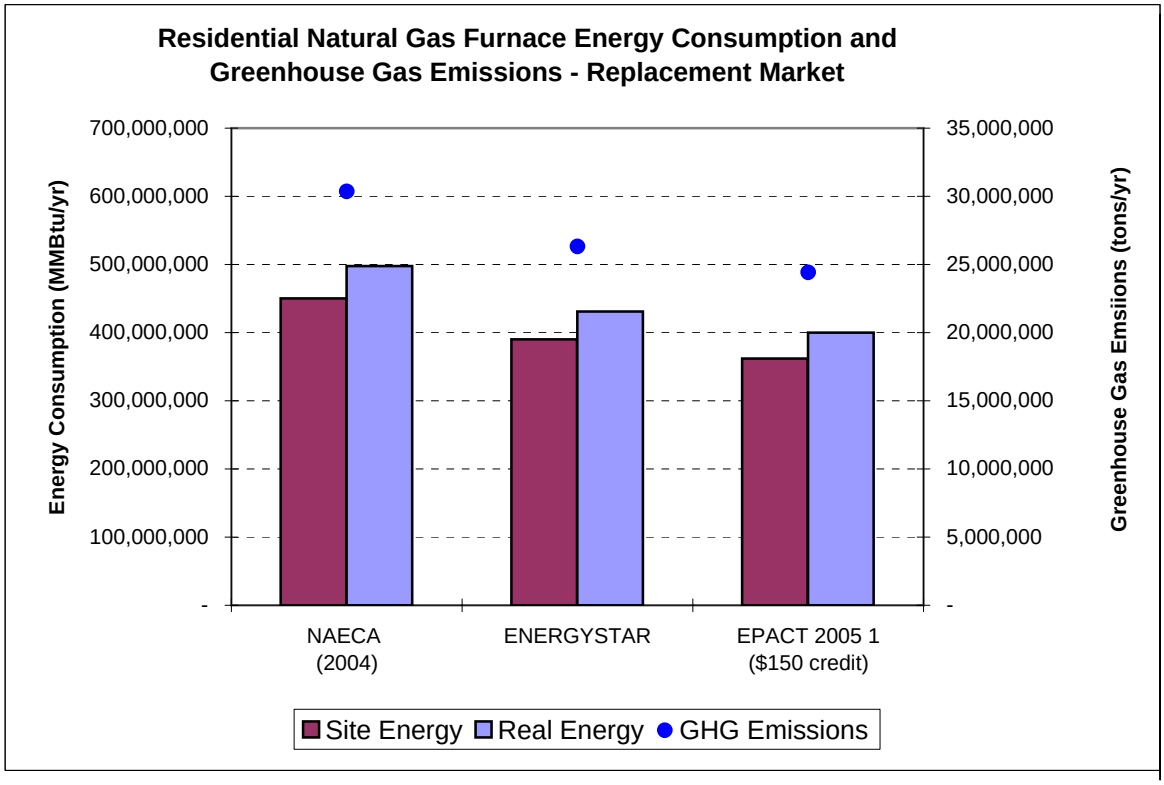
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	3,767,794,872	4,163,309,251	254,065,947
ENERGYSTAR	3,265,422,222	3,608,201,351	220,190,487
EPACT 2005 [1] ($150 credit)	3,029,773,196	3,347,815,686	204,300,452



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

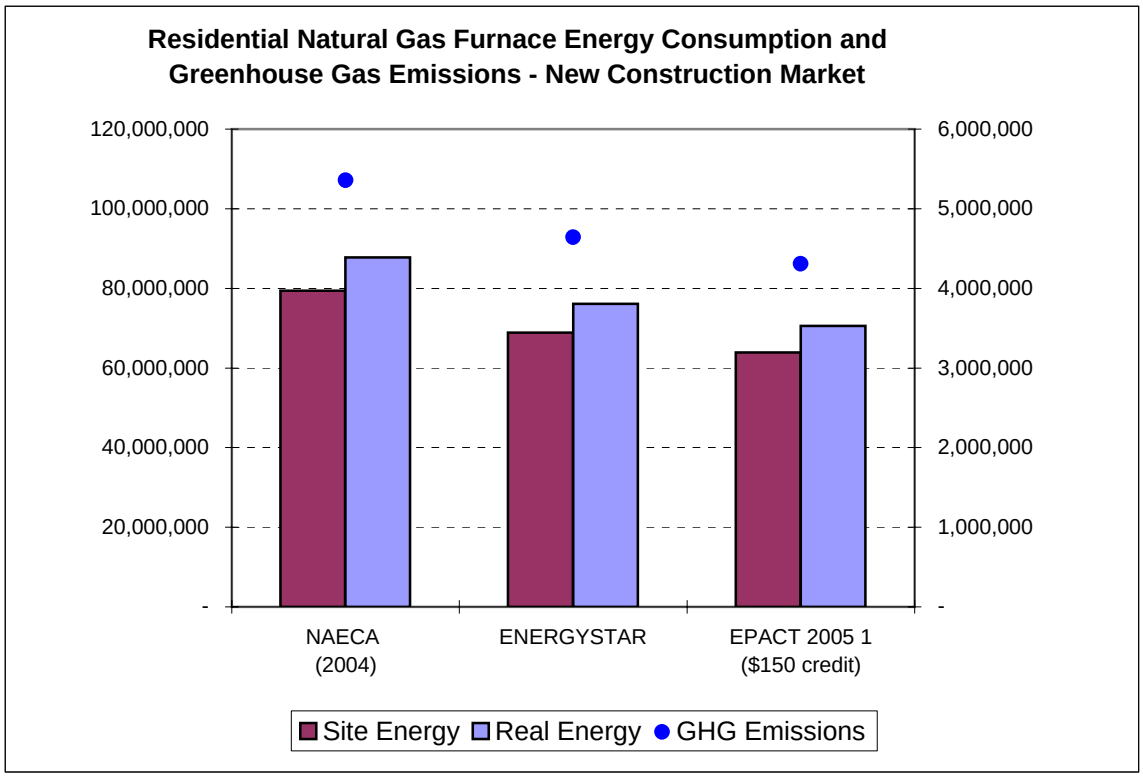
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	450,173,097	497,428,836	30,355,595
ENERGYSTAR	390,150,017	431,104,991	26,308,182
EPACT 2005 [1] ($150 credit)	361,994,861	399,994,322	24,409,653



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

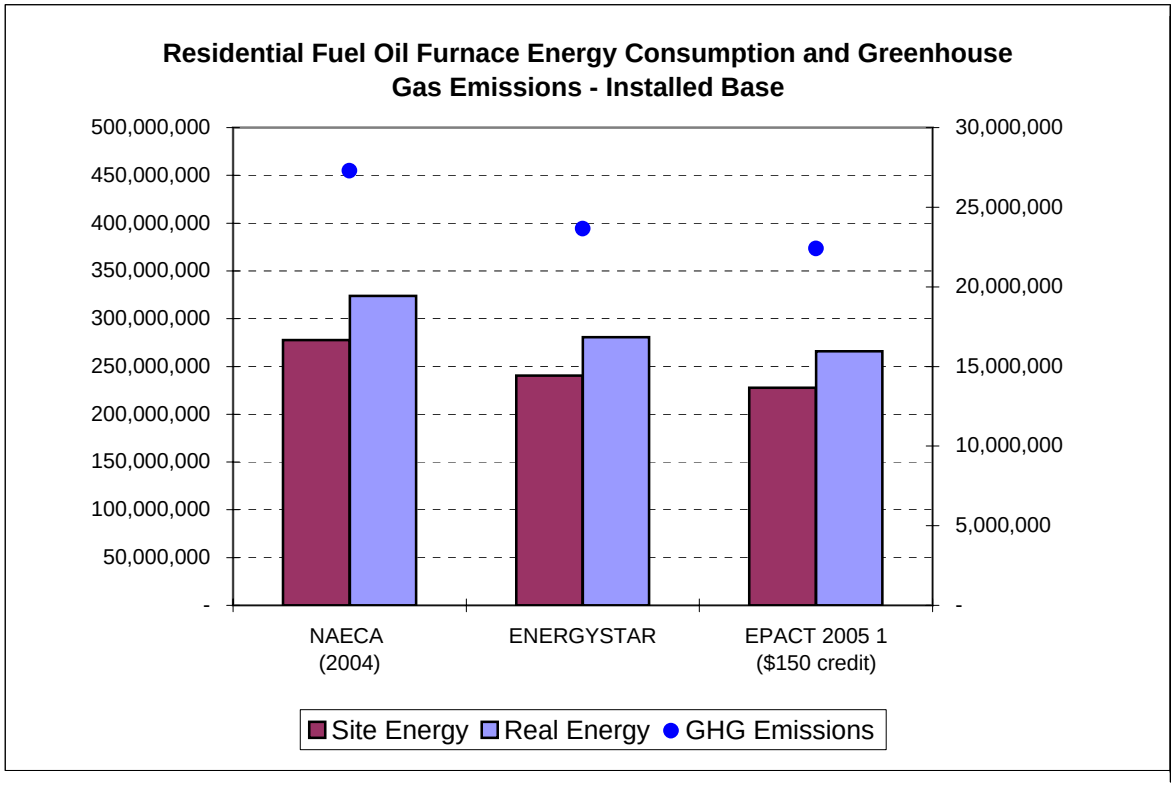
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	79,442,311	87,781,559	5,356,870
ENERGYSTAR	68,850,003	76,077,351	4,642,620
EPACT 2005 [1] ($150 credit)	63,881,446	70,587,233	4,307,586



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

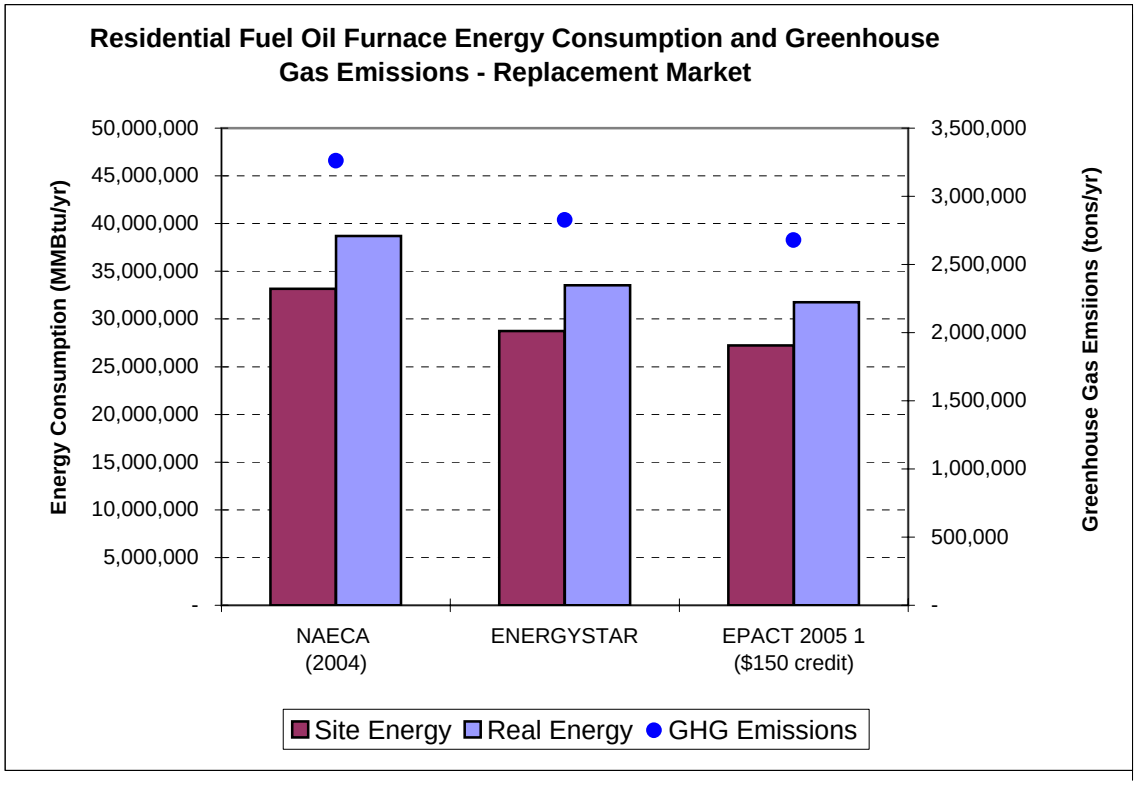
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	277,538,462	323,848,847	27,292,362
ENERGYSTAR	240,533,333	280,669,000	23,653,380
EPACT 2005 [1] ($150 credit)	227,873,684	265,896,948	22,408,465



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

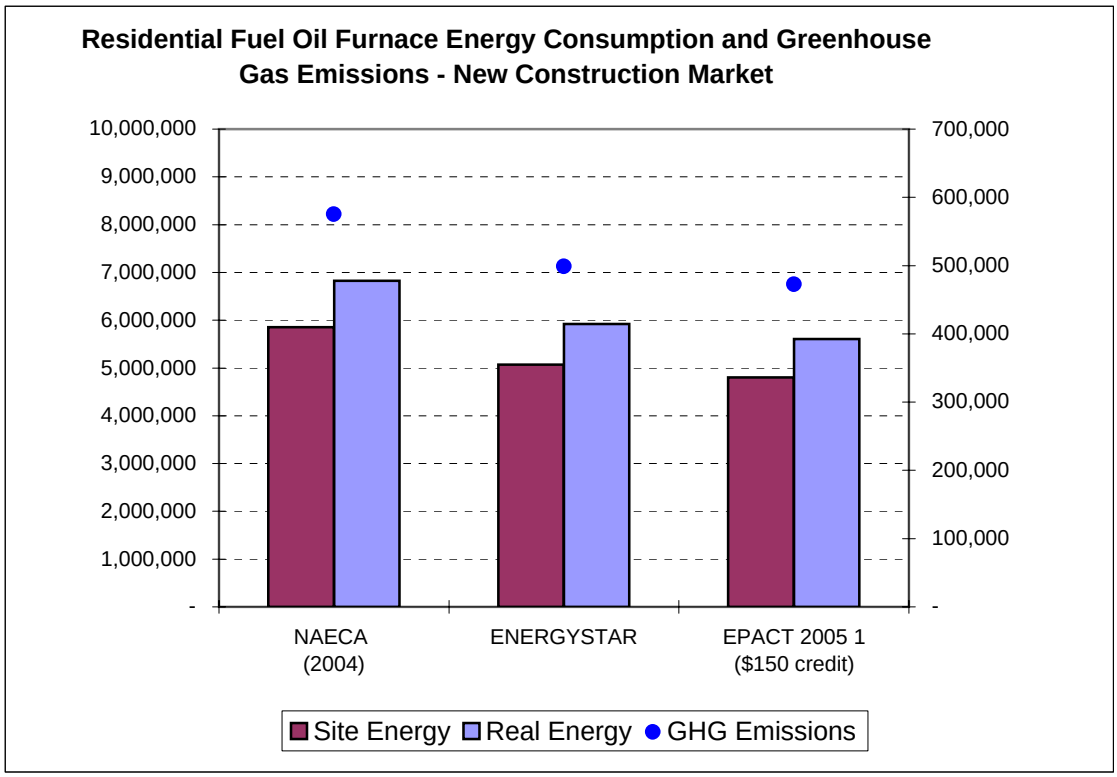
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	33,160,072	38,693,199	3,260,869
ENERGYSTAR	28,738,729	33,534,106	2,826,087
EPACT 2005 [1] ($150 credit)	27,226,164	31,769,153	2,677,345



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

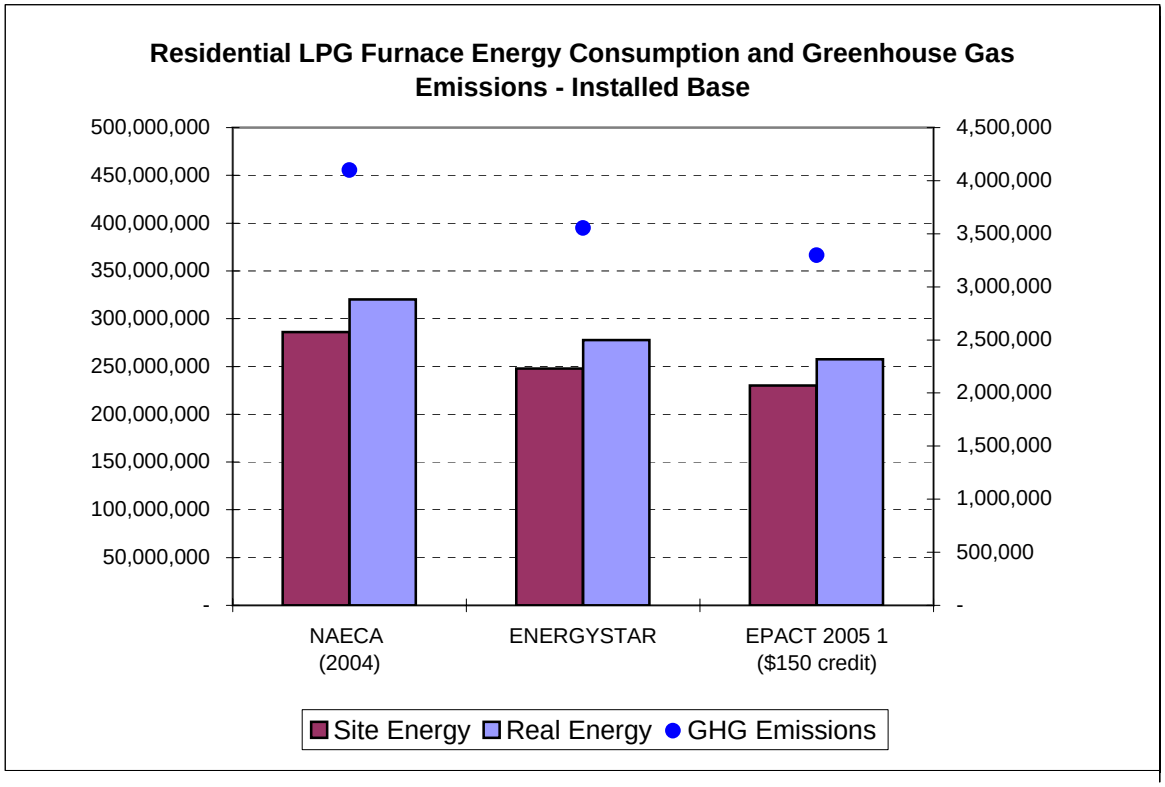
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	5,851,777	6,828,212	575,448
ENERGYSTAR	5,071,540	5,917,783	498,721
EPACT 2005 [1] ($150 credit)	4,804,617	5,606,321	472,473



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

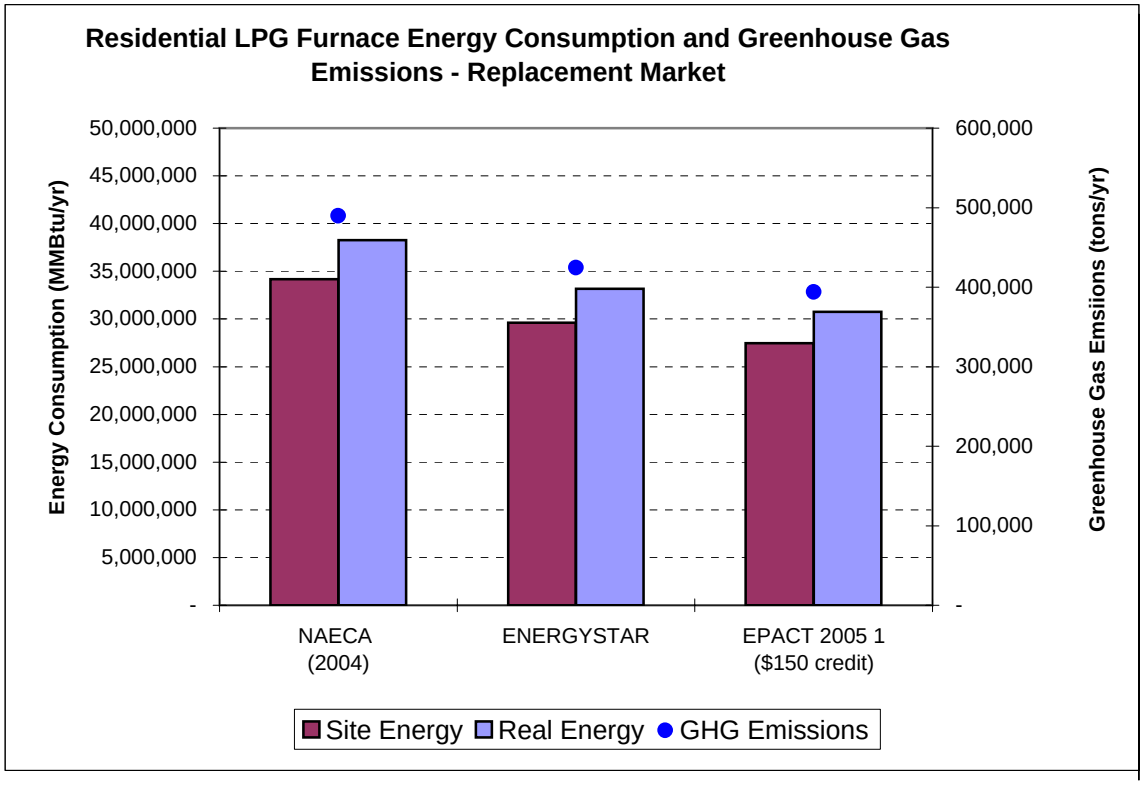
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	285,948,718	320,211,330	4,099,459
ENERGYSTAR	247,822,222	277,516,486	3,552,864
EPACT 2005 [1] ($150 credit)	229,938,144	257,489,523	3,296,472



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

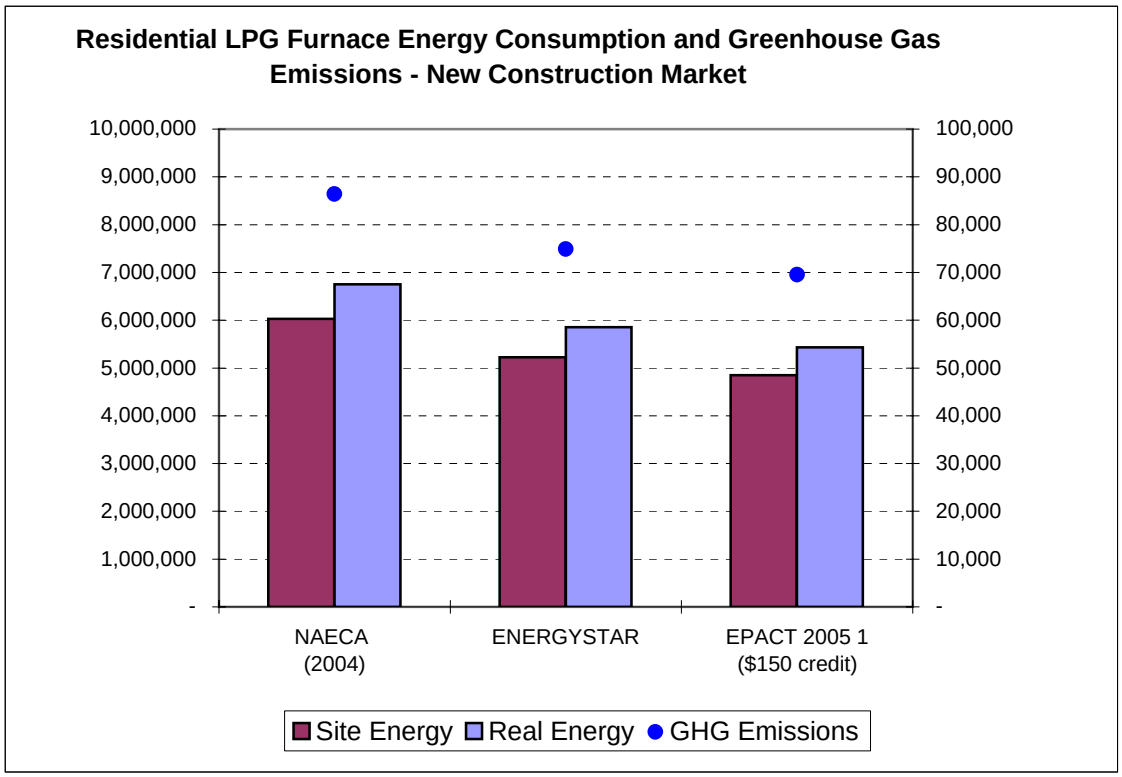
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	34,164,923	38,258,592	489,800
ENERGYSTAR	29,609,600	33,157,446	424,493
EPACT 2005 [1] ($150 credit)	27,472,824	30,764,641	393,860



Residential Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

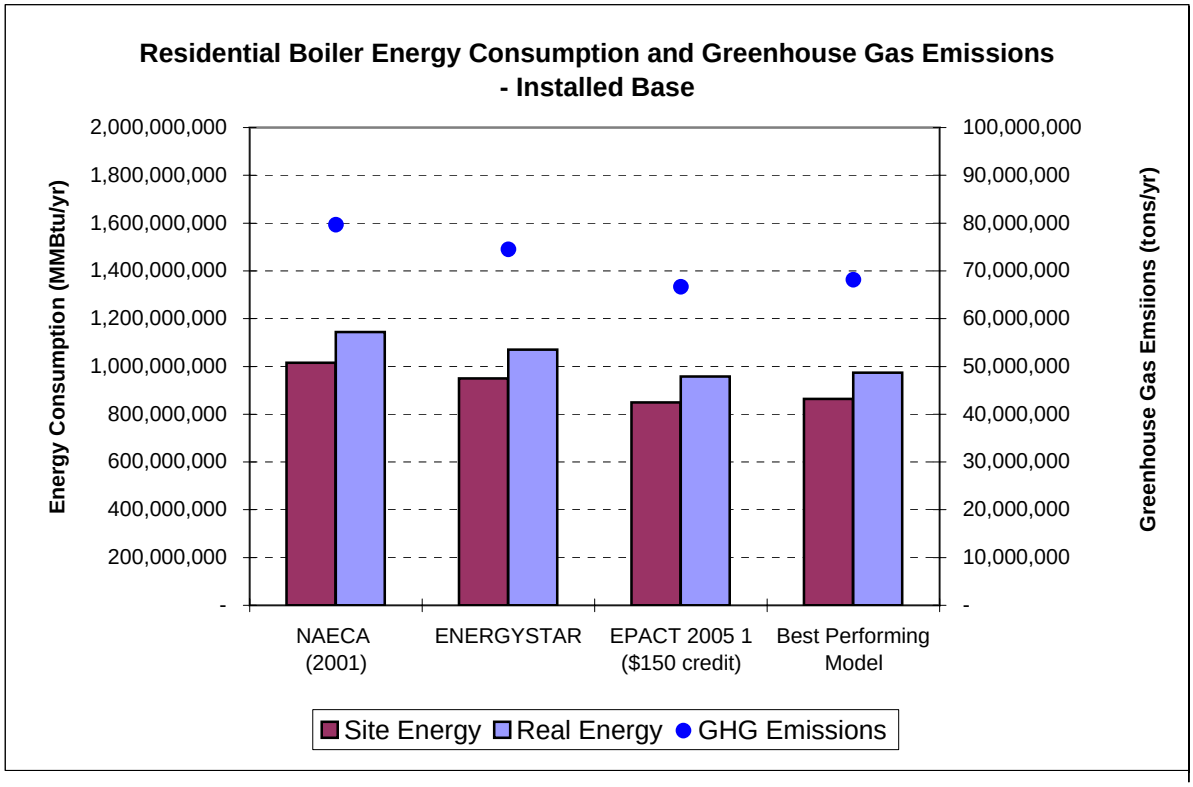
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2004)	6,029,104	6,751,516	86,435
ENERGYSTAR	5,225,223	5,851,314	74,911
EPACT 2005 [1] ($150 credit)	4,848,145	5,429,054	69,505



Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	1,015,479,292	1,144,406,033	79,625,710
ENERGYSTAR	949,270,588	1,069,933,746	74,505,254
EPACT 2005 [1] ($150 credit)	849,347,368	957,309,142	66,662,596
Best Performing Model	863,566,809	974,065,884	68,143,110

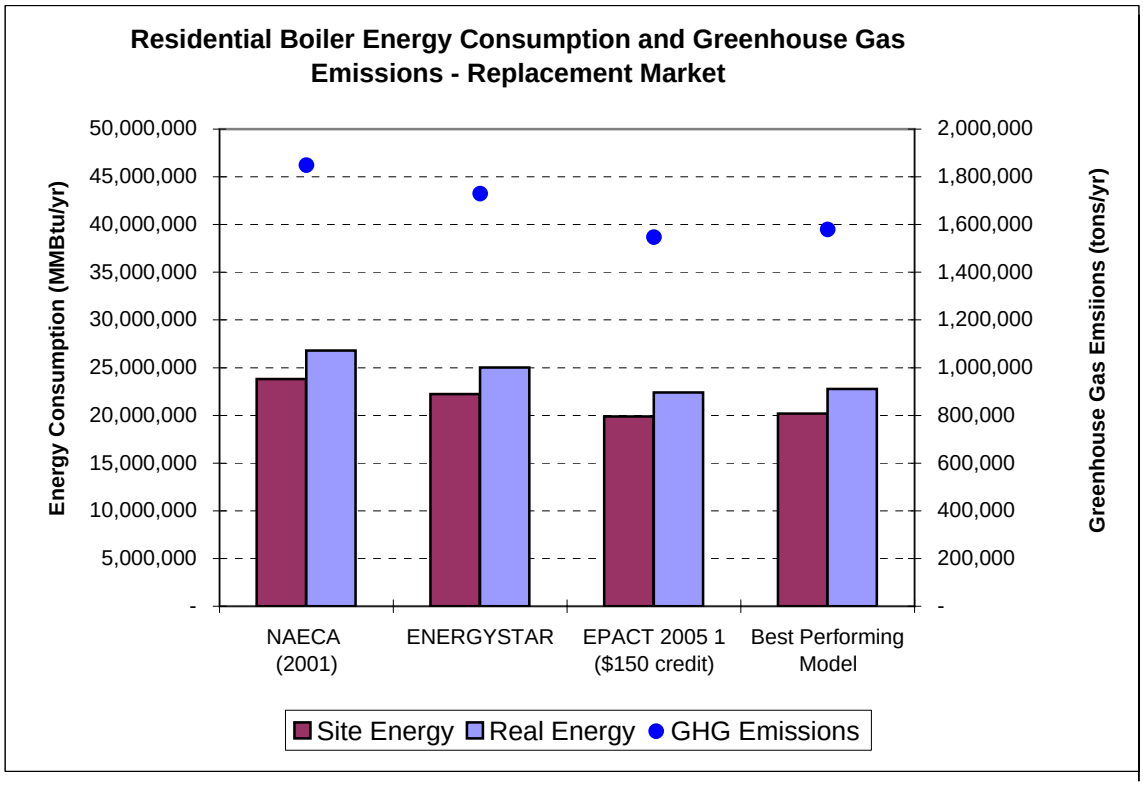


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	23,795,580	26,780,901	1,847,979
ENERGYSTAR	22,238,400	25,031,587	1,728,658
EPACT 2005 [1] ($150 credit)	19,897,516	22,396,683	1,546,694
Best Performing Model	20,201,304	22,755,165	1,578,567



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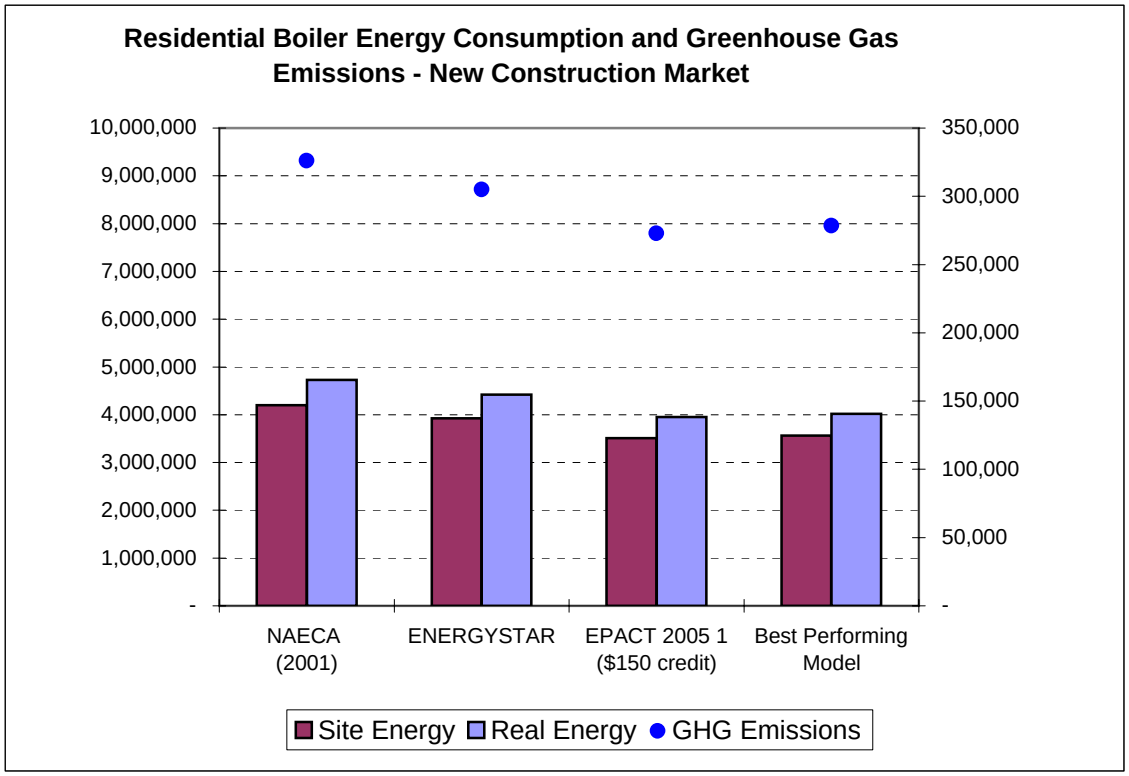
Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	4,199,220	4,726,041	326,114
ENERGYSTAR	3,924,424	4,417,339	305,057
EPACT 2005 [1] ($150 credit)	3,511,326	3,952,356	272,946
Best Performing Model	3,564,936	4,015,617	278,571



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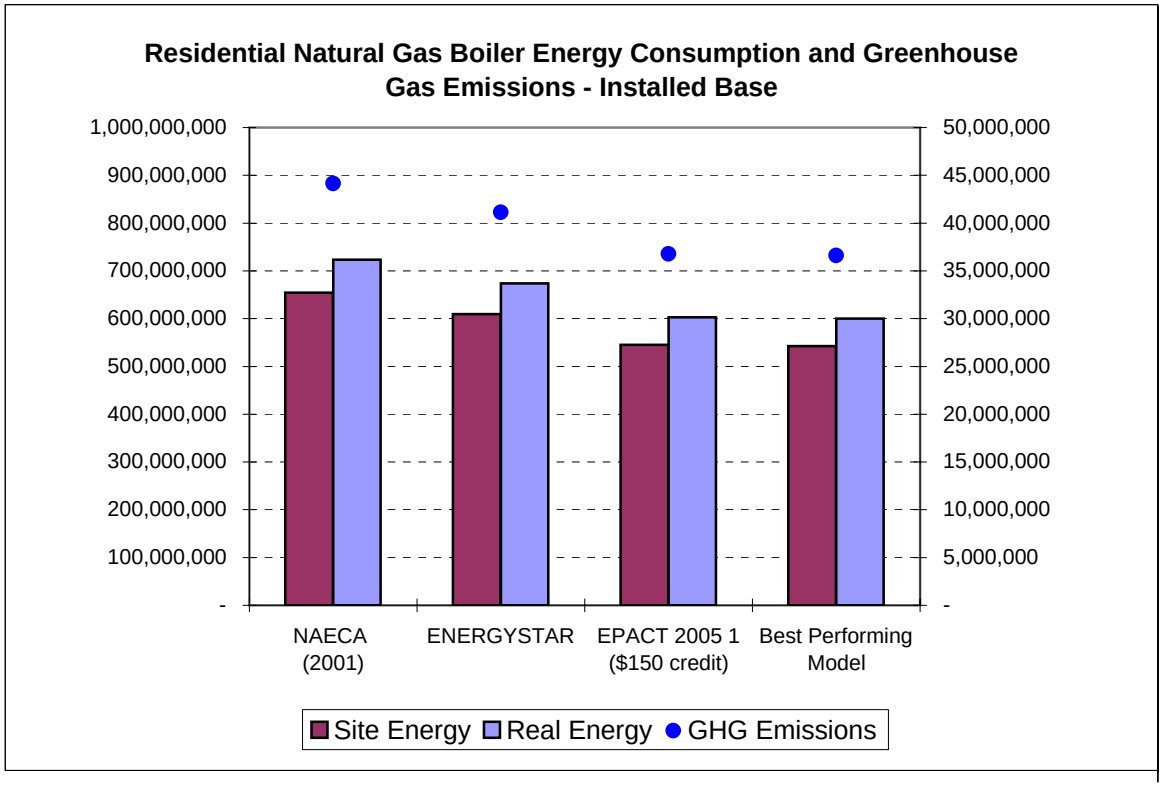
Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	654,679,292	723,402,533	44,145,640
ENERGYSTAR	609,694,118	673,695,158	41,112,247
EPACT 2005 [1] ($150 credit)	545,515,789	602,779,878	36,784,642
Best Performing Model	542,855,698	599,840,550	36,605,270



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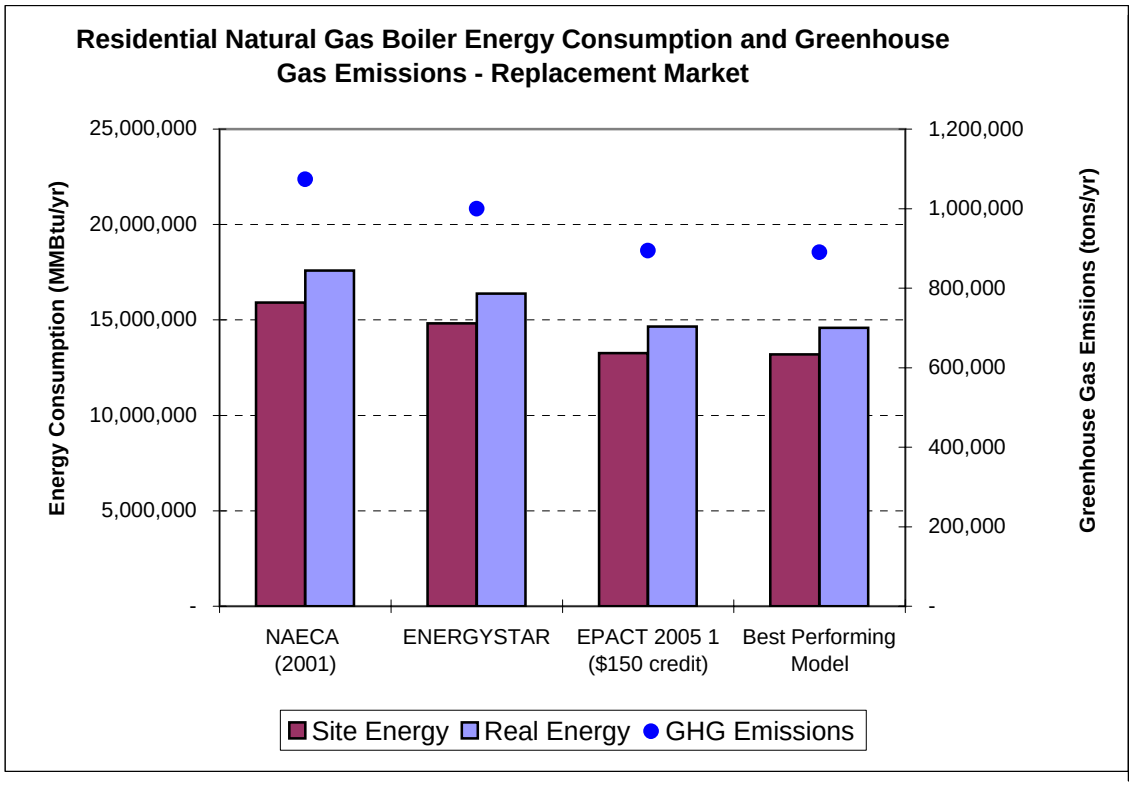
Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	15,919,480	17,590,586	1,073,465
ENERGYSTAR	14,825,600	16,381,878	999,704
EPACT 2005 [1] ($150 credit)	13,265,011	14,657,470	894,472
Best Performing Model	13,200,327	14,585,996	890,110



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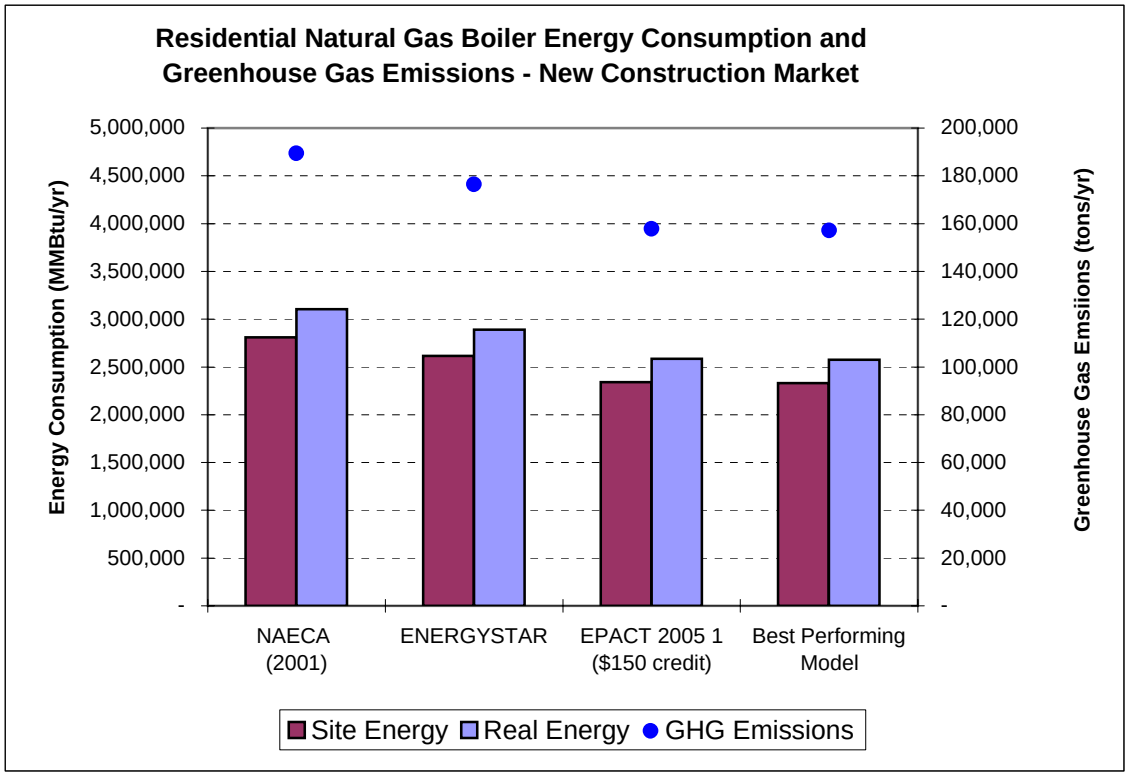
Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	2,809,320	3,104,221	189,435
ENERGYSTAR	2,616,282	2,890,920	176,418
EPACT 2005 [1] ($150 credit)	2,340,884	2,586,612	157,848
Best Performing Model	2,329,469	2,573,999	157,078



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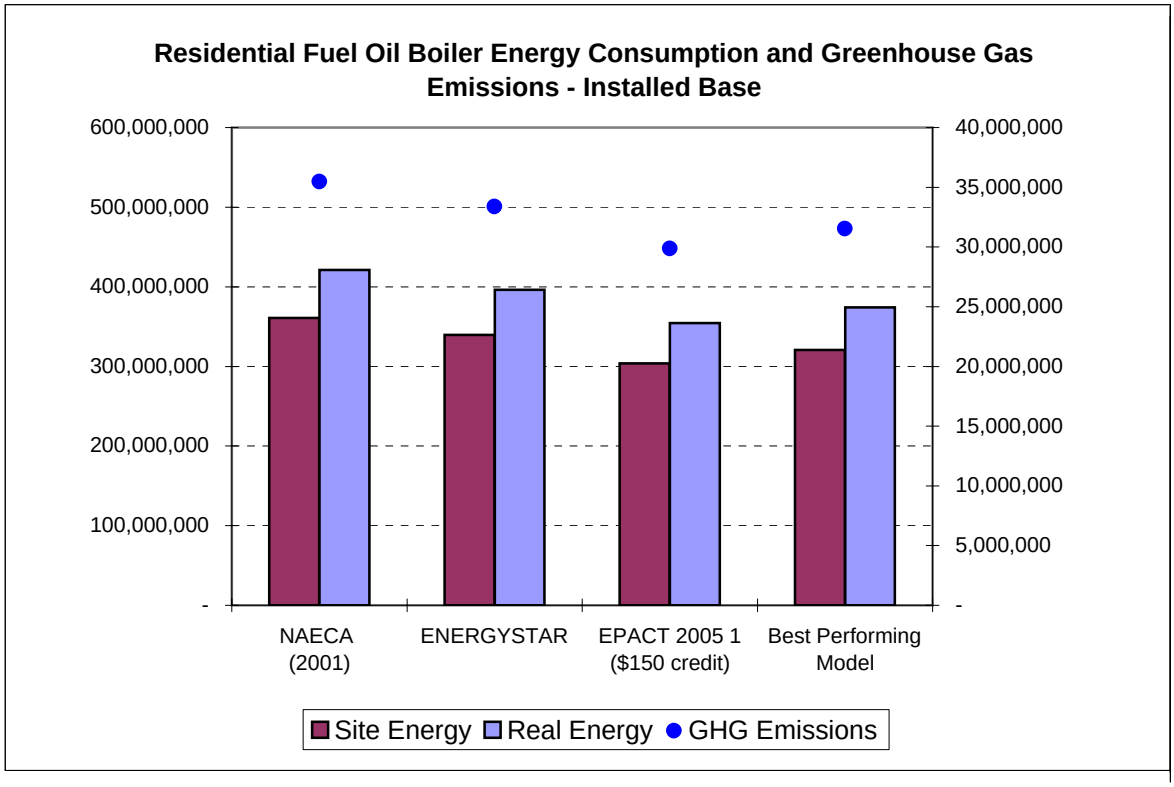
Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	360,800,000	421,003,501	35,480,070
ENERGYSTAR	339,576,471	396,238,589	33,393,007
EPACT 2005 [1] ($150 credit)	303,831,579	354,529,264	29,877,954
Best Performing Model	320,711,111	374,225,334	31,537,840



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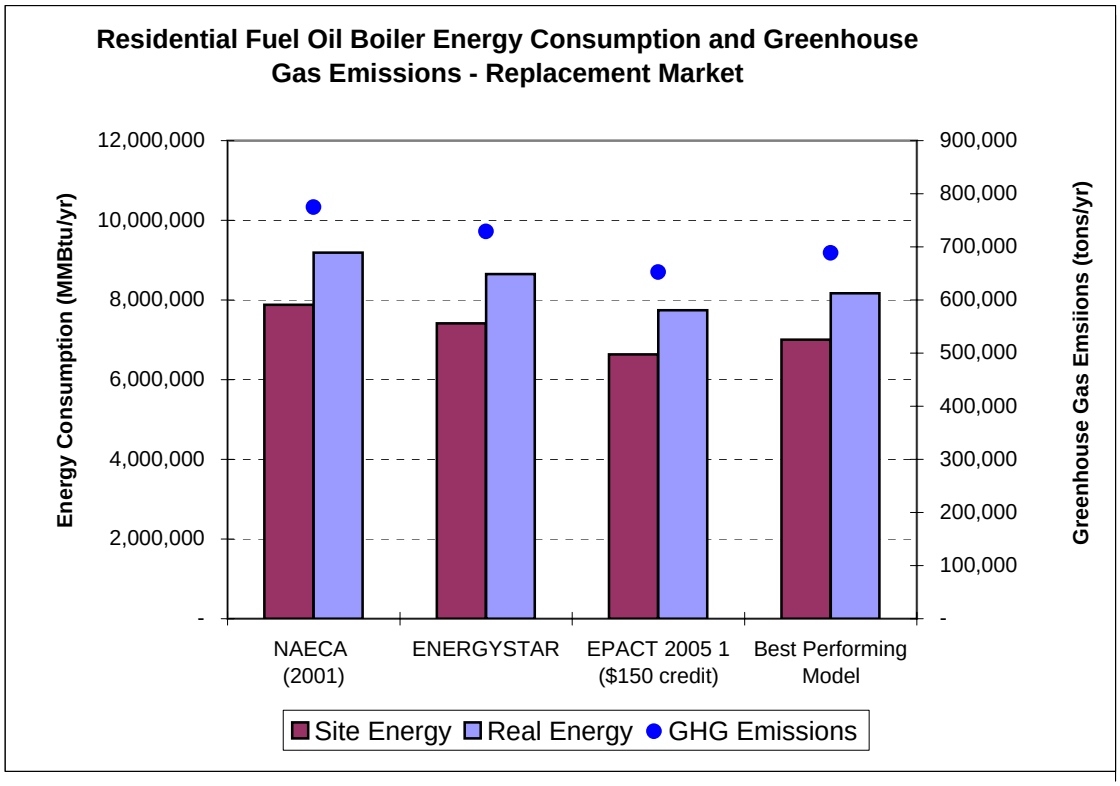
Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
NAECA (2001)	7,876,100	9,190,315	774,514
ENERGYSTAR	7,412,800	8,649,708	728,954
EPACT 2005 [1] ($150 credit)	6,632,505	7,739,213	652,222
Best Performing Model	7,000,978	8,169,169	688,457



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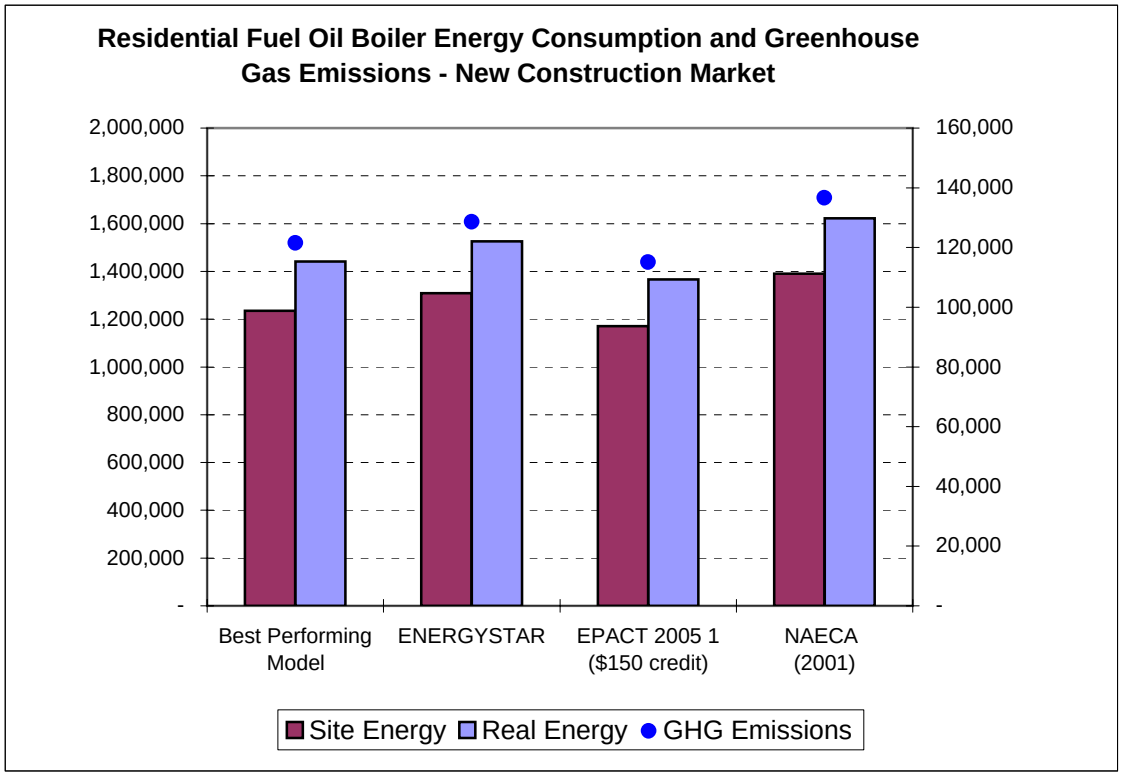
Residential Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumptions & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
Best Performing Model	1,235,467	1,441,618	121,492
ENERGYSTAR	1,308,141	1,526,419	128,639
EPACT 2005 [1] ($150 credit)	1,170,442	1,365,743	115,098
NAECA (2001)	1,389,900	1,621,820	136,679



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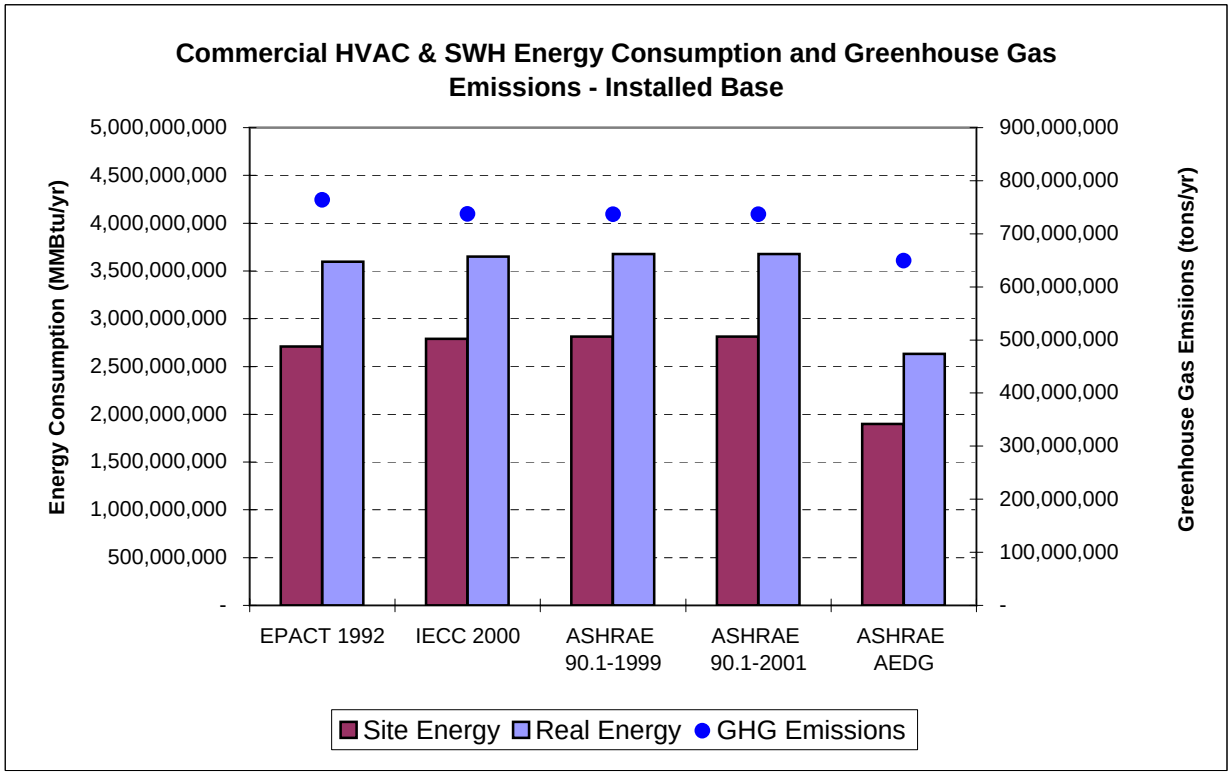
Appendix E

Commercial Appliance Energy Consumption and Greenhouse Gas Emissions

Commercial HVAC & SWH Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

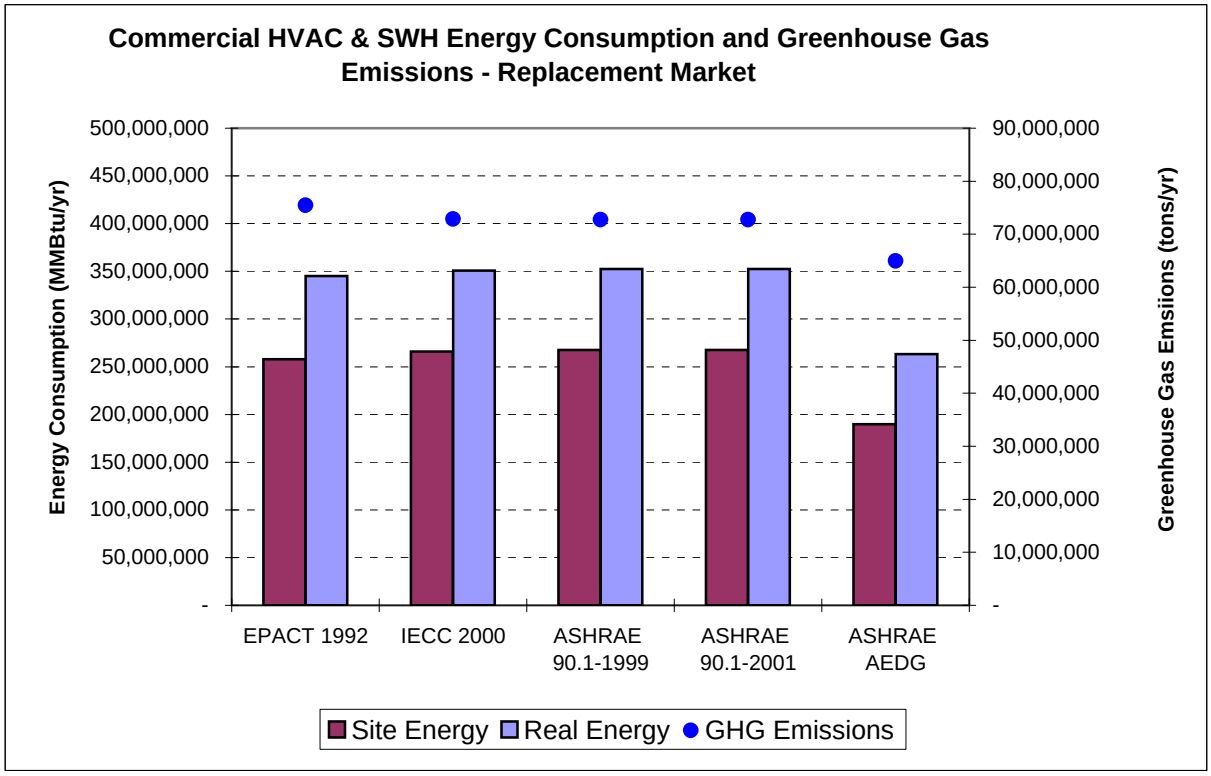
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	2,710,515,594	3,595,563,291	763,507,720
IECC 2000	2,789,265,057	3,650,564,442	737,307,597
ASHRAE 90.1-1999	2,814,022,041	3,675,879,555	736,854,210
ASHRAE 90.1-2001	2,814,022,041	3,675,879,555	736,854,210
ASHRAE AEDG	1,898,731,091	2,633,334,606	649,295,286



Commercial HVAC & SWH Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

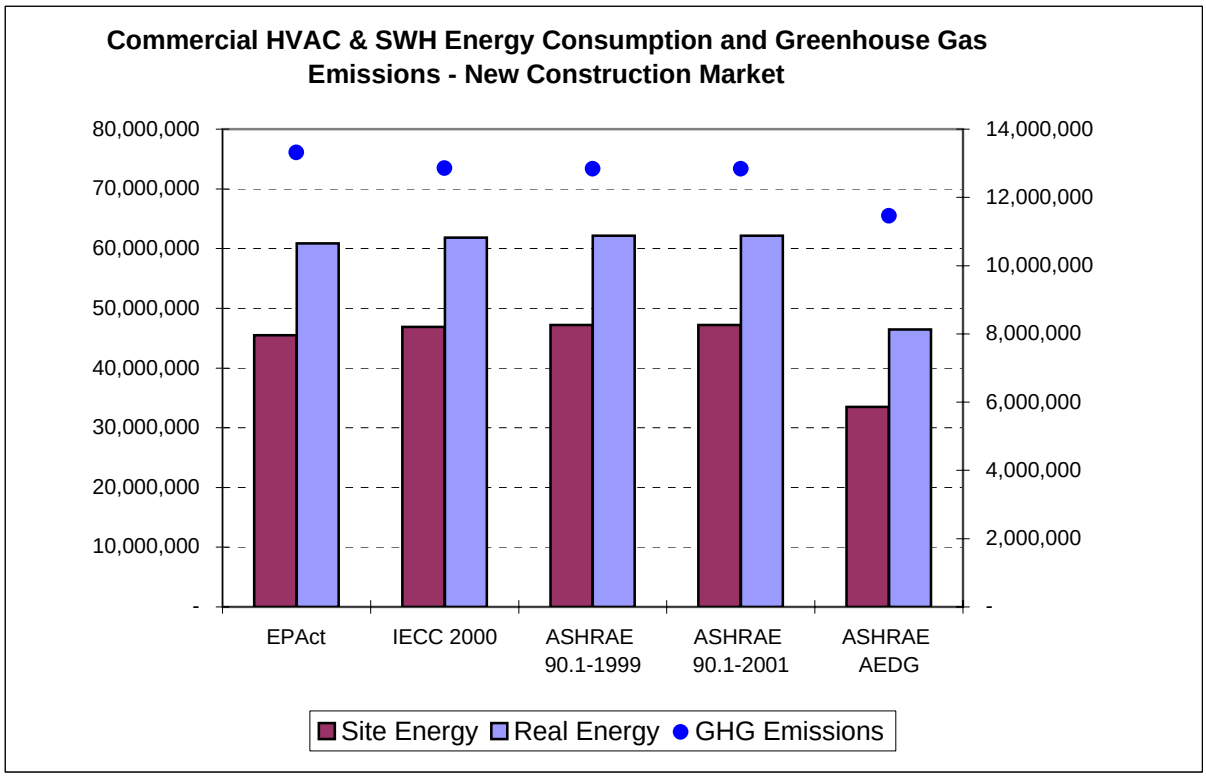
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	258,012,080	345,148,065	75,471,508
IECC 2000	265,887,026	350,648,180	72,851,495
ASHRAE 90.1-1999	267,663,101	352,406,626	72,758,980
ASHRAE 90.1-2001	267,663,101	352,406,626	72,758,980
ASHRAE AEDG	189,873,109	263,333,461	64,929,529



Commercial HVAC & SWH Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

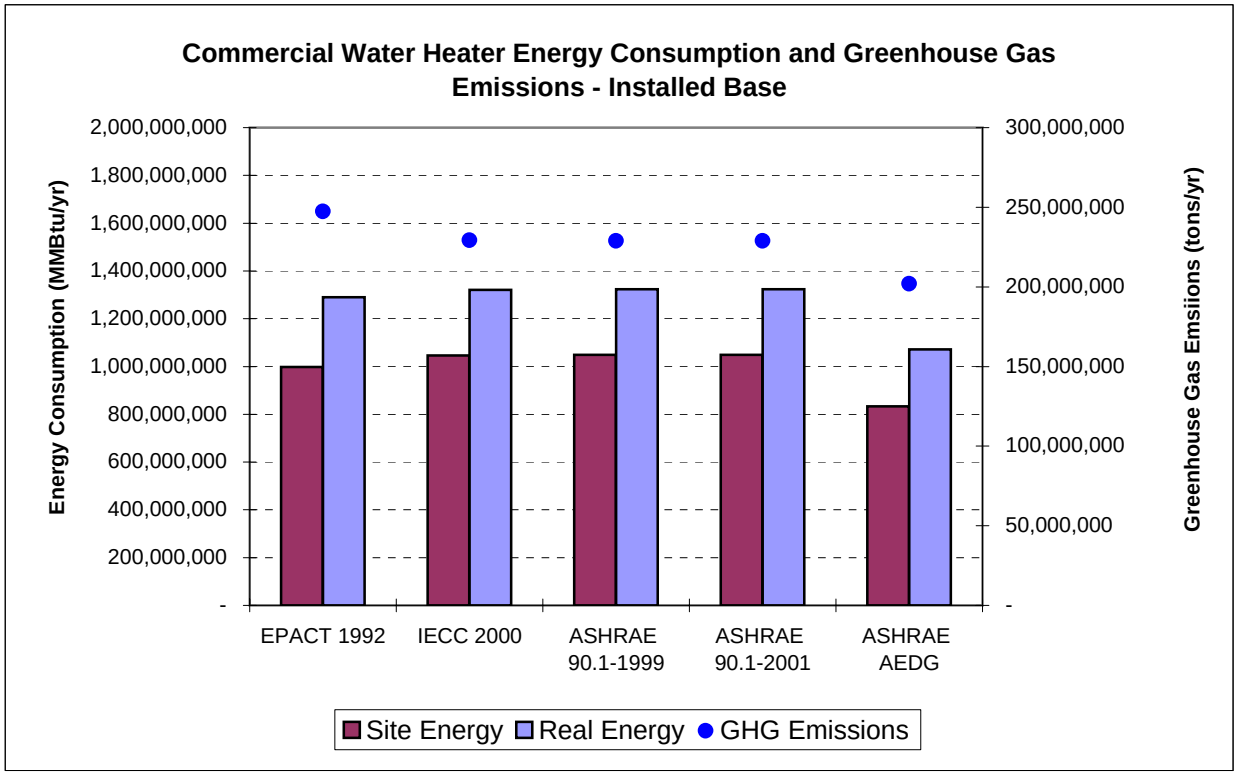
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	45,488,611	60,861,043	13,315,606
IECC 2000	46,878,308	61,831,652	12,853,251
ASHRAE 90.1-1999	47,189,429	62,139,420	12,836,770
ASHRAE 90.1-2001	47,189,429	62,139,420	12,836,770
ASHRAE AEDG	33,507,019	46,470,611	11,458,152



Commercial Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

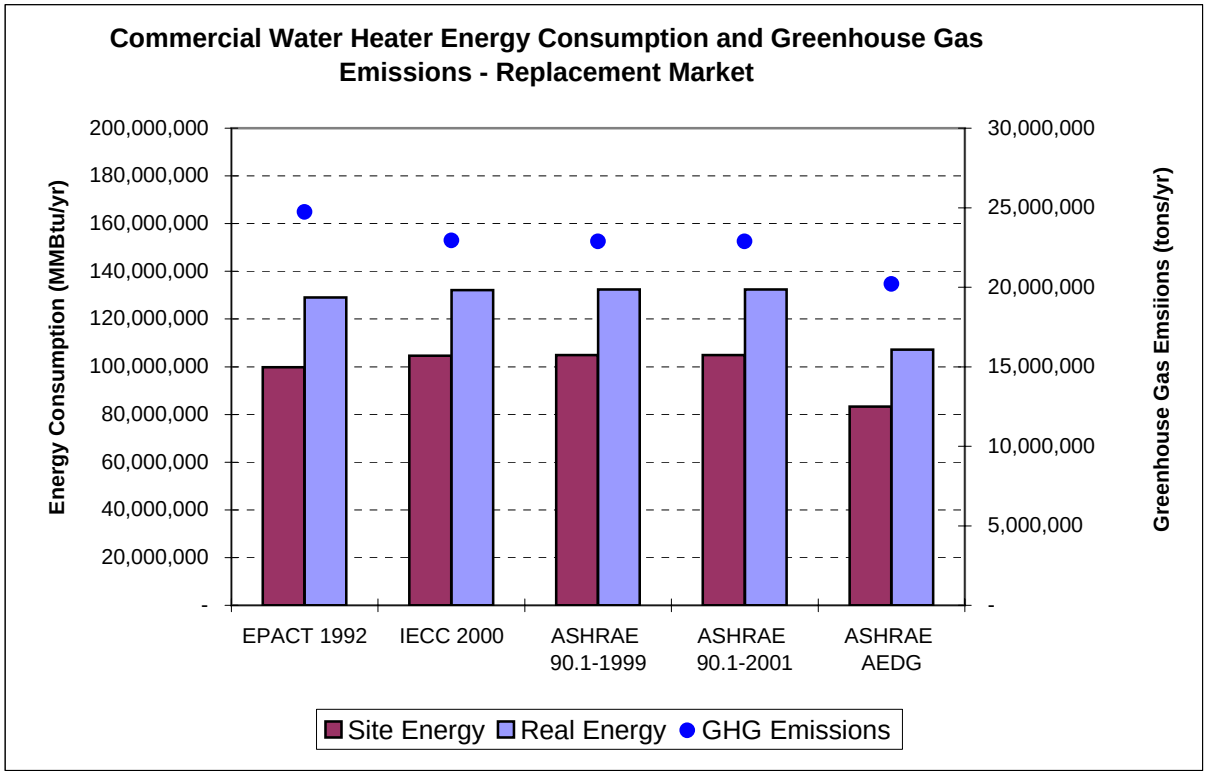
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	998,351,171	1,290,088,026	247,297,834
IECC 2000	1,045,740,168	1,320,890,638	229,280,202
ASHRAE 90.1-1999	1,048,651,987	1,323,475,377	228,823,886
ASHRAE 90.1-2001	1,048,651,987	1,323,475,377	228,823,886
ASHRAE AEDG	833,418,579	1,071,144,613	201,945,233



Commercial Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

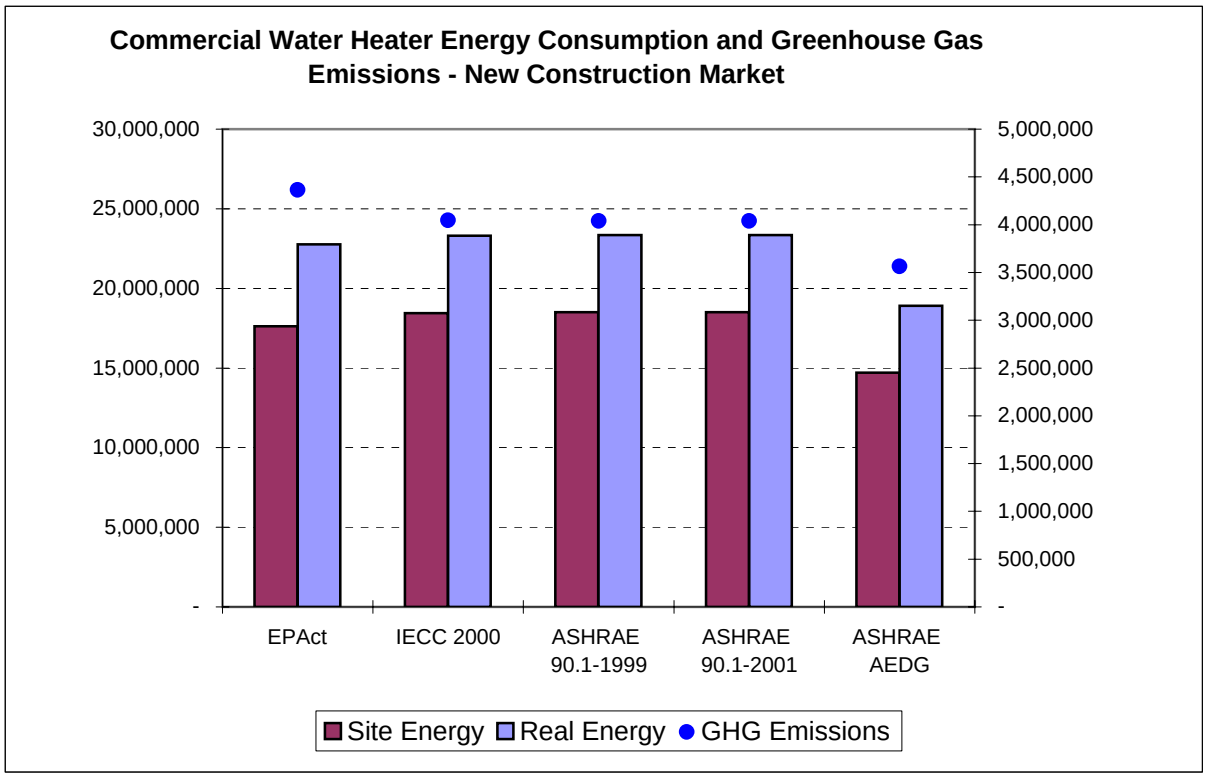
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	99,835,117	129,008,803	24,729,783
IECC 2000	104,574,017	132,089,064	22,928,020
ASHRAE 90.1-1999	104,865,199	132,347,538	22,882,389
ASHRAE 90.1-2001	104,865,199	132,347,538	22,882,389
ASHRAE AEDG	83,341,858	107,114,461	20,194,523



Commercial Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

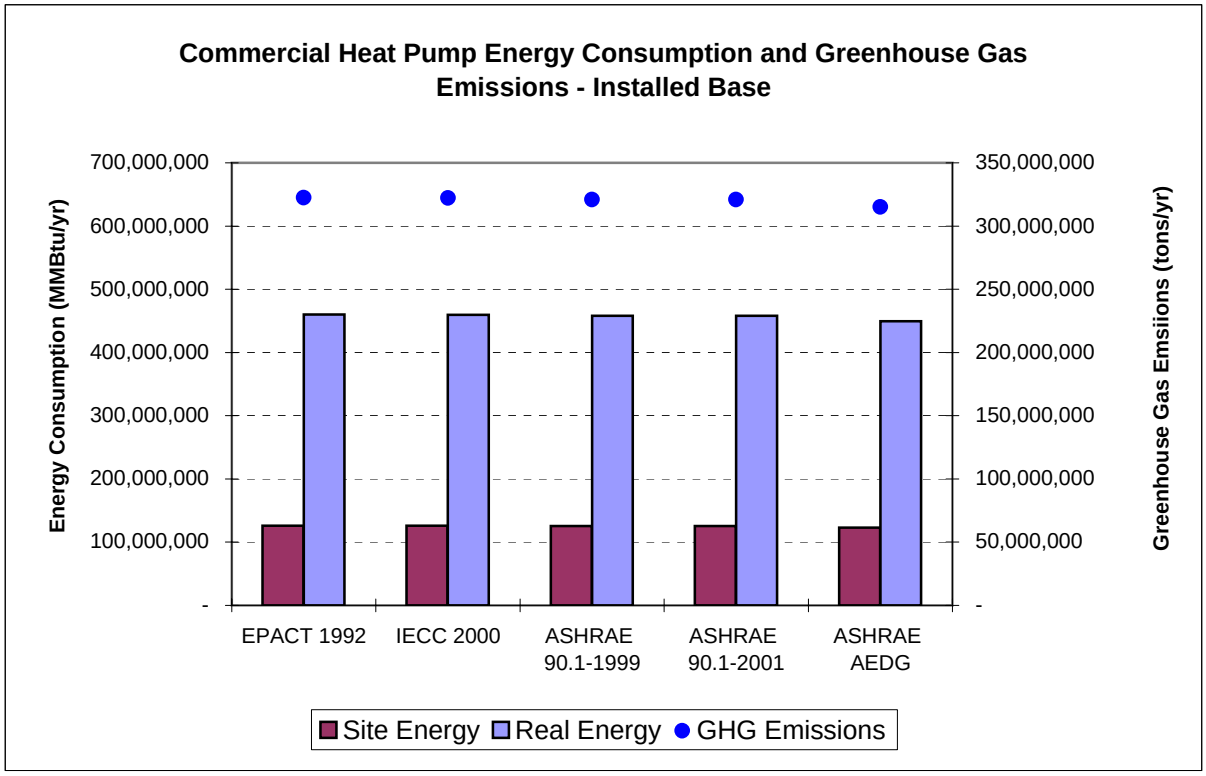
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	17,617,962	22,766,259	4,364,079
IECC 2000	18,454,238	23,309,835	4,046,121
ASHRAE 90.1-1999	18,505,623	23,355,448	4,038,069
ASHRAE 90.1-2001	18,505,623	23,355,448	4,038,069
ASHRAE AEDG	14,707,387	18,902,552	3,563,739



Commercial Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

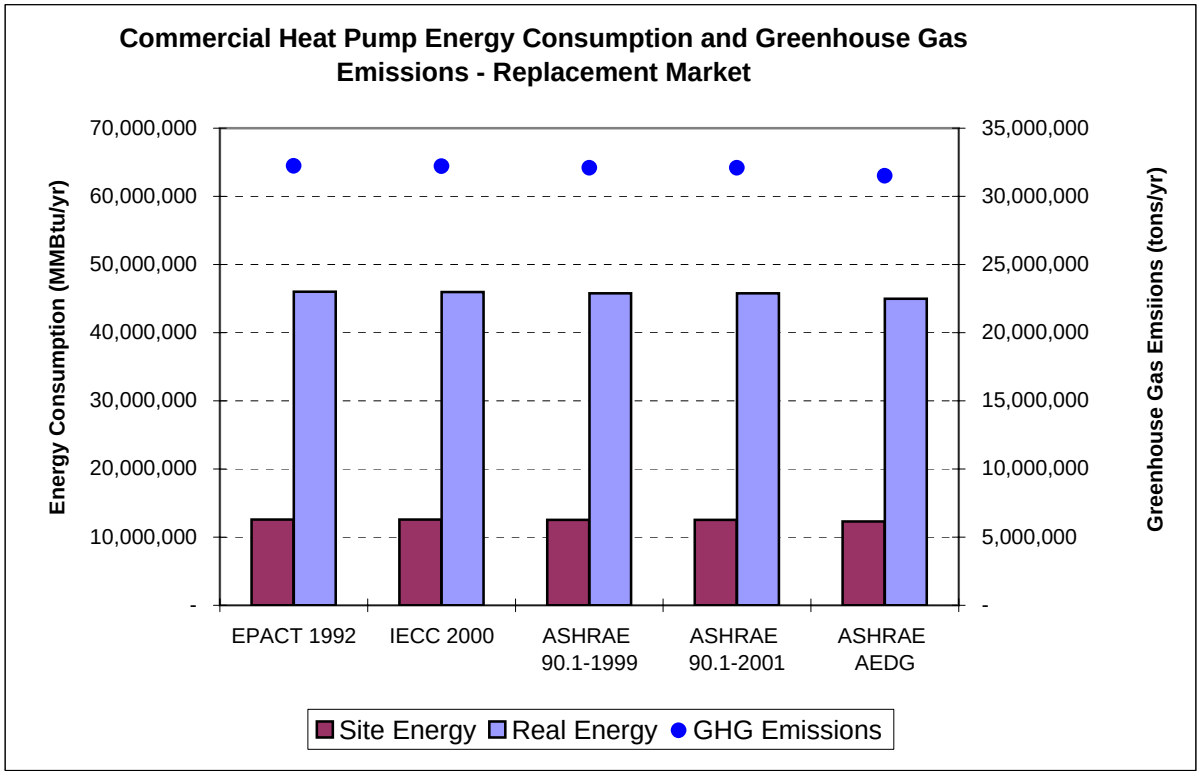
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	126,048,552	460,031,211	322,364,571
IECC 2000	125,976,106	459,766,812	322,179,295
ASHRAE 90.1-1999	125,479,707	457,955,136	320,909,772
ASHRAE 90.1-2001	125,479,707	457,955,136	320,909,772
ASHRAE AEDG	123,174,388	449,541,561	315,014,001



Commercial Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

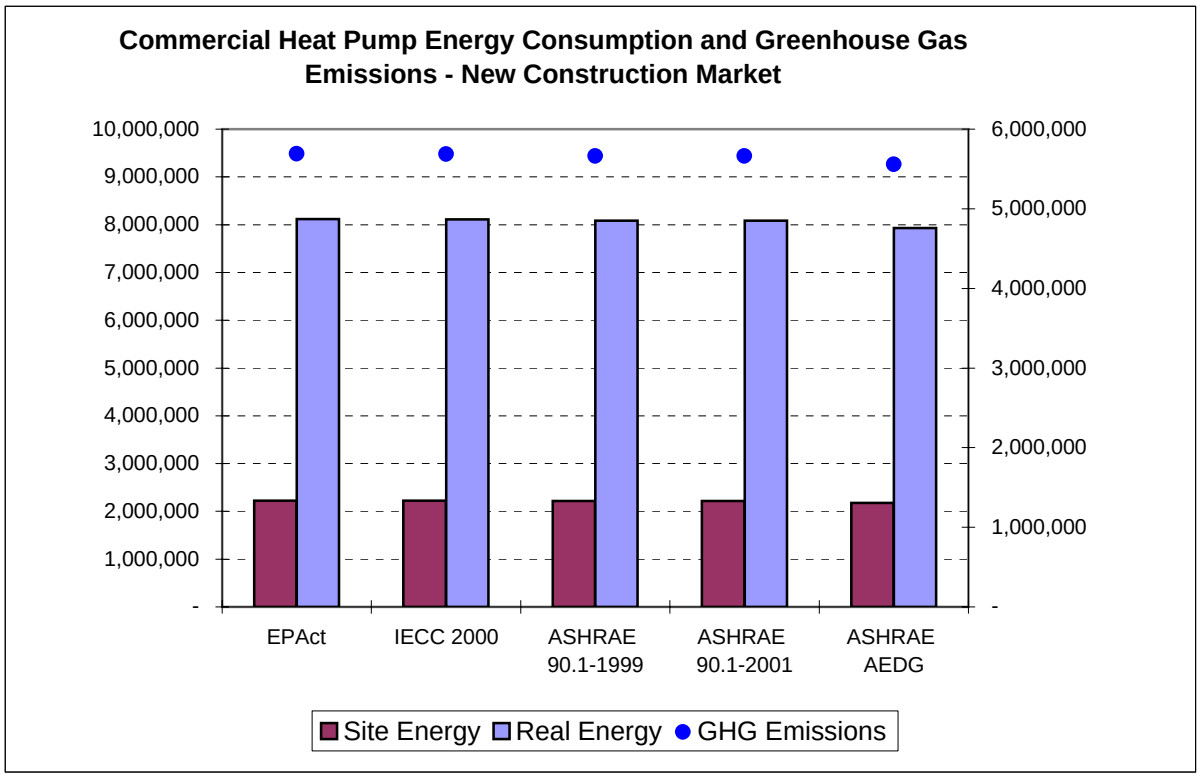
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	12,604,855	46,003,121	32,236,457
IECC 2000	12,597,611	45,976,681	32,217,929
ASHRAE 90.1-1999	12,547,971	45,795,514	32,090,977
ASHRAE 90.1-2001	12,547,971	45,795,514	32,090,977
ASHRAE AEDG	12,317,439	44,954,156	31,501,400



Commercial Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

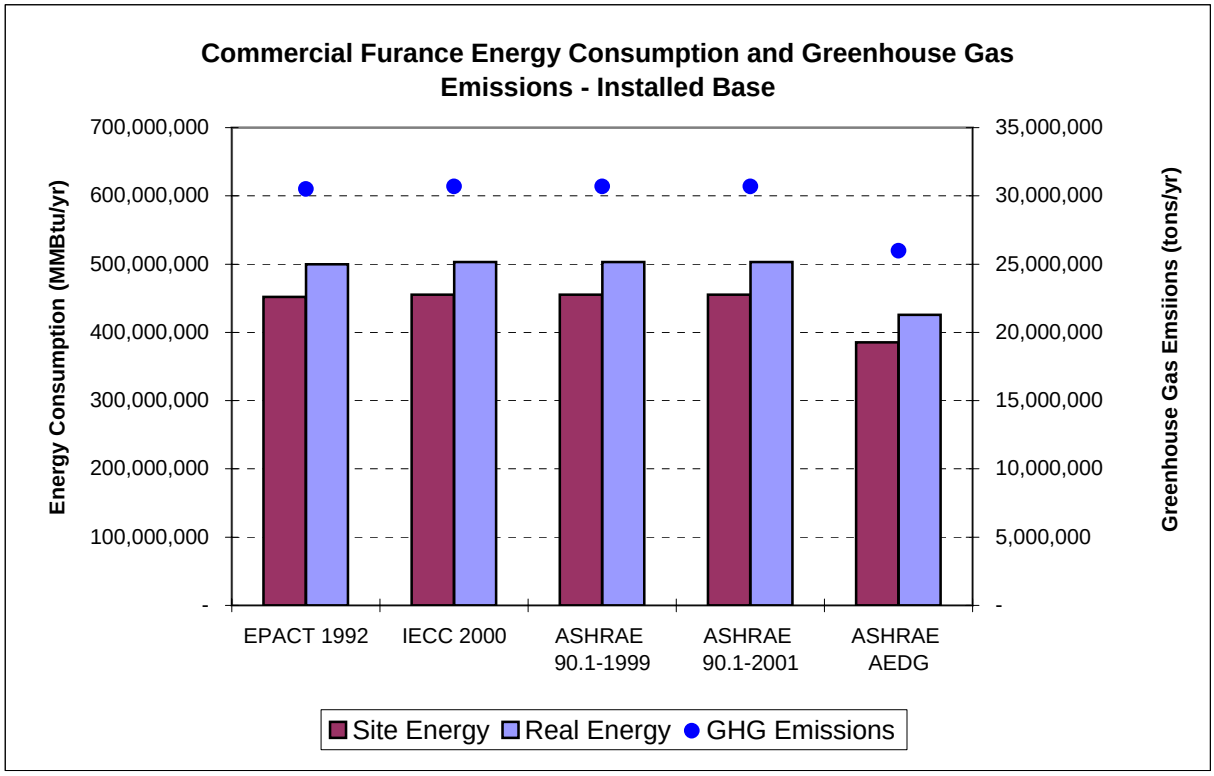
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	2,224,386	8,118,198	5,688,787
IECC 2000	2,223,108	8,113,532	5,685,517
ASHRAE 90.1-1999	2,214,348	8,081,561	5,663,114
ASHRAE 90.1-2001	2,214,348	8,081,561	5,663,114
ASHRAE AEDG	2,173,666	7,933,086	5,559,071



Commercial Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

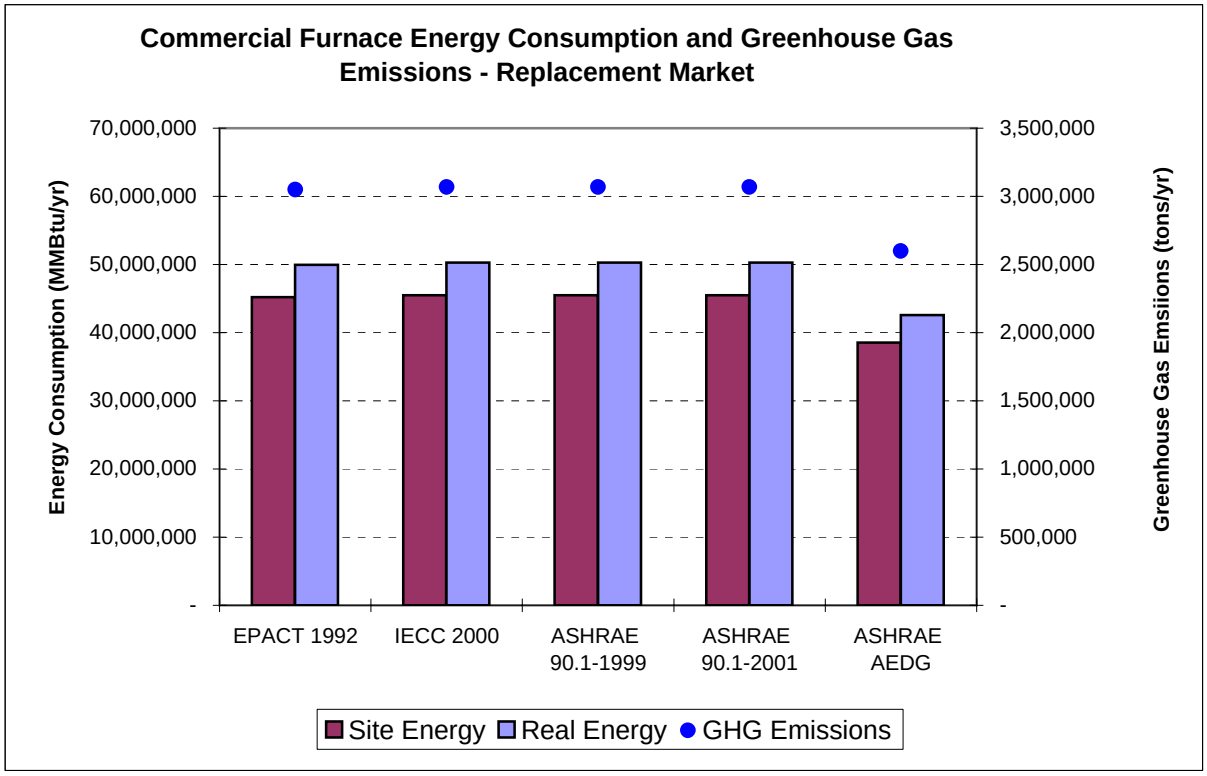
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	452,185,910	499,652,940	30,491,321
IECC 2000	455,101,631	502,874,730	30,687,930
ASHRAE 90.1-1999	455,101,631	502,874,730	30,687,930
ASHRAE 90.1-2001	455,101,631	502,874,730	30,687,930
ASHRAE AEDG	385,331,013	425,780,125	25,983,232



Commercial Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

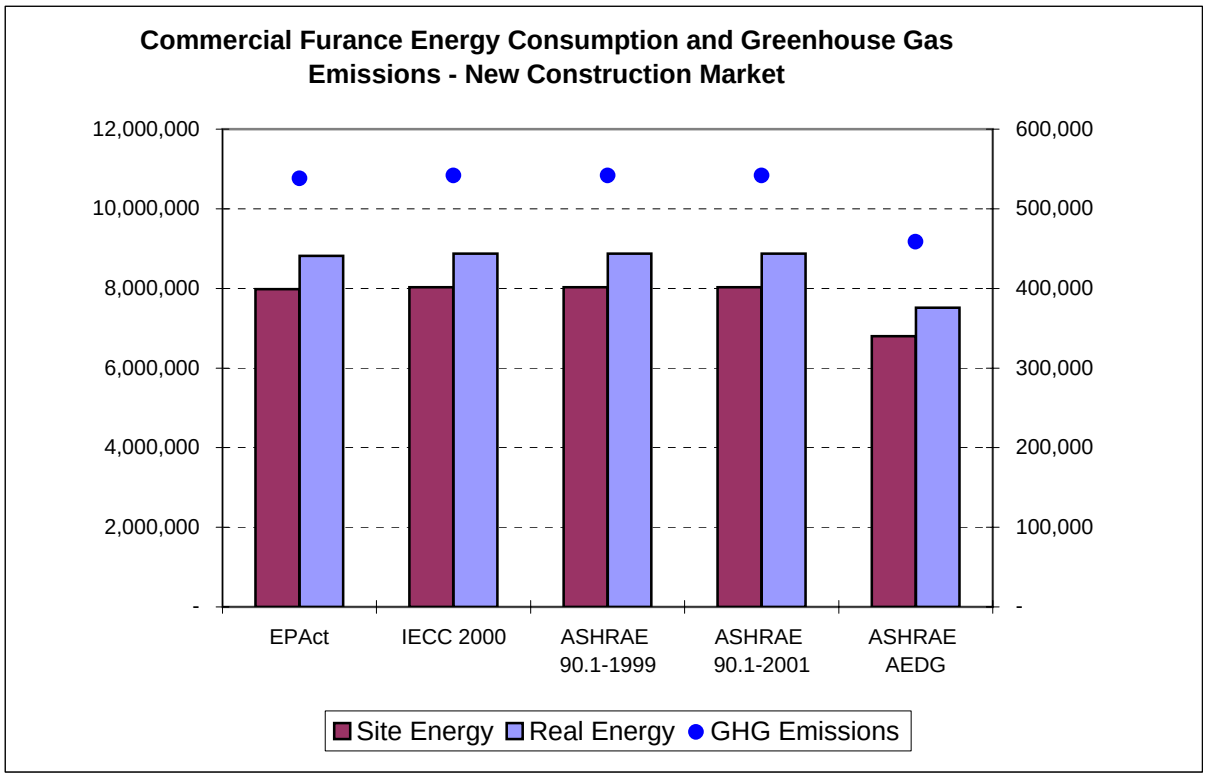
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	45,218,591	49,965,294	3,049,132
IECC 2000	45,510,163	50,287,473	3,068,793
ASHRAE 90.1-1999	45,510,163	50,287,473	3,068,793
ASHRAE 90.1-2001	45,510,163	50,287,473	3,068,793
ASHRAE AEDG	38,533,101	42,578,012	2,598,323



Commercial Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

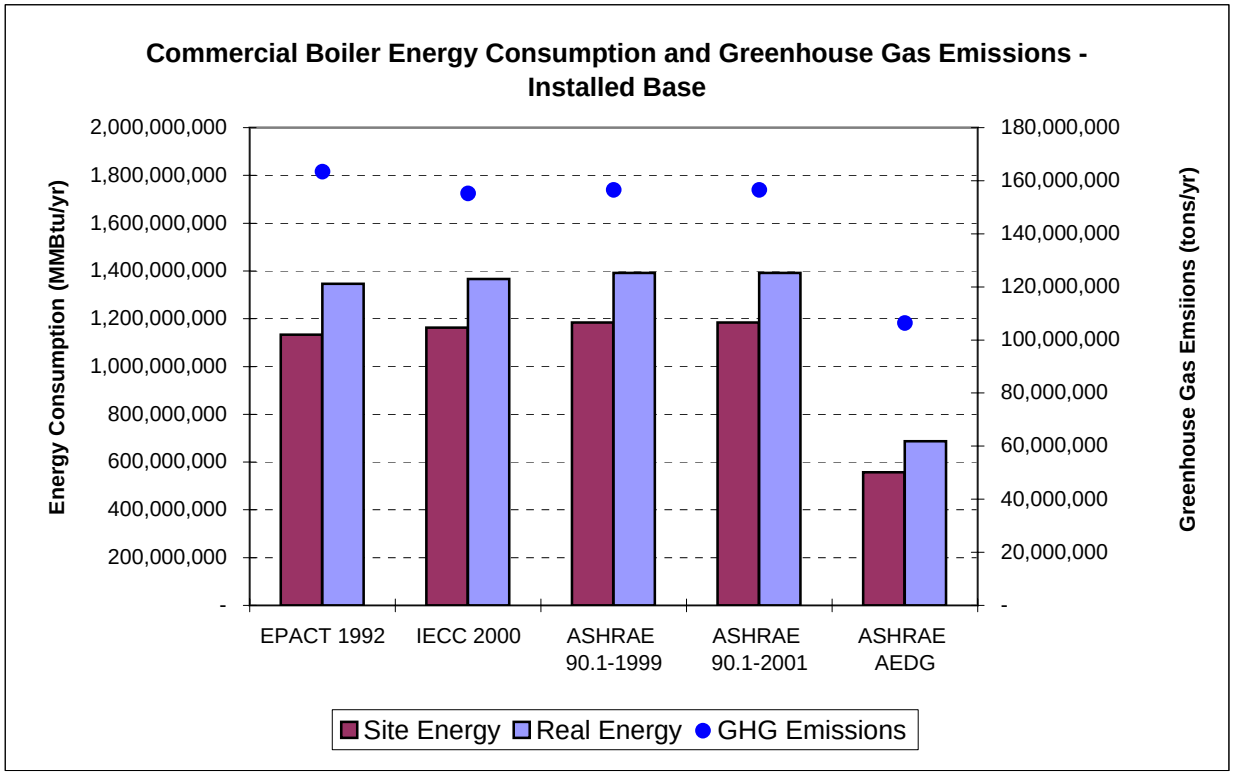
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	7,979,751	8,817,405	538,082
IECC 2000	8,031,205	8,874,260	541,552
ASHRAE 90.1-1999	8,031,205	8,874,260	541,552
ASHRAE 90.1-2001	8,031,205	8,874,260	541,552
ASHRAE AEDG	6,799,959	7,513,767	458,528



Commercial Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

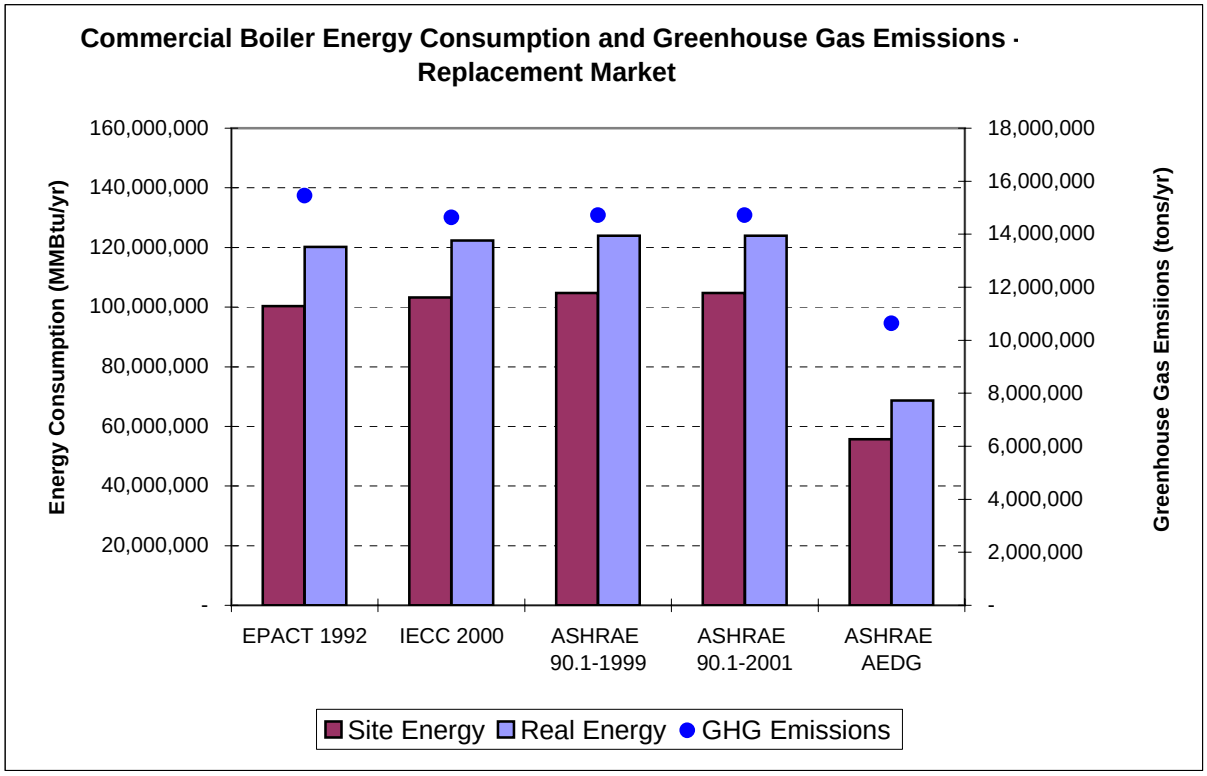
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,133,929,961	1,345,791,115	163,353,994
IECC 2000	1,162,447,151	1,367,032,262	155,160,170
ASHRAE 90.1-1999	1,184,788,716	1,391,574,312	156,432,622
ASHRAE 90.1-2001	1,184,788,716	1,391,574,312	156,432,622
ASHRAE AEDG	556,807,111	686,868,308	106,352,819



Commercial Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

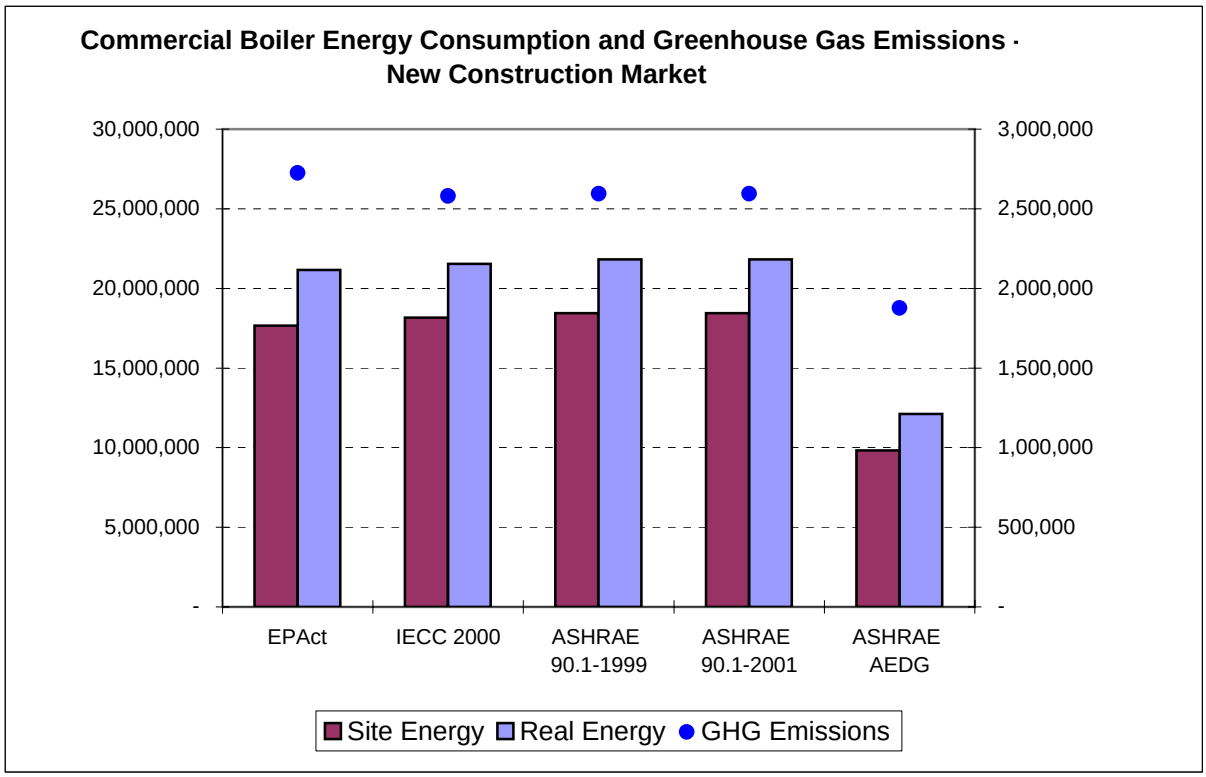
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	100,353,517	120,170,847	15,456,135
IECC 2000	103,205,236	122,294,962	14,636,753
ASHRAE 90.1-1999	104,739,768	123,976,101	14,716,821
ASHRAE 90.1-2001	104,739,768	123,976,101	14,716,821
ASHRAE AEDG	55,680,711	68,686,831	10,635,282



Commercial Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

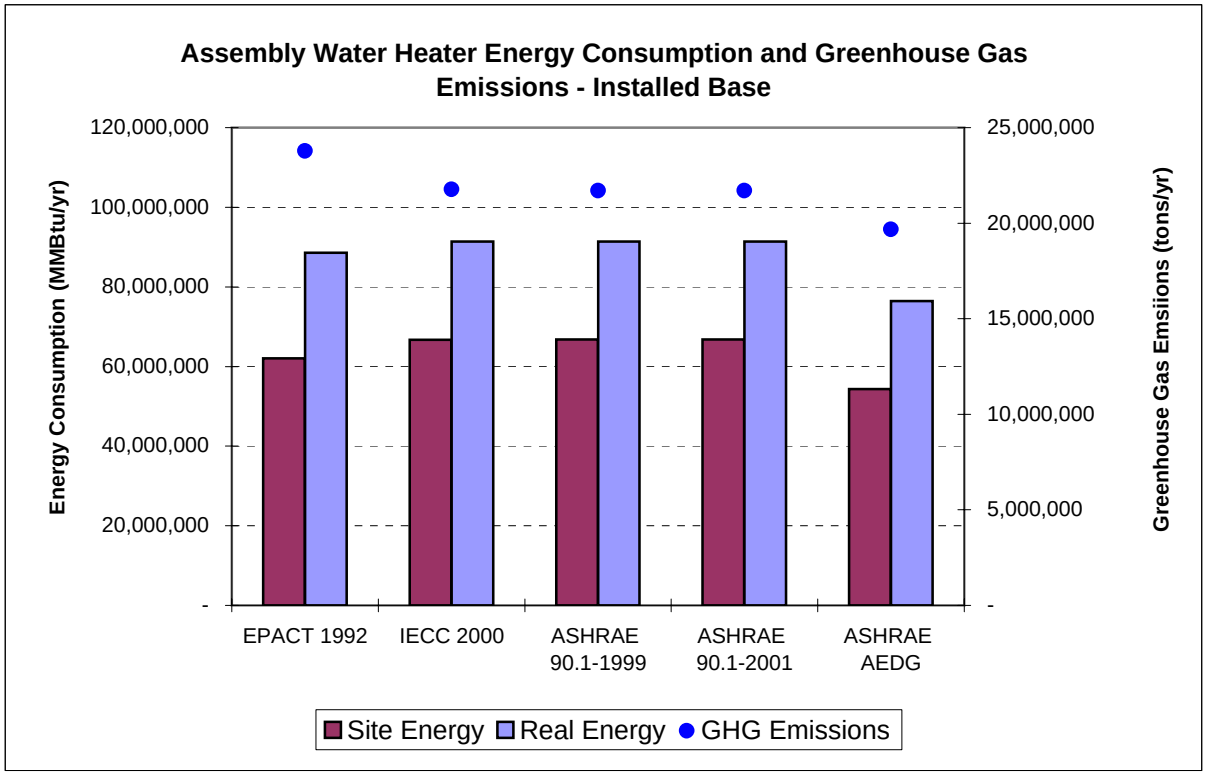
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	17,666,512	21,159,181	2,724,658
IECC 2000	18,169,757	21,534,025	2,580,061
ASHRAE 90.1-1999	18,438,253	21,828,151	2,594,036
ASHRAE 90.1-2001	18,438,253	21,828,151	2,594,036
ASHRAE AEDG	9,826,008	12,121,205	1,876,814



Assembly Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

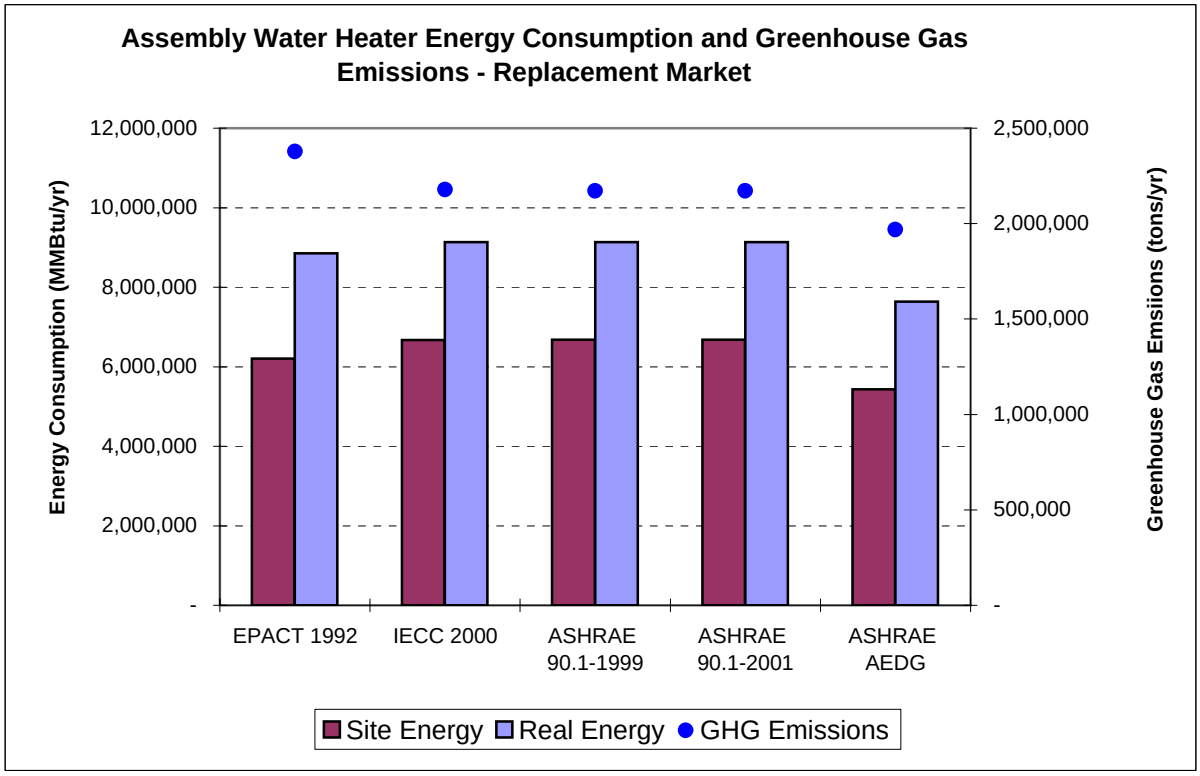
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	62,021,630	88,560,226	23,780,243
IECC 2000	66,699,028	91,357,061	21,774,997
ASHRAE 90.1-1999	66,793,139	91,385,044	21,706,969
ASHRAE 90.1-2001	66,793,139	91,385,044	21,706,969
ASHRAE AEDG	54,326,540	76,400,439	19,682,940



Assembly Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

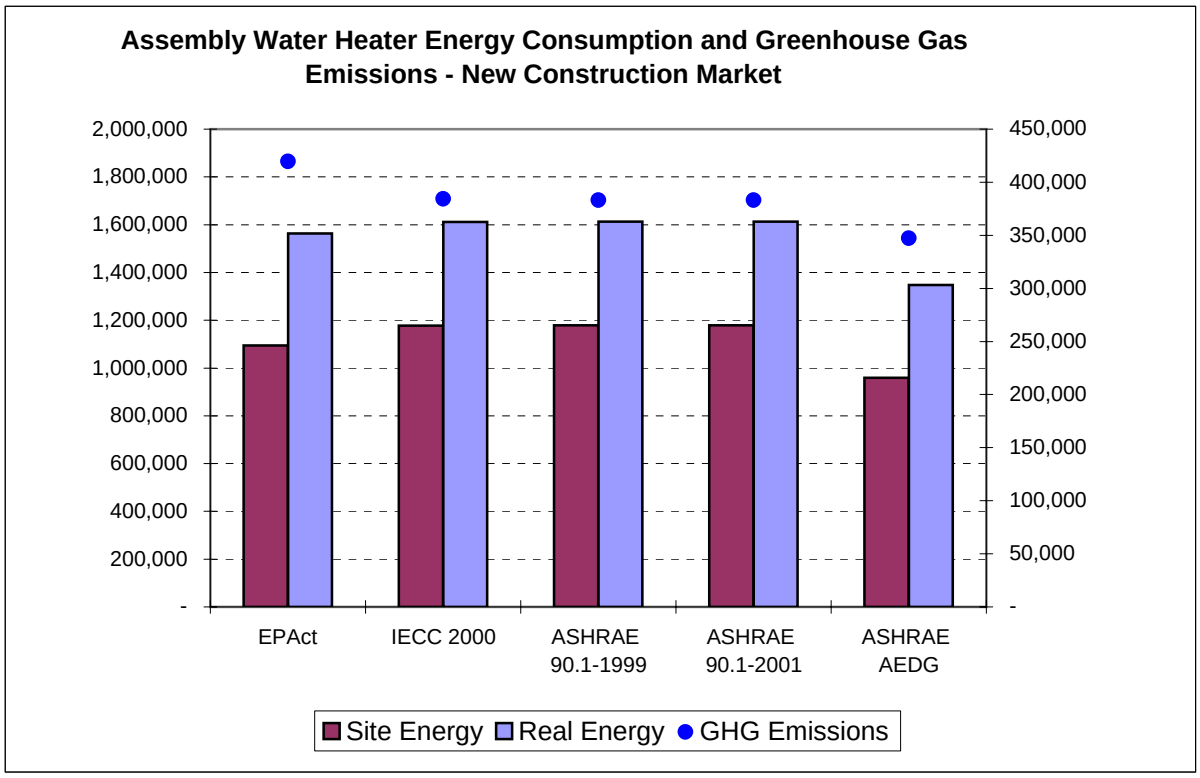
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	6,202,163	8,856,023	2,378,024
IECC 2000	6,669,903	9,135,706	2,177,500
ASHRAE 90.1-1999	6,679,314	9,138,504	2,170,697
ASHRAE 90.1-2001	6,679,314	9,138,504	2,170,697
ASHRAE AEDG	5,432,654	7,640,044	1,968,294



Assembly Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

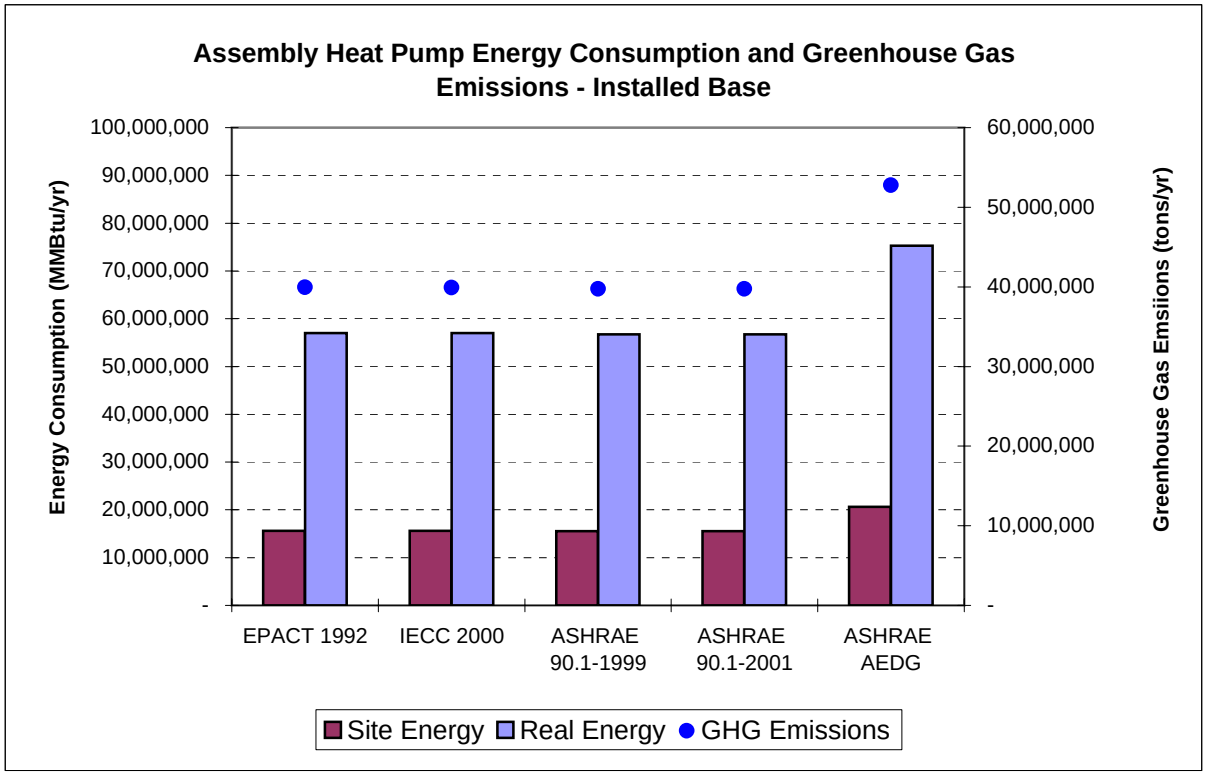
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,094,499	1,562,828	419,651
IECC 2000	1,177,042	1,612,183	384,265
ASHRAE 90.1-1999	1,178,702	1,612,677	383,064
ASHRAE 90.1-2001	1,178,702	1,612,677	383,064
ASHRAE AEDG	958,704	1,348,243	347,346



Assembly Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

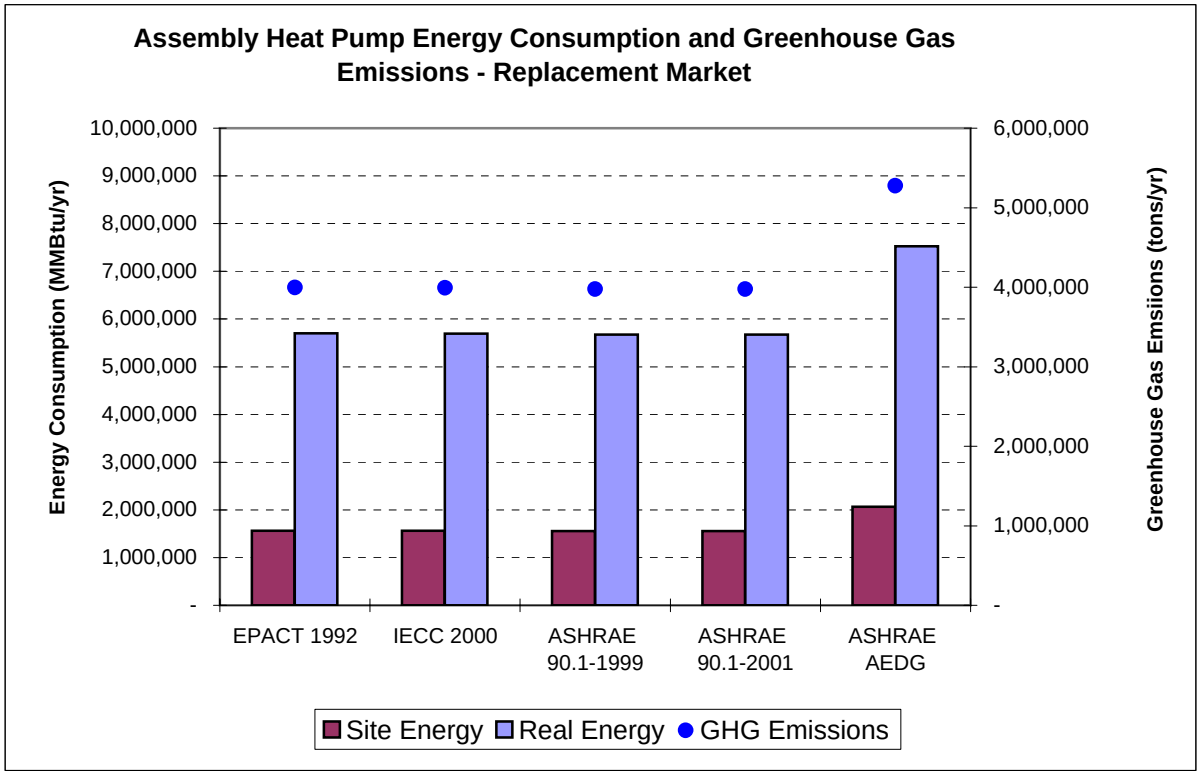
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	15,618,584	57,002,132	39,943,959
IECC 2000	15,609,608	56,969,371	39,921,002
ASHRAE 90.1-1999	15,548,099	56,744,887	39,763,696
ASHRAE 90.1-2001	15,548,099	56,744,887	39,763,696
ASHRAE AEDG	20,627,650	75,283,394	52,754,462



Assembly Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

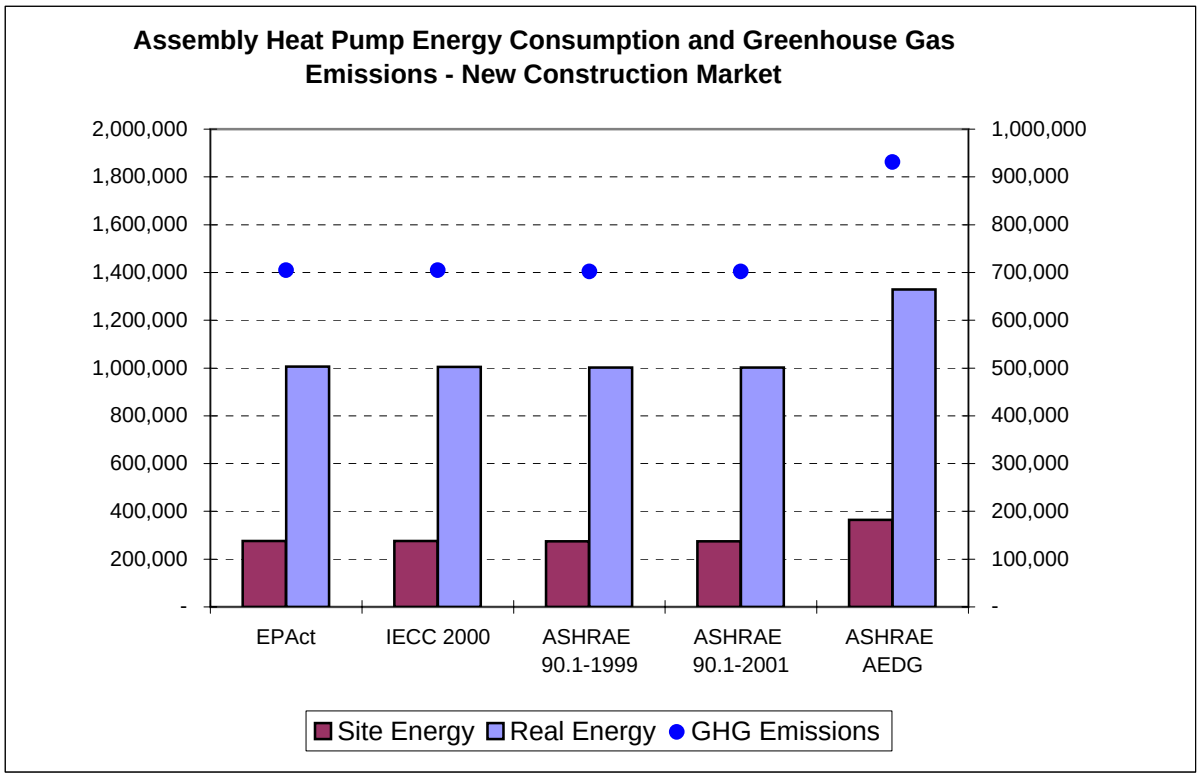
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,561,858	5,700,213	3,994,396
IECC 2000	1,560,961	5,696,937	3,992,100
ASHRAE 90.1-1999	1,554,810	5,674,489	3,976,370
ASHRAE 90.1-2001	1,554,810	5,674,489	3,976,370
ASHRAE AEDG	2,062,765	7,528,339	5,275,446



Assembly Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

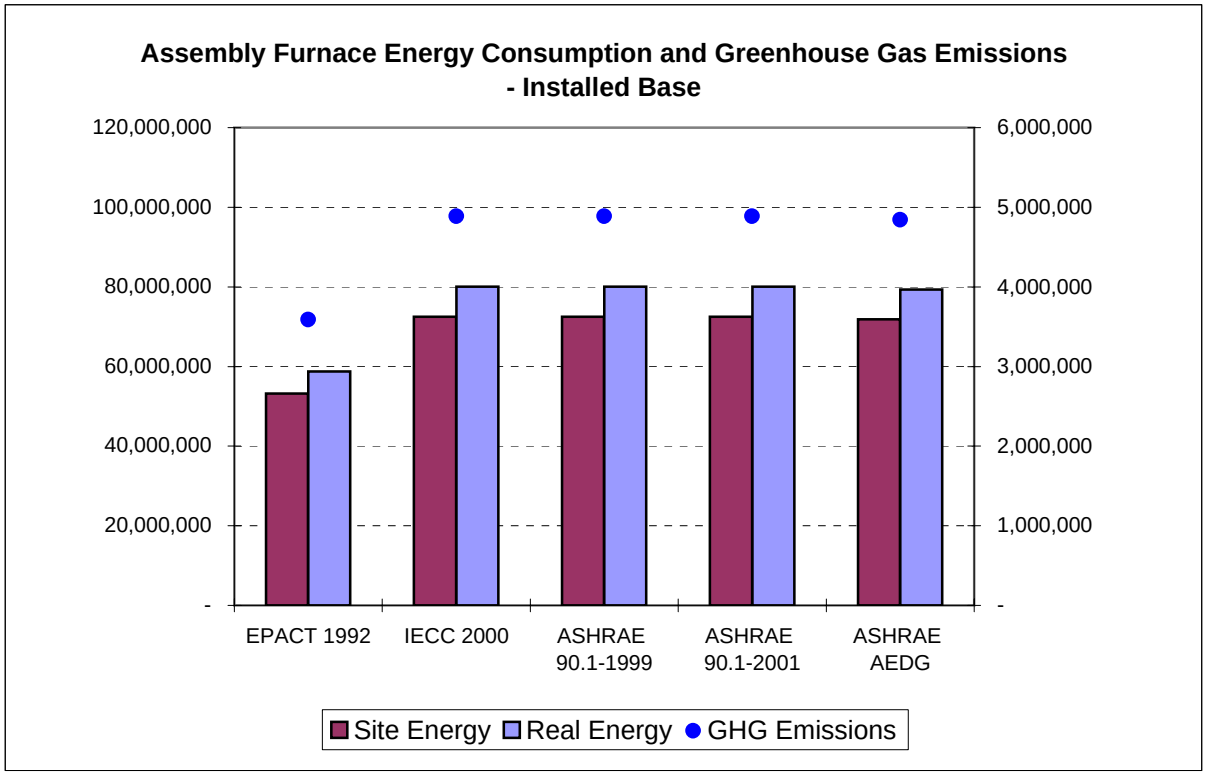
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	275,622	1,005,920	704,893
IECC 2000	275,464	1,005,342	704,488
ASHRAE 90.1-1999	274,378	1,001,380	701,712
ASHRAE 90.1-2001	274,378	1,001,380	701,712
ASHRAE AEDG	364,017	1,328,530	930,961



Assembly Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	53,207,996	58,793,366	3,587,865
IECC 2000	72,472,020	80,079,580	4,886,856
ASHRAE 90.1-1999	72,472,020	80,079,580	4,886,856
ASHRAE 90.1-2001	72,472,020	80,079,580	4,886,856
ASHRAE AEDG	71,819,602	79,358,676	4,842,863

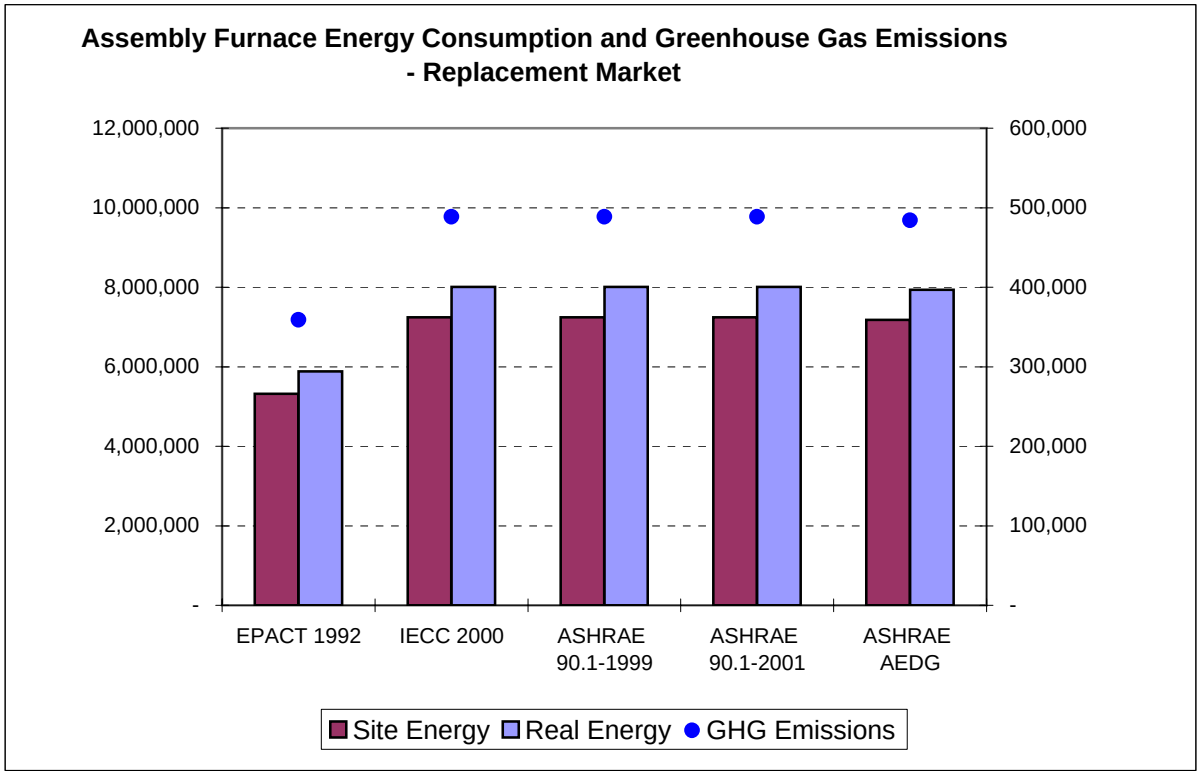


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Assembly Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,320,800	5,879,337	358,787
IECC 2000	7,247,202	8,007,958	488,686
ASHRAE 90.1-1999	7,247,202	8,007,958	488,686
ASHRAE 90.1-2001	7,247,202	8,007,958	488,686
ASHRAE AEDG	7,181,960	7,935,868	484,286

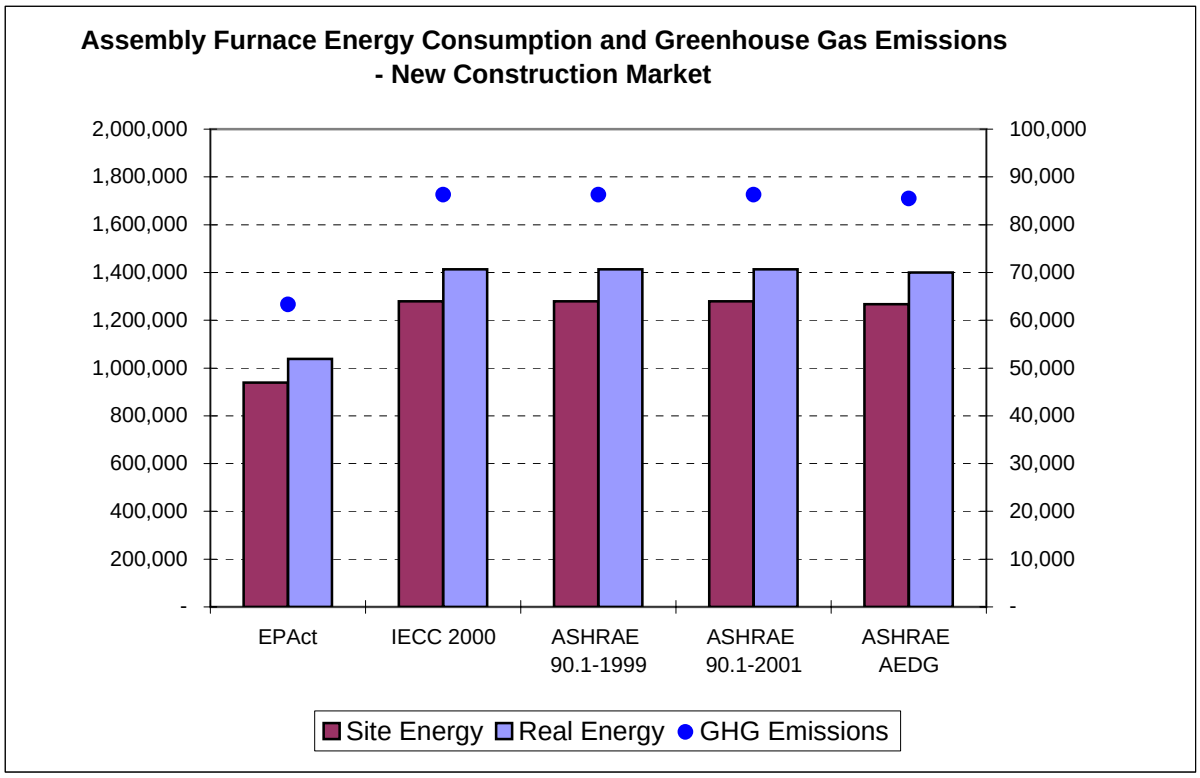


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Assembly Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	938,965	1,037,530	63,315
IECC 2000	1,278,918	1,413,169	86,239
ASHRAE 90.1-1999	1,278,918	1,413,169	86,239
ASHRAE 90.1-2001	1,278,918	1,413,169	86,239
ASHRAE AEDG	1,267,405	1,400,447	85,462

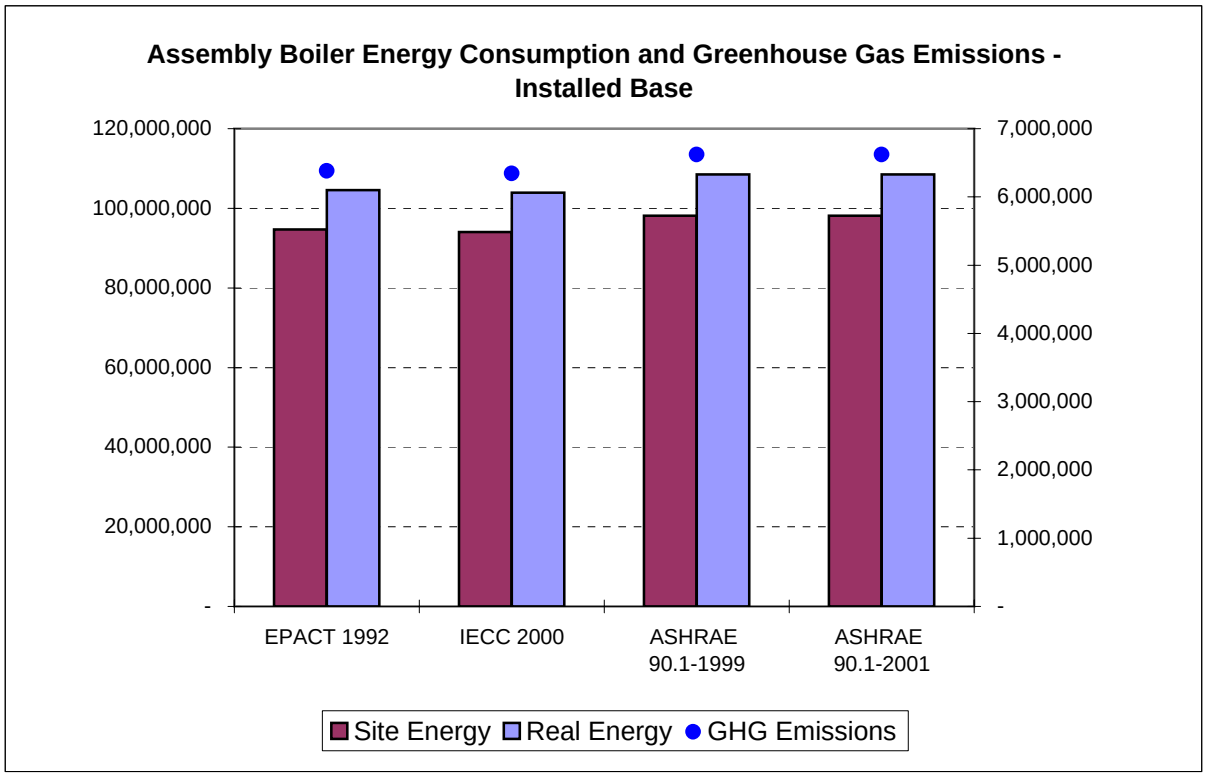


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Assembly Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

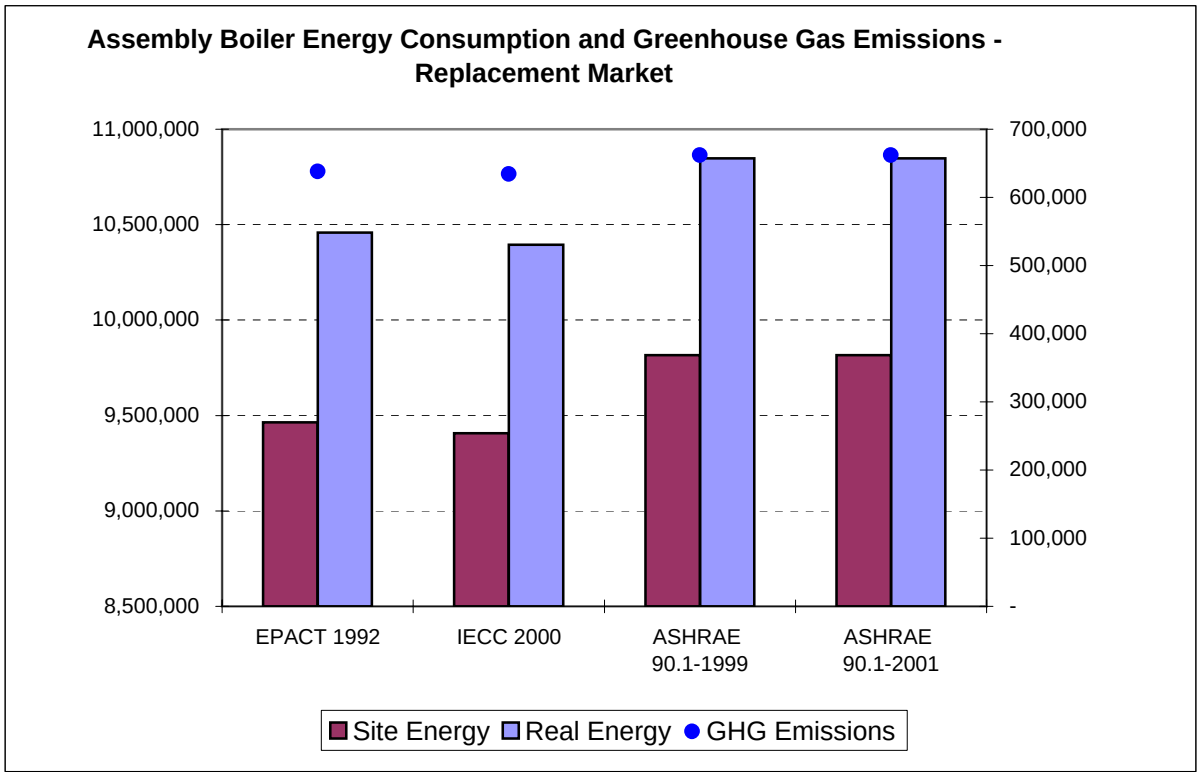
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	94,643,174	104,578,093	6,381,878
IECC 2000	94,070,947	103,945,798	6,343,292
ASHRAE 90.1-1999	98,166,483	108,471,252	6,619,458
ASHRAE 90.1-2001	98,166,483	108,471,252	6,619,458
ASHRAE AEDG	-	-	-



Assembly Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

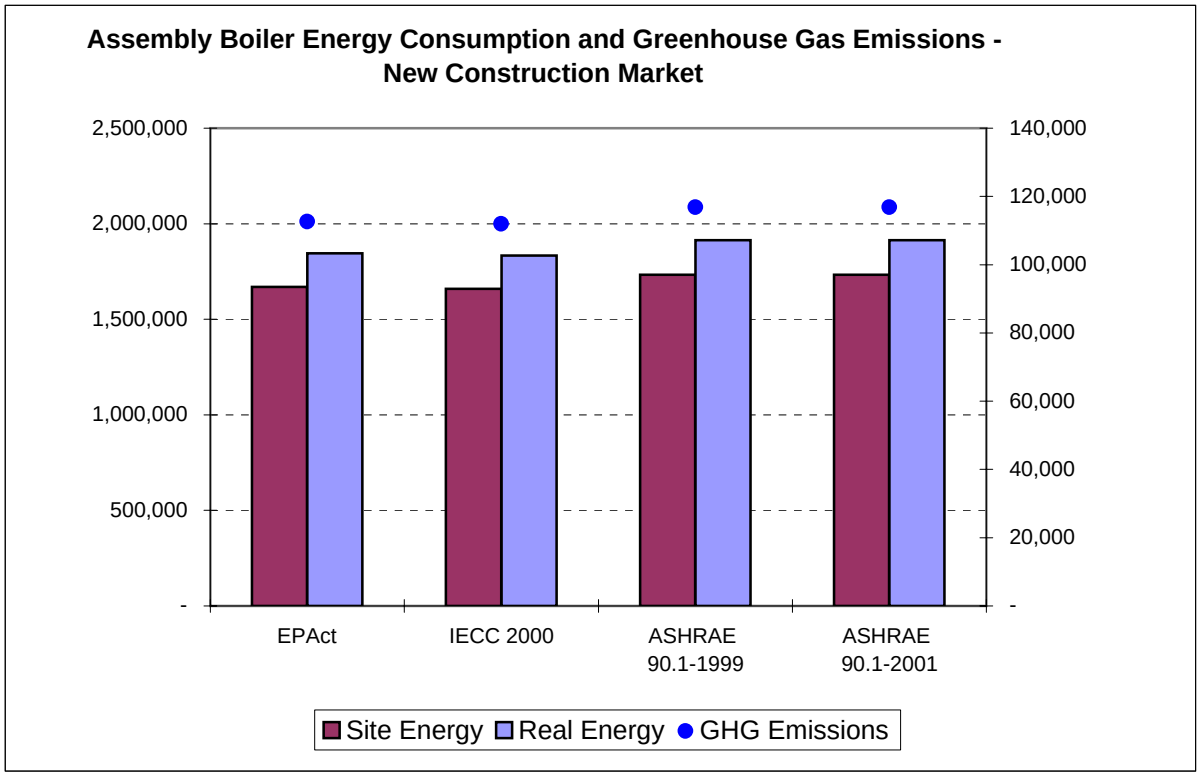
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	9,464,317	10,457,809	638,188
IECC 2000	9,407,095	10,394,580	634,329
ASHRAE 90.1-1999	9,816,648	10,847,125	661,946
ASHRAE 90.1-2001	9,816,648	10,847,125	661,946
ASHRAE AEDG	-	-	-



Assembly Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

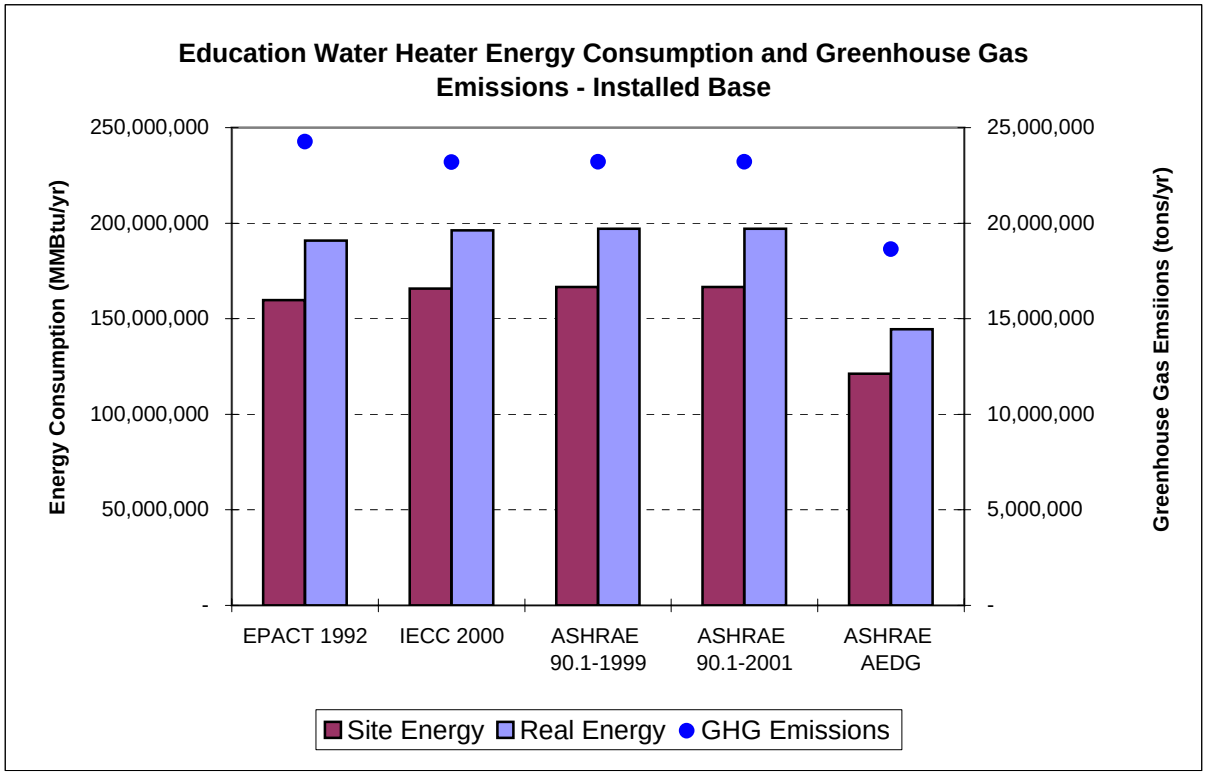
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,670,174	1,845,496	112,621
IECC 2000	1,660,076	1,834,338	111,940
ASHRAE 90.1-1999	1,732,350	1,914,199	116,814
ASHRAE 90.1-2001	1,732,350	1,914,199	116,814
ASHRAE AEDG	-	-	-



Education Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

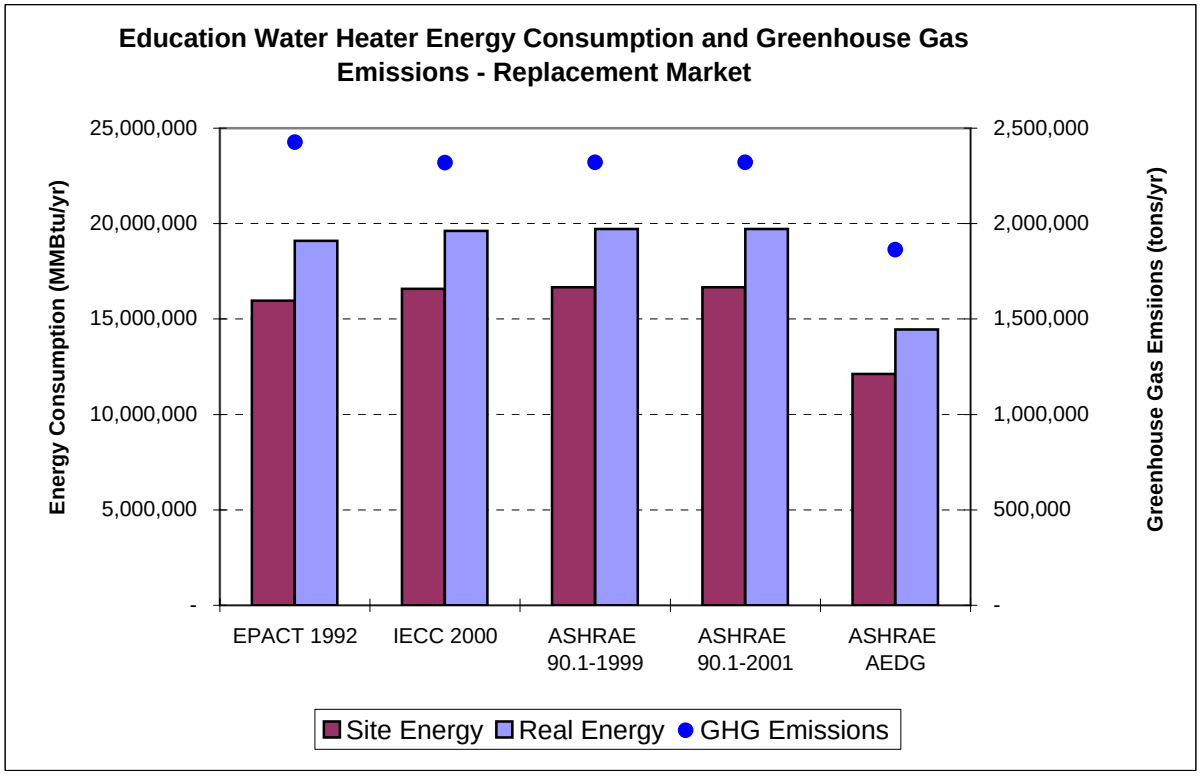
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	159,677,315	190,897,269	24,254,935
IECC 2000	165,795,353	196,177,967	23,186,459
ASHRAE 90.1-1999	166,662,434	197,113,990	23,210,117
ASHRAE 90.1-2001	166,662,434	197,113,990	23,210,117
ASHRAE AEDG	121,170,546	144,582,299	18,633,291



Education Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

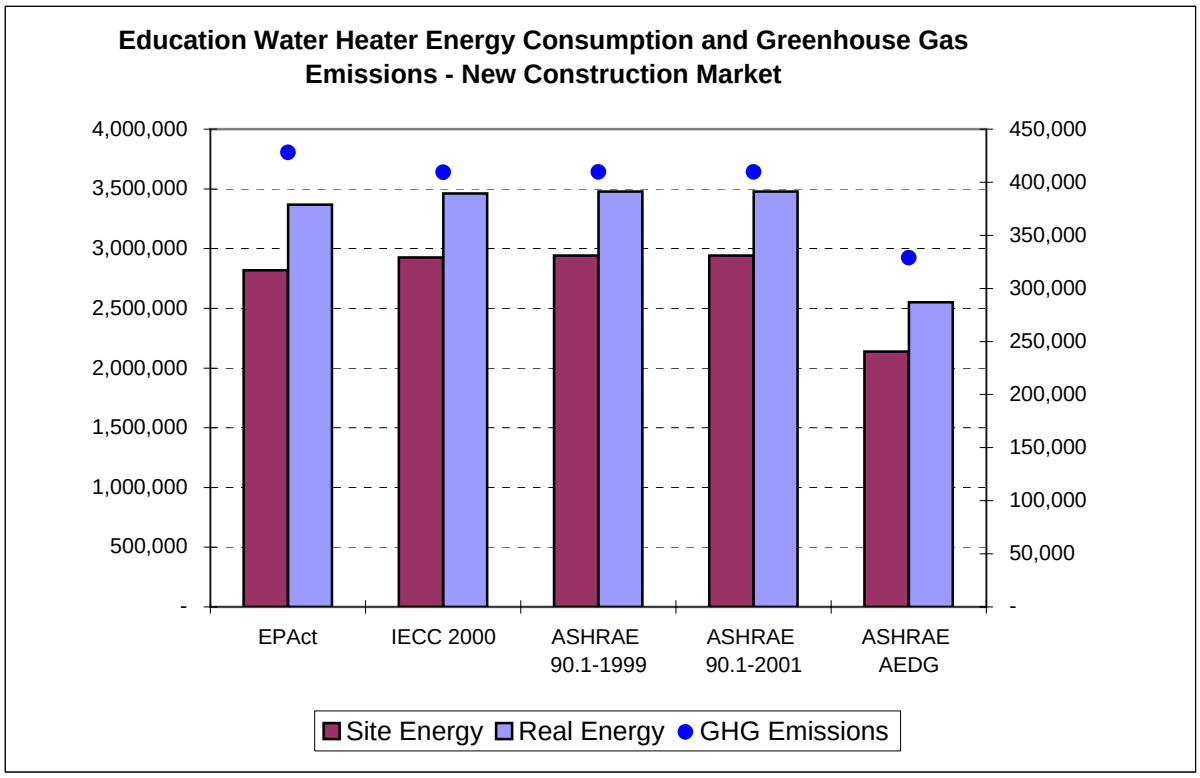
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	15,967,732	19,089,727	2,425,494
IECC 2000	16,579,535	19,617,797	2,318,646
ASHRAE 90.1-1999	16,666,243	19,711,399	2,321,012
ASHRAE 90.1-2001	16,666,243	19,711,399	2,321,012
ASHRAE AEDG	12,117,055	14,458,230	1,863,329



Education Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

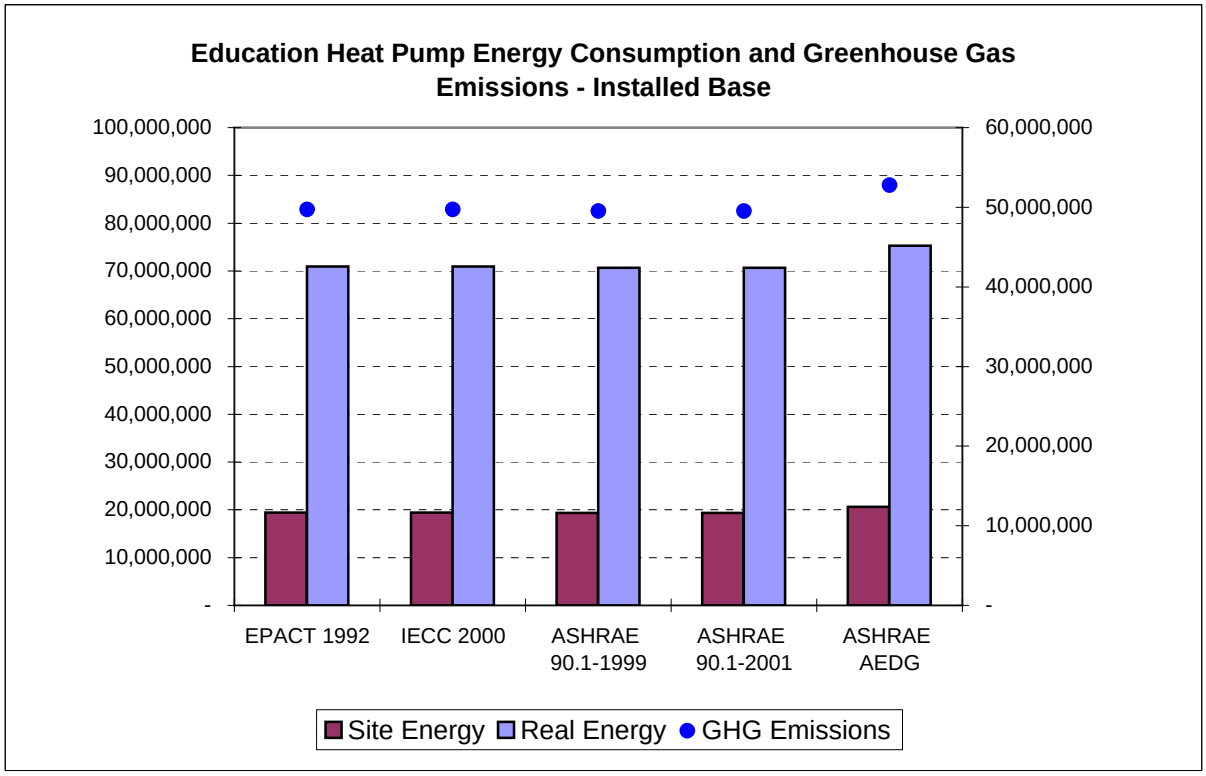
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	2,817,835	3,368,775	428,028
IECC 2000	2,925,800	3,461,964	409,173
ASHRAE 90.1-1999	2,941,102	3,478,482	409,590
ASHRAE 90.1-2001	2,941,102	3,478,482	409,590
ASHRAE AEDG	2,138,304	2,551,452	328,823



Education Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

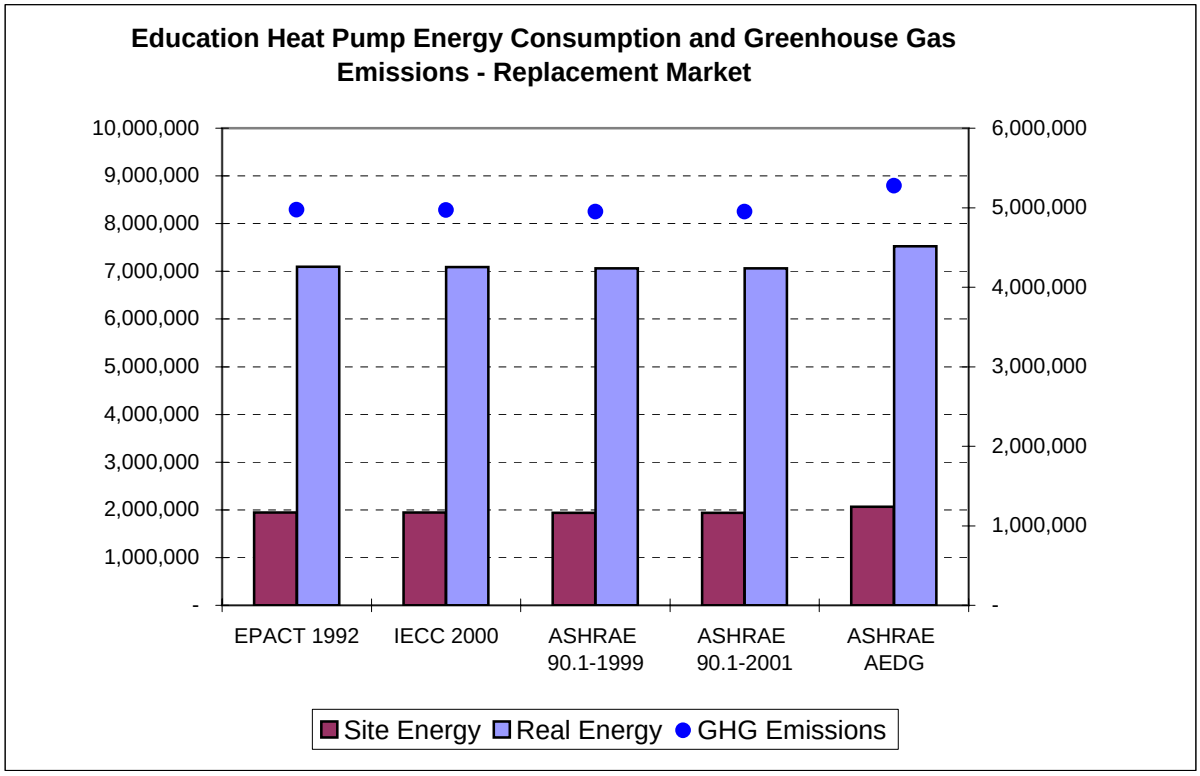
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	19,443,724	70,962,495	49,726,613
IECC 2000	19,432,548	70,921,709	49,698,033
ASHRAE 90.1-1999	19,355,976	70,642,248	49,502,202
ASHRAE 90.1-2001	19,355,976	70,642,248	49,502,202
ASHRAE AEDG	20,627,650	75,283,394	52,754,462



Education Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

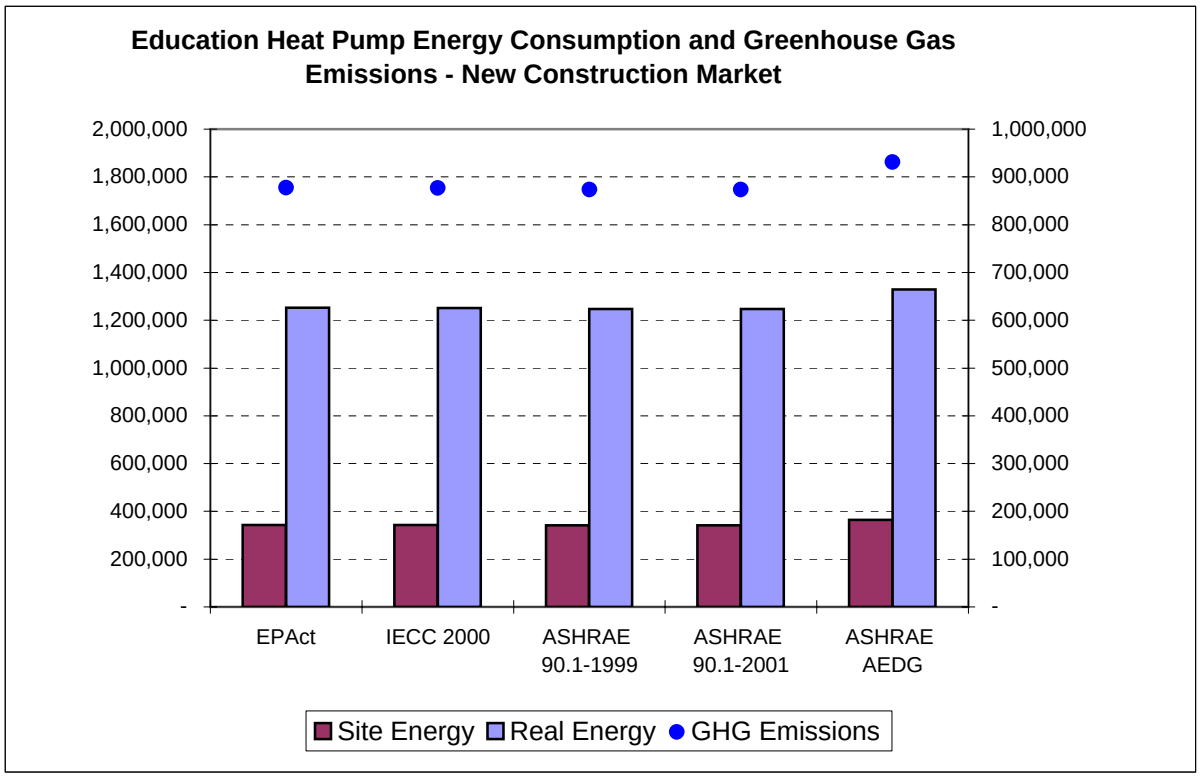
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,944,372	7,096,249	4,972,661
IECC 2000	1,943,255	7,092,171	4,969,803
ASHRAE 90.1-1999	1,935,598	7,064,225	4,950,220
ASHRAE 90.1-2001	1,935,598	7,064,225	4,950,220
ASHRAE AEDG	2,062,765	7,528,339	5,275,446



Education Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

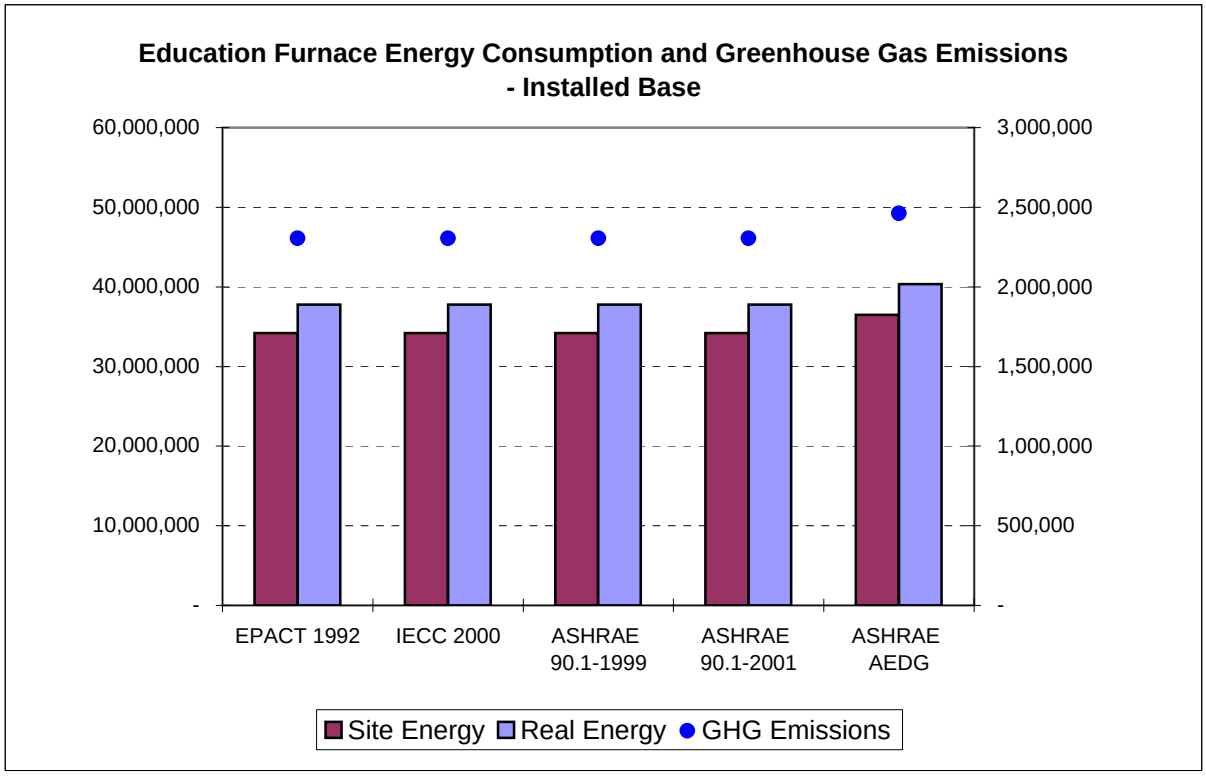
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	343,125	1,252,279	877,528
IECC 2000	342,927	1,251,560	877,024
ASHRAE 90.1-1999	341,576	1,246,628	873,568
ASHRAE 90.1-2001	341,576	1,246,628	873,568
ASHRAE AEDG	364,017	1,328,530	930,961



Education Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	34,186,552	37,775,195	2,305,231
IECC 2000	34,186,552	37,775,195	2,305,231
ASHRAE 90.1-1999	34,186,552	37,775,195	2,305,231
ASHRAE 90.1-2001	34,186,552	37,775,195	2,305,231
ASHRAE AEDG	36,497,889	40,329,159	2,461,087

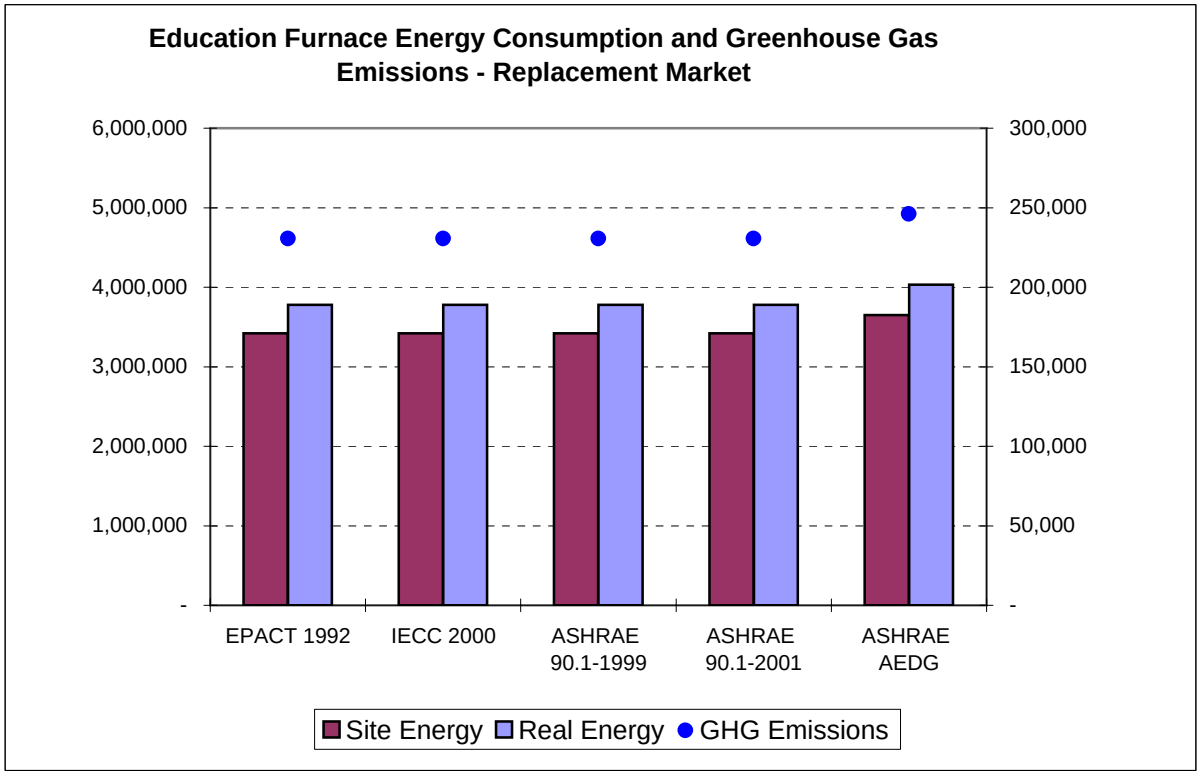


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Education Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	3,418,655	3,777,520	230,523
IECC 2000	3,418,655	3,777,520	230,523
ASHRAE 90.1-1999	3,418,655	3,777,520	230,523
ASHRAE 90.1-2001	3,418,655	3,777,520	230,523
ASHRAE AEDG	3,649,789	4,032,916	246,109

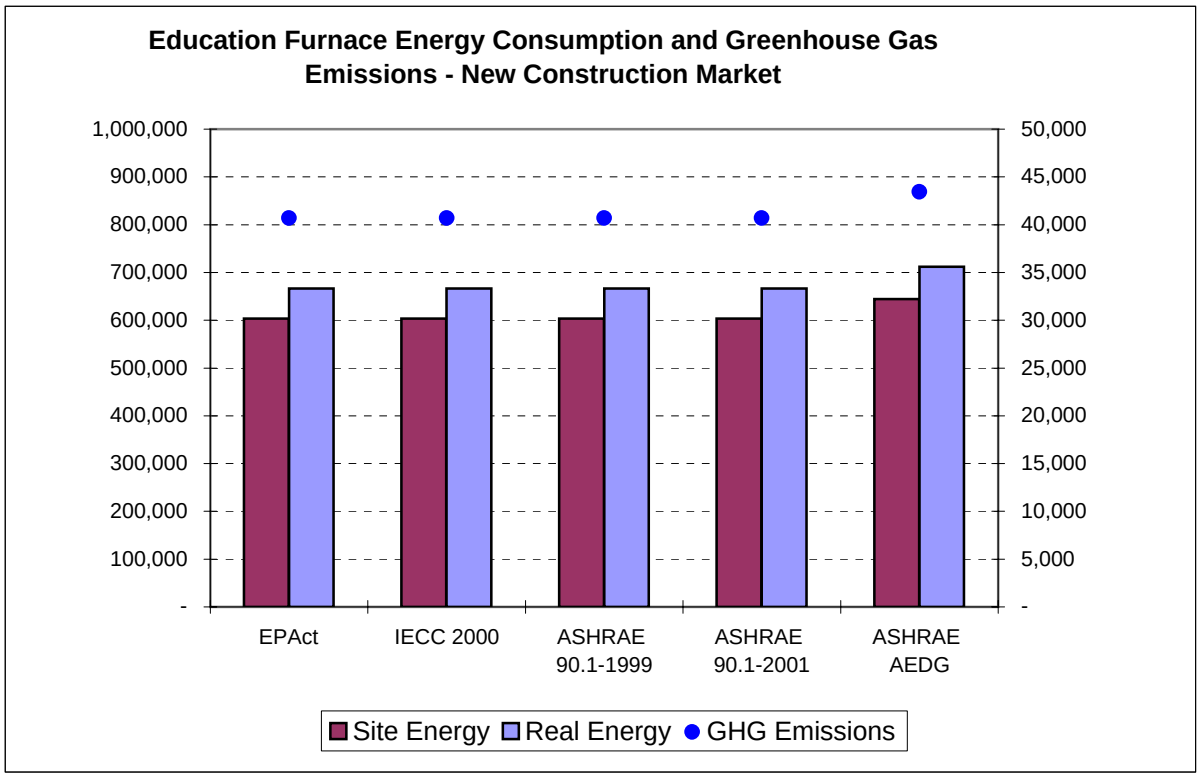


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Education Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	603,292	666,621	40,681
IECC 2000	603,292	666,621	40,681
ASHRAE 90.1-1999	603,292	666,621	40,681
ASHRAE 90.1-2001	603,292	666,621	40,681
ASHRAE AEDG	644,080	711,691	43,431

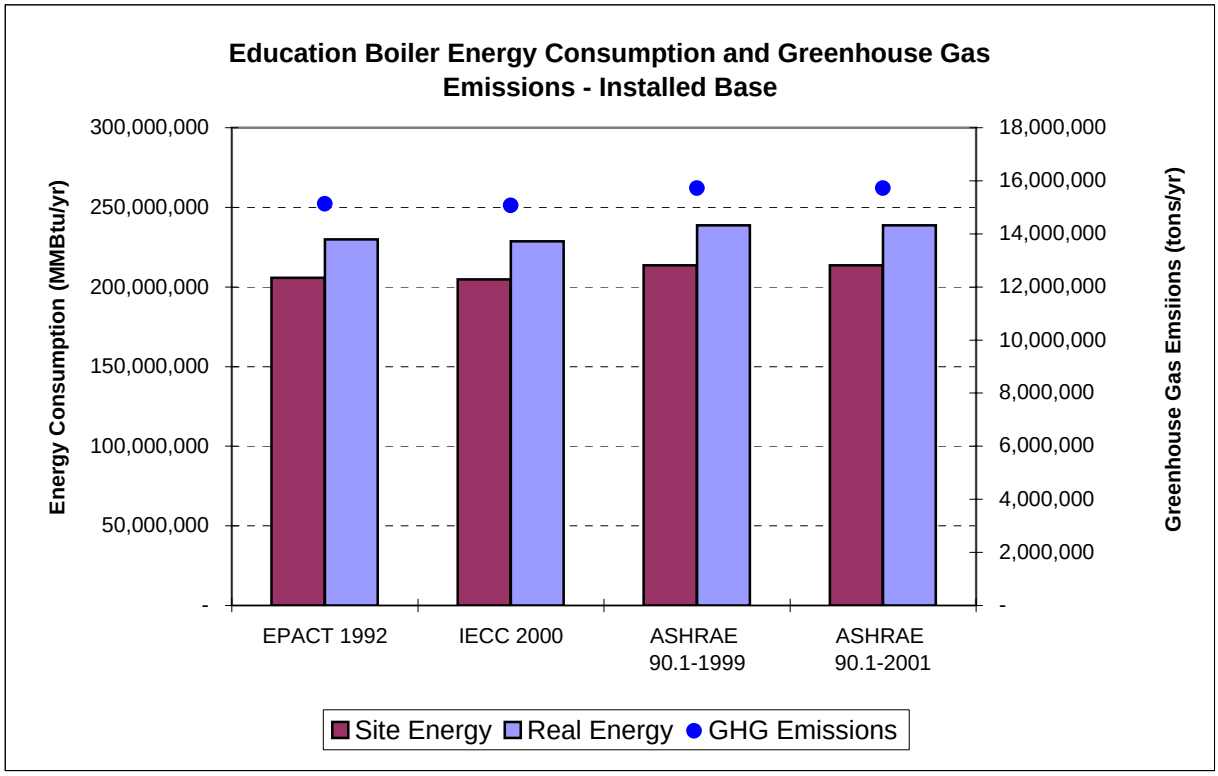


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Education Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

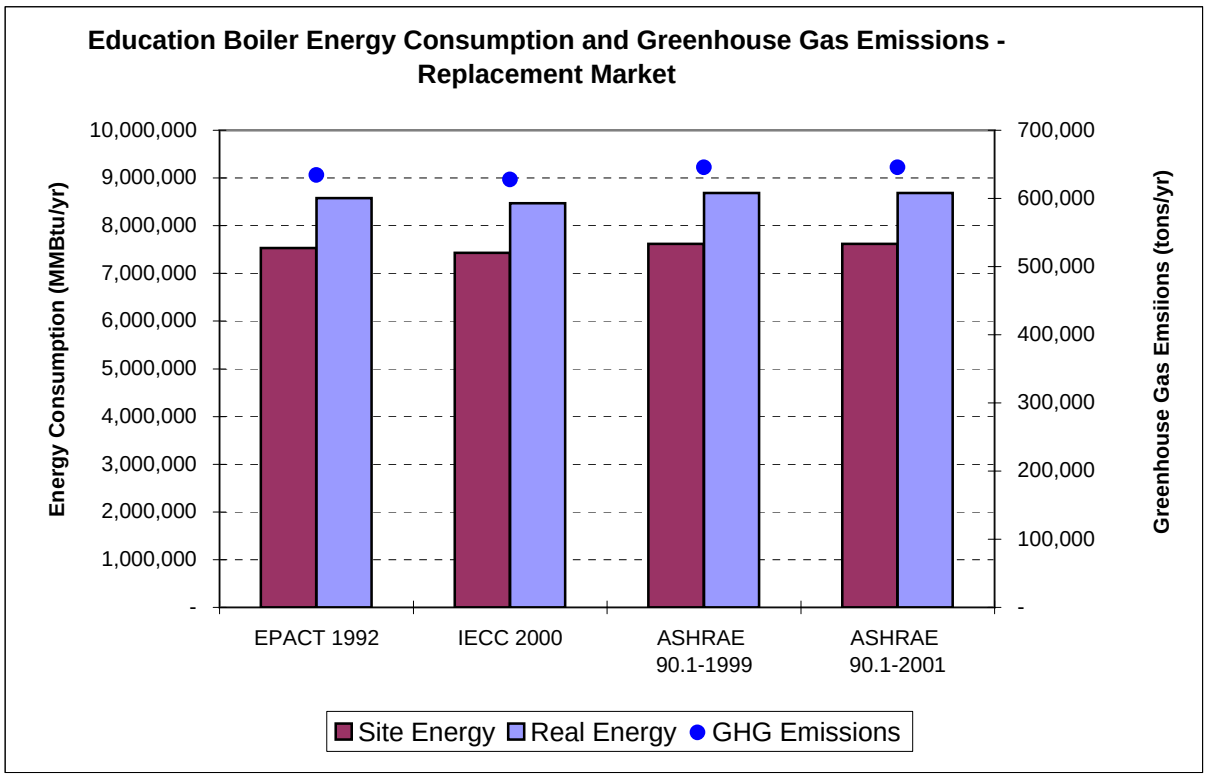
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	205,736,180	229,862,522	15,136,290
IECC 2000	204,739,406	228,761,114	15,069,076
ASHRAE 90.1-1999	213,583,332	238,639,228	15,718,275
ASHRAE 90.1-2001	213,583,332	238,639,228	15,718,275



Education Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

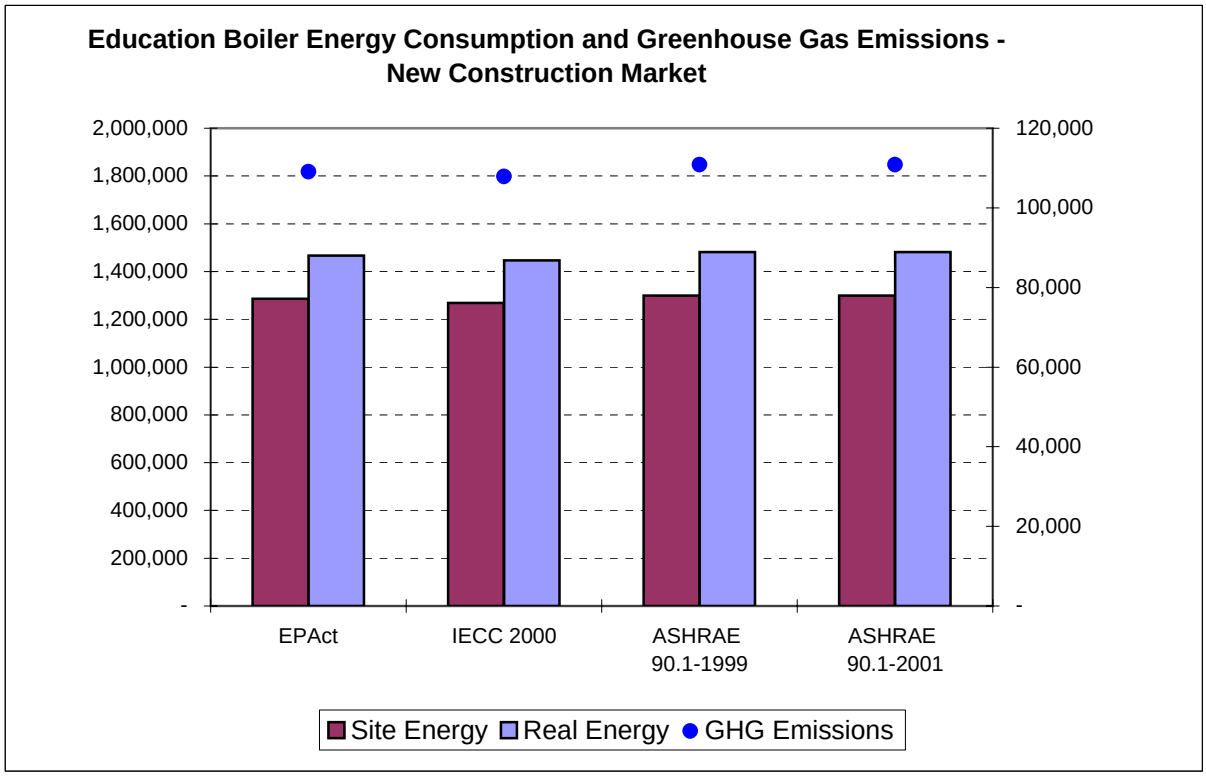
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	7,534,139	8,577,988	634,365
IECC 2000	7,434,461	8,467,847	627,643
ASHRAE 90.1-1999	7,619,230	8,682,593	645,387
ASHRAE 90.1-2001	7,619,230	8,682,593	645,387



Education Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

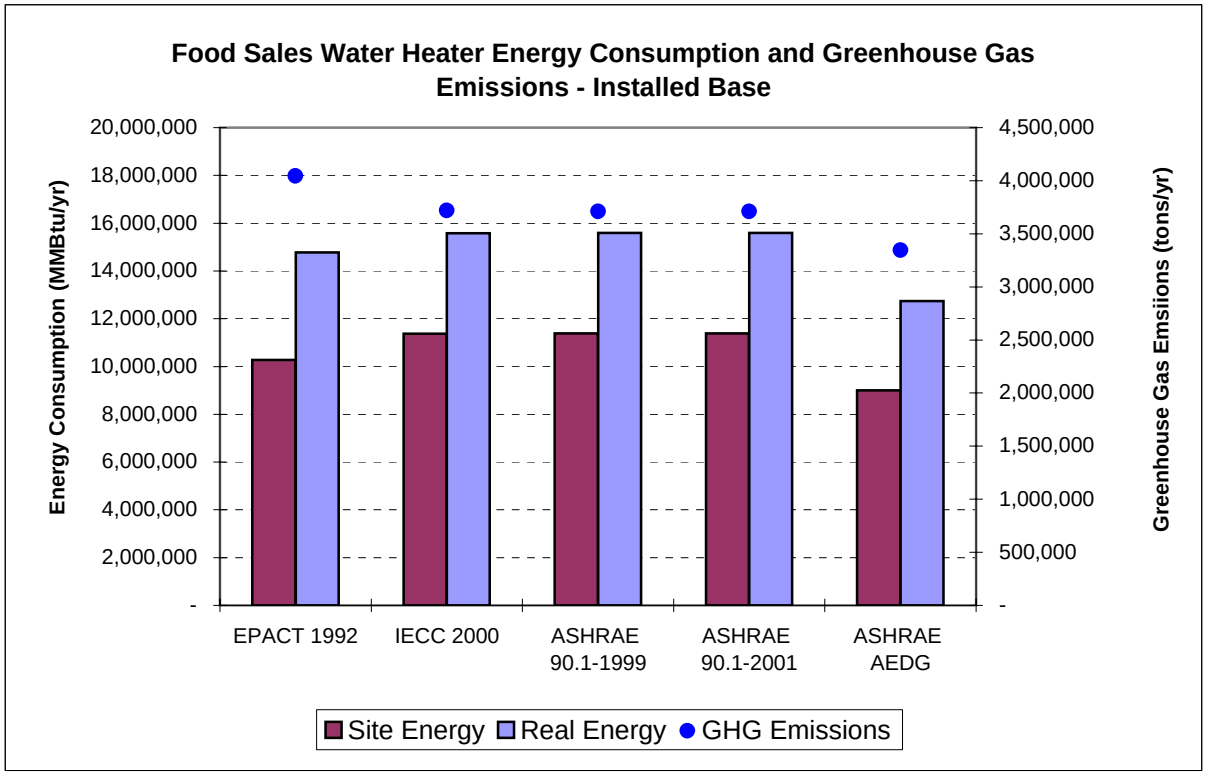
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,286,622	1,466,324	109,052
IECC 2000	1,269,032	1,446,887	107,866
ASHRAE 90.1-1999	1,299,334	1,482,238	110,842
ASHRAE 90.1-2001	1,299,334	1,482,238	110,842



Food Sales Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

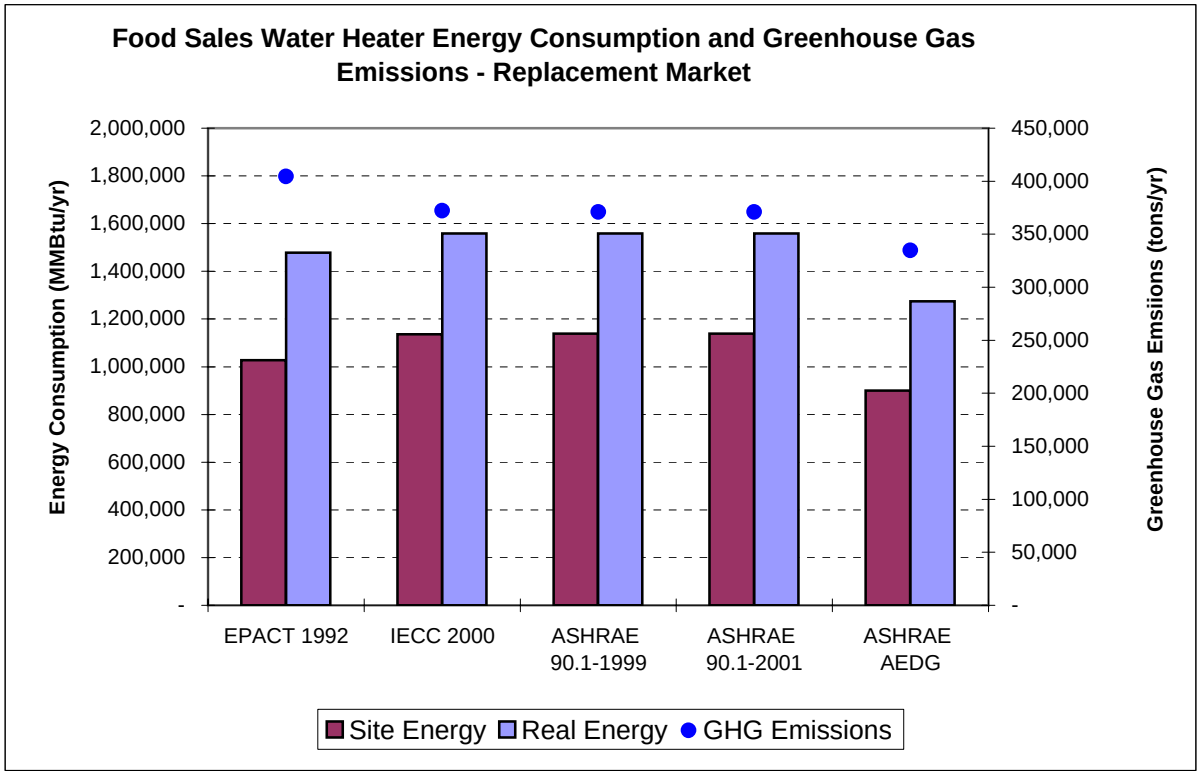
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	10,276,095	14,779,190	4,043,798
IECC 2000	11,368,022	15,580,250	3,720,645
ASHRAE 90.1-1999	11,390,537	15,592,133	3,709,446
ASHRAE 90.1-2001	11,390,537	15,592,133	3,709,446
ASHRAE AEDG	8,999,212	12,743,009	3,345,861



Food Sales Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

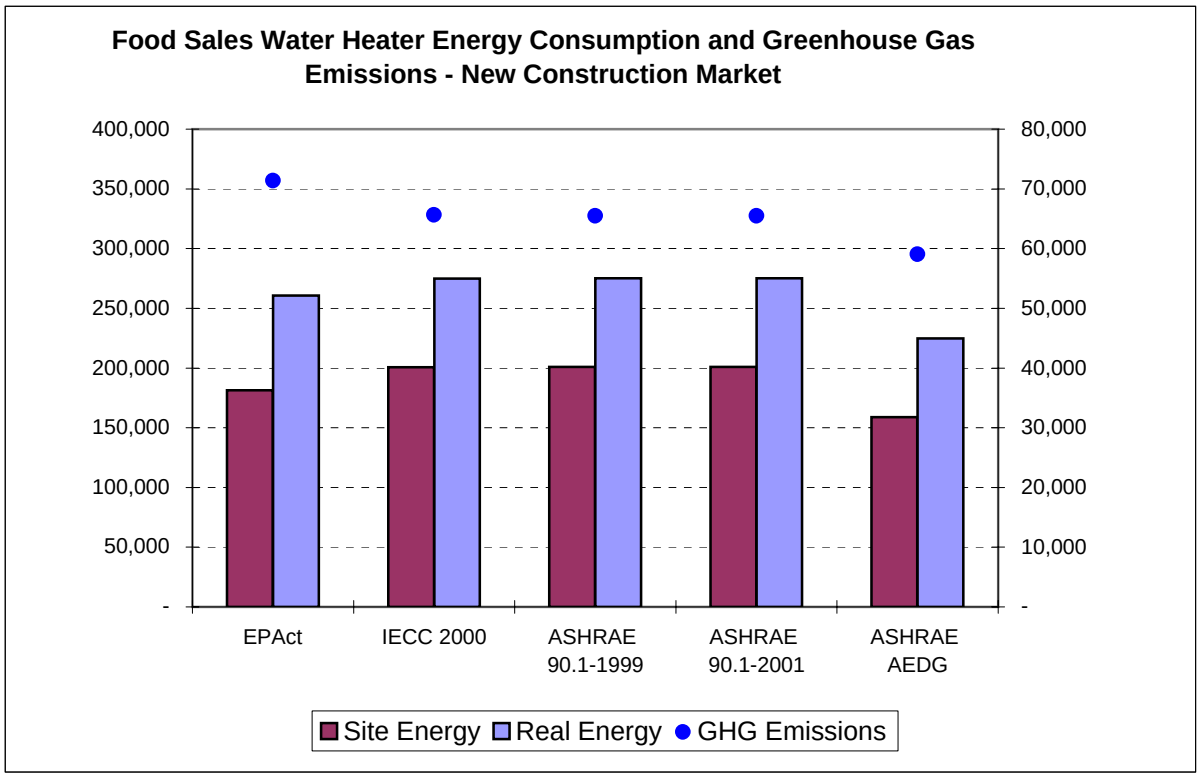
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,027,610	1,477,919	404,380
IECC 2000	1,136,802	1,558,025	372,064
ASHRAE 90.1-1999	1,139,054	1,559,213	370,945
ASHRAE 90.1-2001	1,139,054	1,559,213	370,945
ASHRAE AEDG	899,921	1,274,301	334,586



Food Sales Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

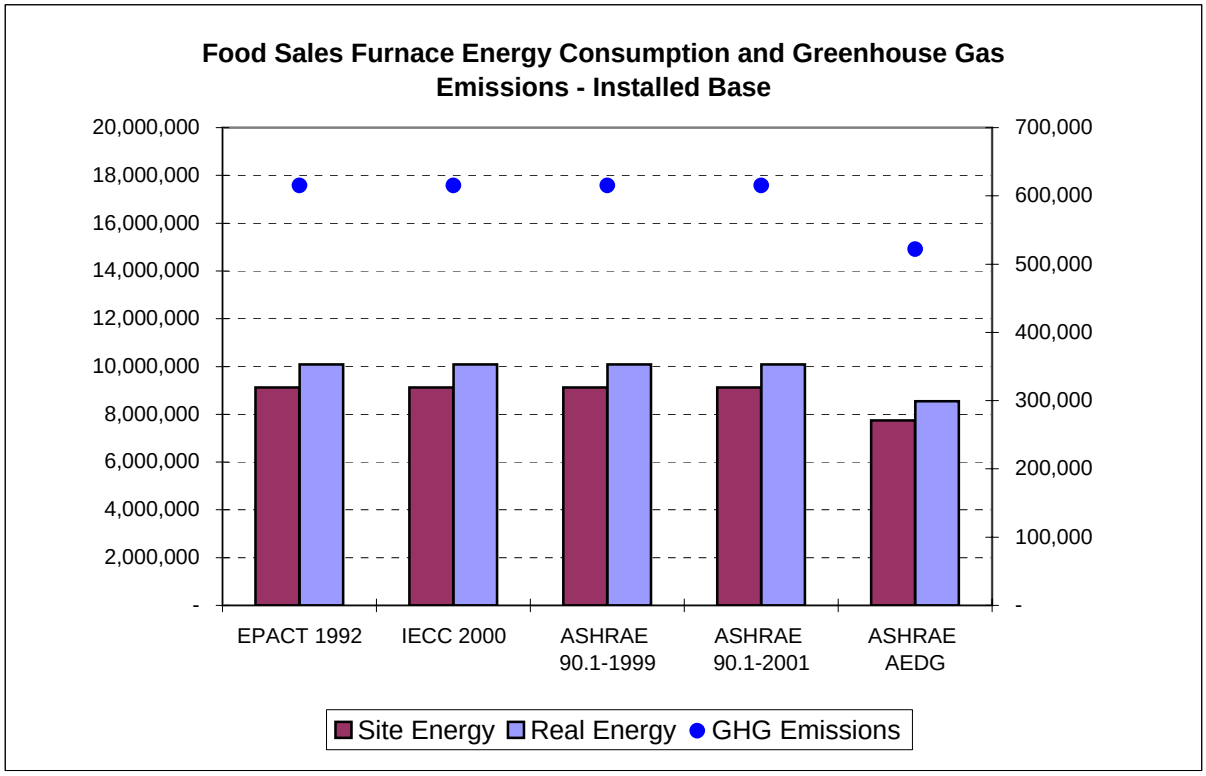
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	181,343	260,809	71,361
IECC 2000	200,612	274,946	65,658
ASHRAE 90.1-1999	201,009	275,155	65,461
ASHRAE 90.1-2001	201,009	275,155	65,461
ASHRAE AEDG	158,810	224,877	59,045



Food Sales Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	9,122,751	10,080,388	615,156
IECC 2000	9,122,751	10,080,388	615,156
ASHRAE 90.1-1999	9,122,751	10,080,388	615,156
ASHRAE 90.1-2001	9,122,751	10,080,388	615,156
ASHRAE AEDG	7,738,361	8,550,675	521,805

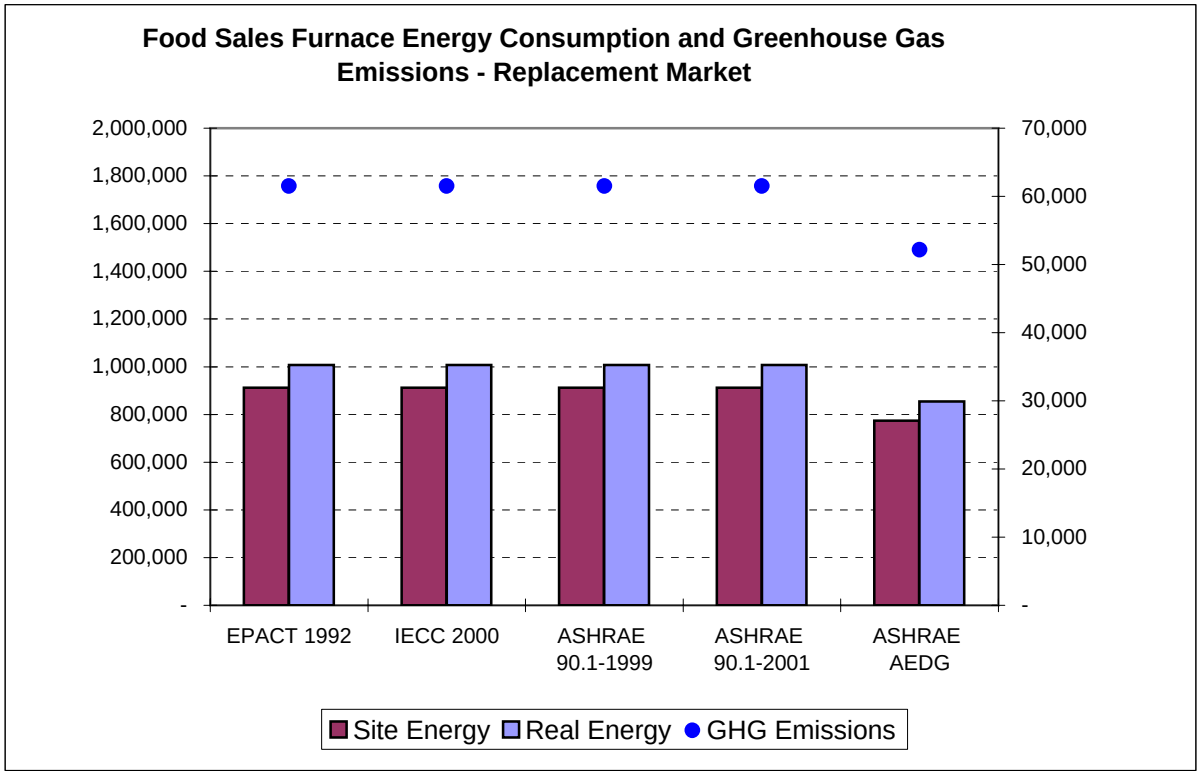


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Food Sales Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	912,275	1,008,039	61,516
IECC 2000	912,275	1,008,039	61,516
ASHRAE 90.1-1999	912,275	1,008,039	61,516
ASHRAE 90.1-2001	912,275	1,008,039	61,516
ASHRAE AEDG	773,836	855,068	52,180

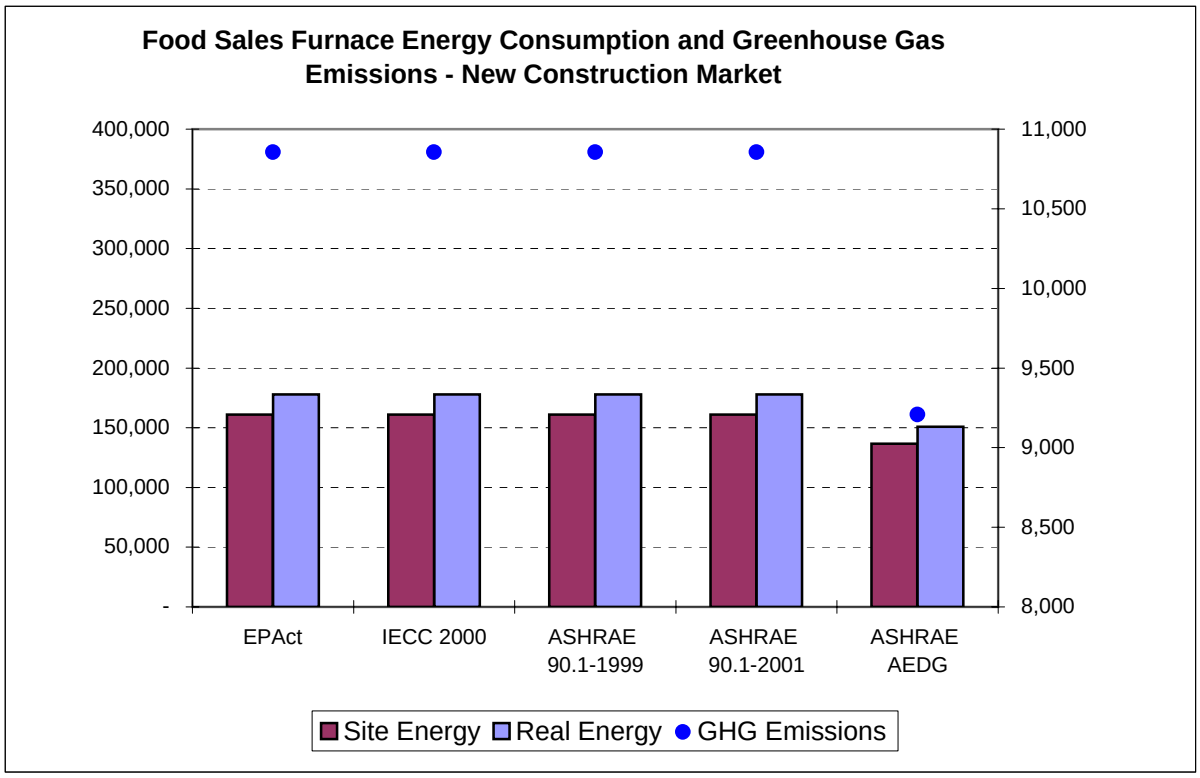


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Food Sales Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	160,990	177,889	10,856
IECC 2000	160,990	177,889	10,856
ASHRAE 90.1-1999	160,990	177,889	10,856
ASHRAE 90.1-2001	160,990	177,889	10,856
ASHRAE AEDG	136,559	150,894	9,208

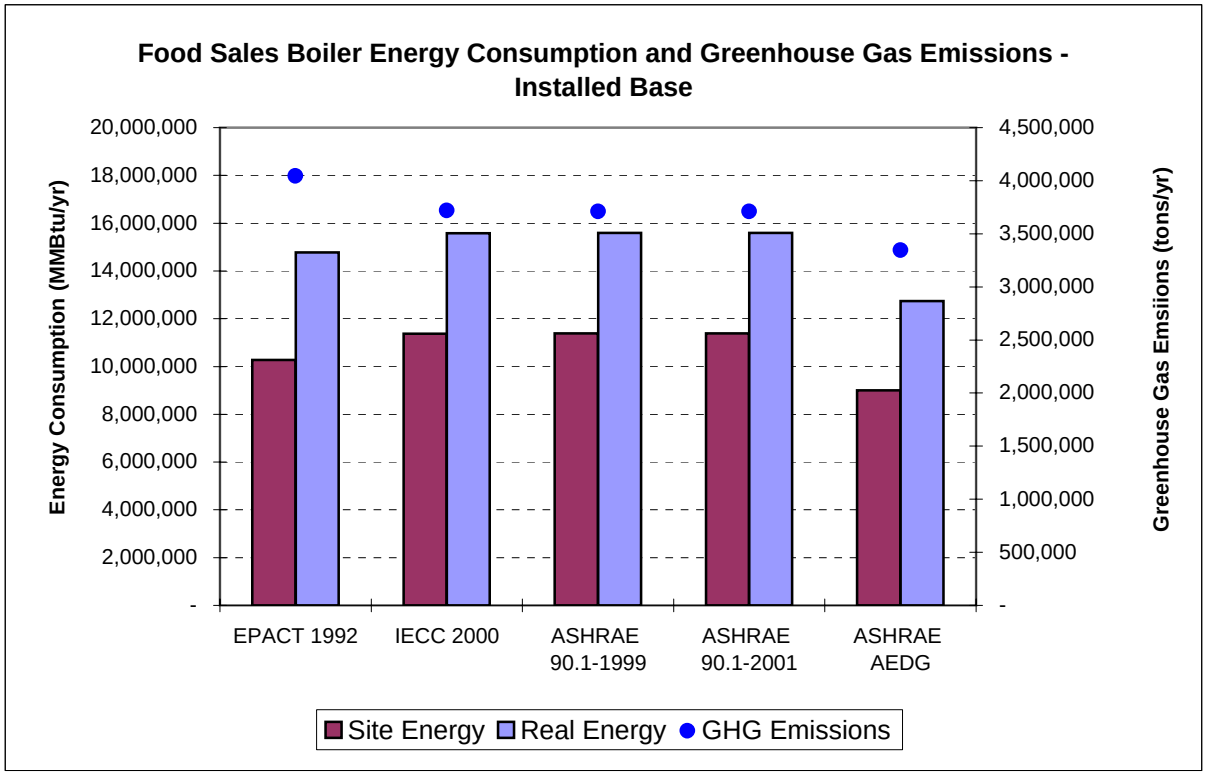


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Food Sales Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

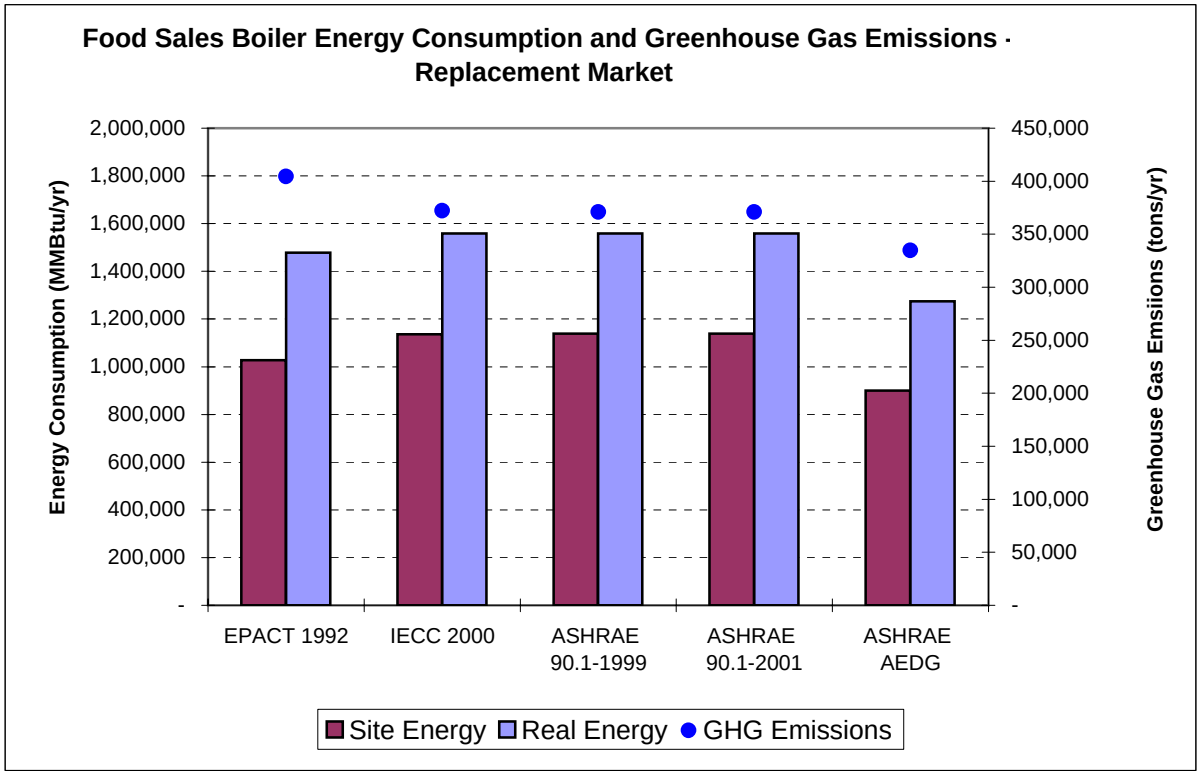
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	10,276,095	14,779,190	4,043,798
IECC 2000	11,368,022	15,580,250	3,720,645
ASHRAE 90.1-1999	11,390,537	15,592,133	3,709,446
ASHRAE 90.1-2001	11,390,537	15,592,133	3,709,446
ASHRAE AEDG	8,999,212	12,743,009	3,345,861



Food Sales Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

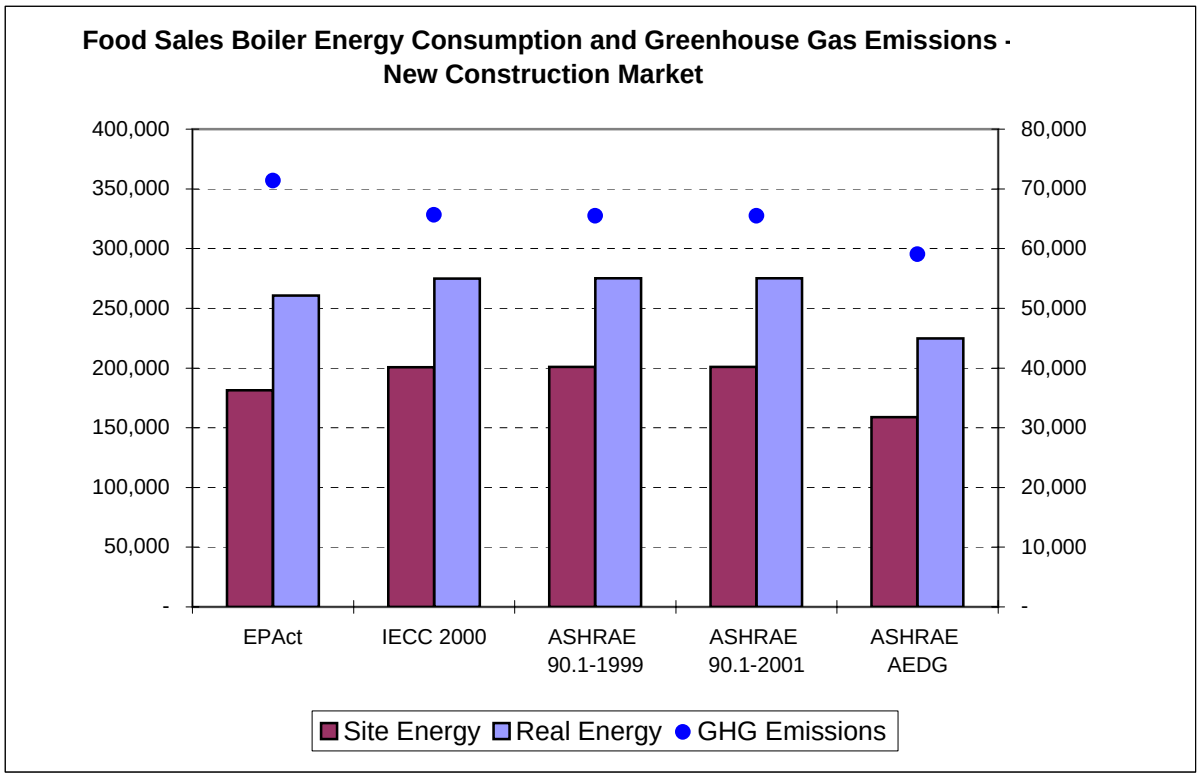
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,027,610	1,477,919	404,380
IECC 2000	1,136,802	1,558,025	372,064
ASHRAE 90.1-1999	1,139,054	1,559,213	370,945
ASHRAE 90.1-2001	1,139,054	1,559,213	370,945
ASHRAE AEDG	899,921	1,274,301	334,586



Food Sales Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

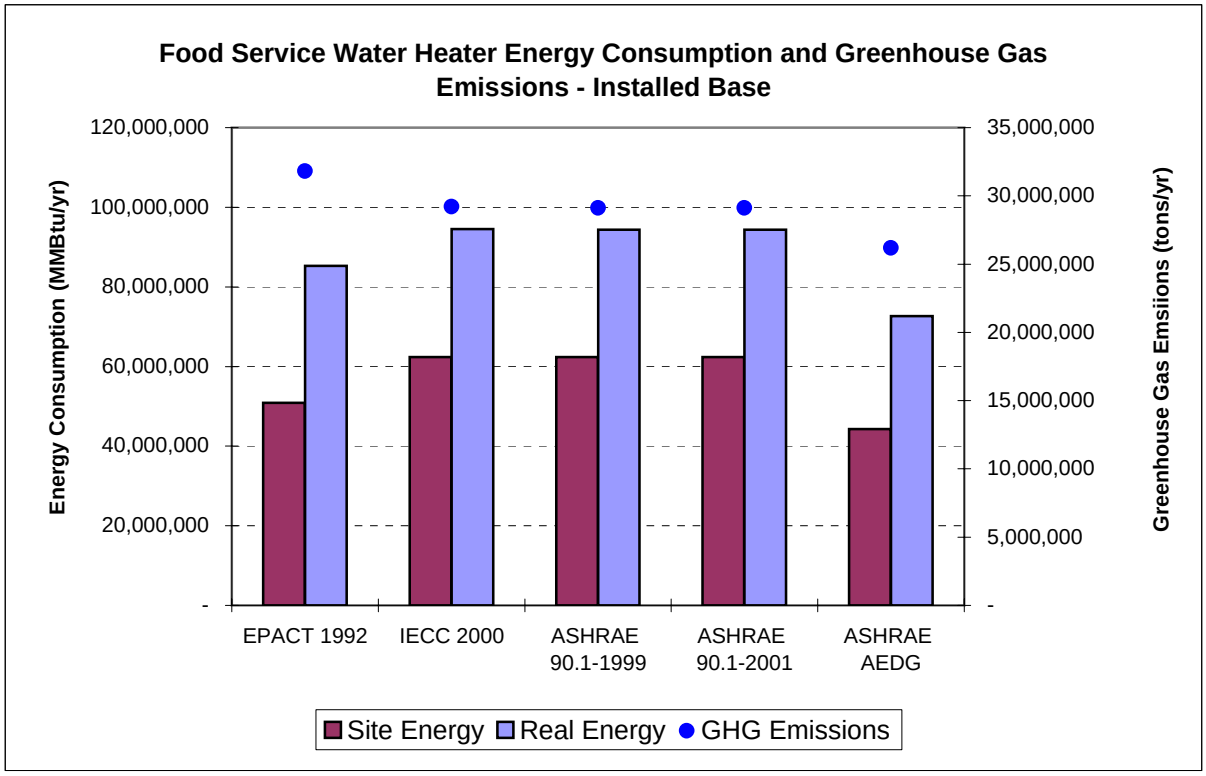
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	181,343	260,809	71,361
IECC 2000	200,612	274,946	65,658
ASHRAE 90.1-1999	201,009	275,155	65,461
ASHRAE 90.1-2001	201,009	275,155	65,461
ASHRAE AEDG	158,810	224,877	59,045



Food Service Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

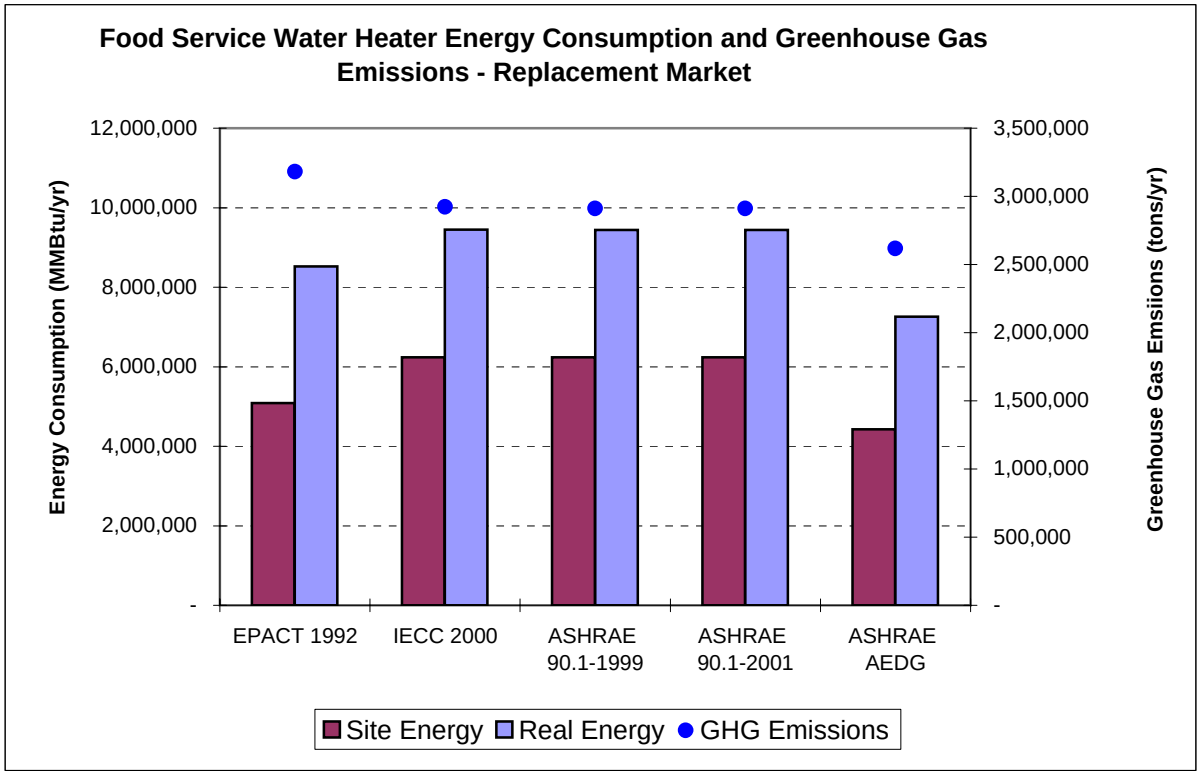
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	50,898,590	85,238,807	31,806,883
IECC 2000	62,379,144	94,490,876	29,221,117
ASHRAE 90.1-1999	62,379,564	94,381,296	29,113,463
ASHRAE 90.1-2001	62,379,564	94,381,296	29,113,463
ASHRAE AEDG	44,275,738	72,626,120	26,179,347



Food Service Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

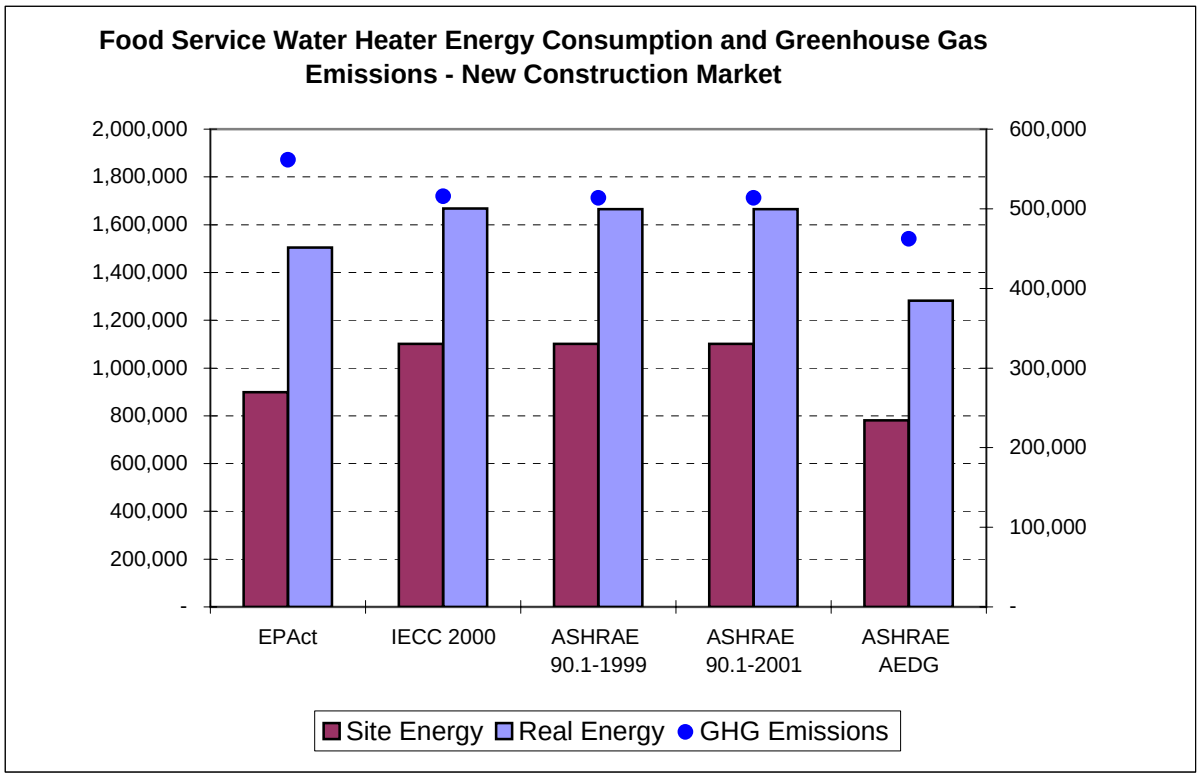
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,089,859	8,523,881	3,180,688
IECC 2000	6,237,914	9,449,088	2,922,112
ASHRAE 90.1-1999	6,237,956	9,438,130	2,911,346
ASHRAE 90.1-2001	6,237,956	9,438,130	2,911,346
ASHRAE AEDG	4,427,574	7,262,612	2,617,935



Food Service Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

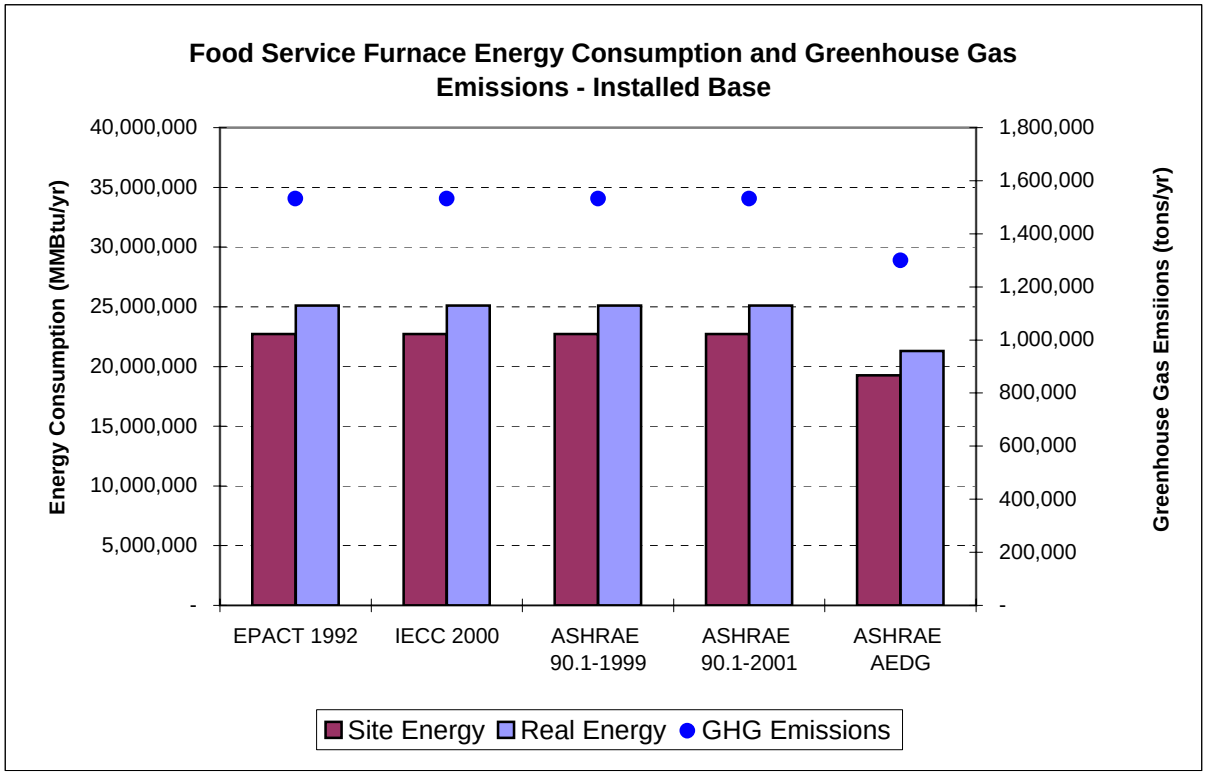
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	898,210	1,504,214	561,298
IECC 2000	1,100,808	1,667,486	515,667
ASHRAE 90.1-1999	1,100,816	1,665,552	513,767
ASHRAE 90.1-2001	1,100,816	1,665,552	513,767
ASHRAE AEDG	781,337	1,281,637	461,988



Food Service Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	22,722,935	25,108,215	1,532,229
IECC 2000	22,722,935	25,108,215	1,532,229
ASHRAE 90.1-1999	22,722,935	25,108,215	1,532,229
ASHRAE 90.1-2001	22,722,935	25,108,215	1,532,229
ASHRAE AEDG	19,274,699	21,298,009	1,299,711

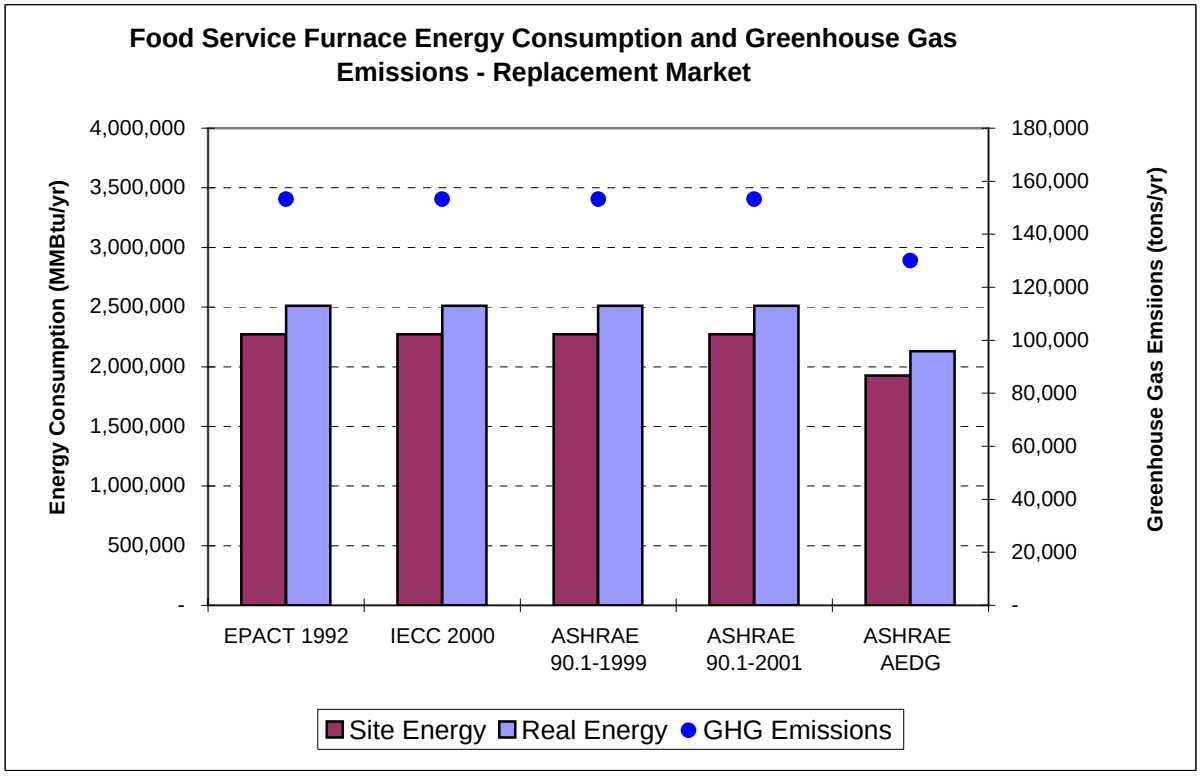


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Food Service Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	2,272,293	2,510,821	153,223
IECC 2000	2,272,293	2,510,821	153,223
ASHRAE 90.1-1999	2,272,293	2,510,821	153,223
ASHRAE 90.1-2001	2,272,293	2,510,821	153,223
ASHRAE AEDG	1,927,470	2,129,801	129,971

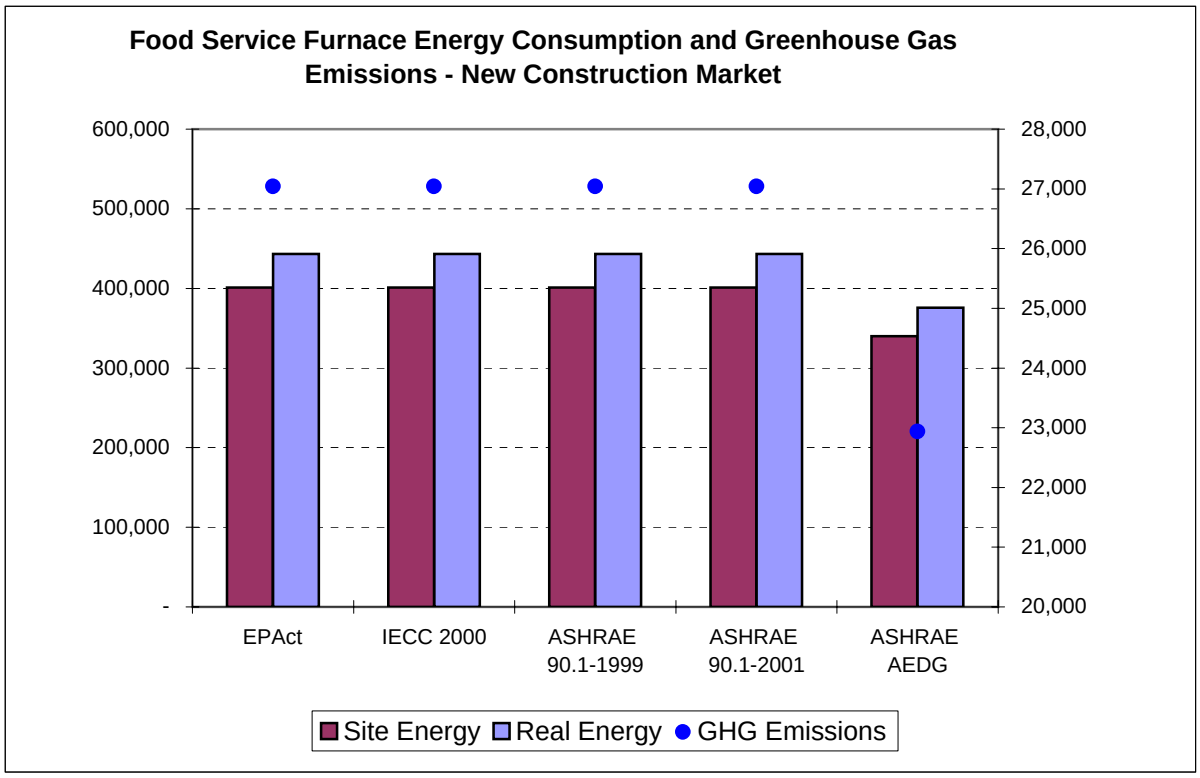


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Food Service Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	400,993	443,086	27,039
IECC 2000	400,993	443,086	27,039
ASHRAE 90.1-1999	400,993	443,086	27,039
ASHRAE 90.1-2001	400,993	443,086	27,039
ASHRAE AEDG	340,142	375,847	22,936



Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Food Service Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	50,898,590	85,238,807	31,806,883
IECC 2000	62,379,144	94,490,876	29,221,117
ASHRAE 90.1-1999	62,379,564	94,381,296	29,113,463
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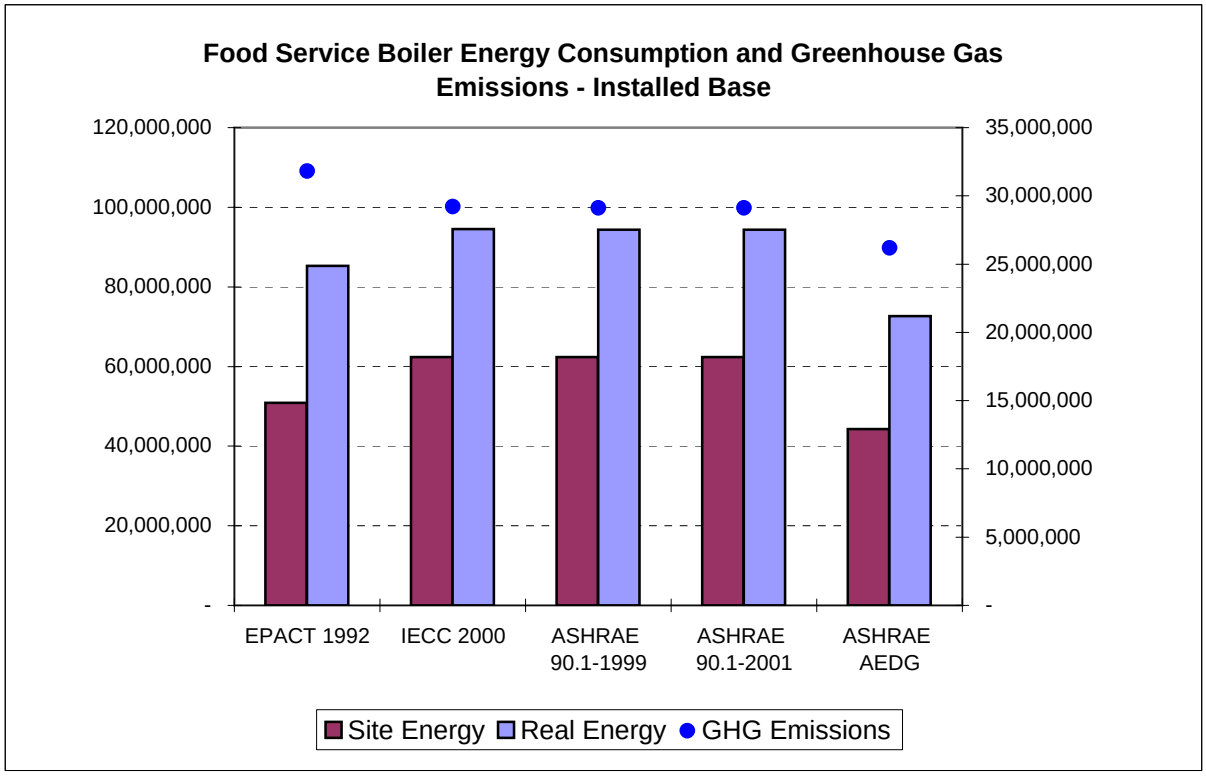
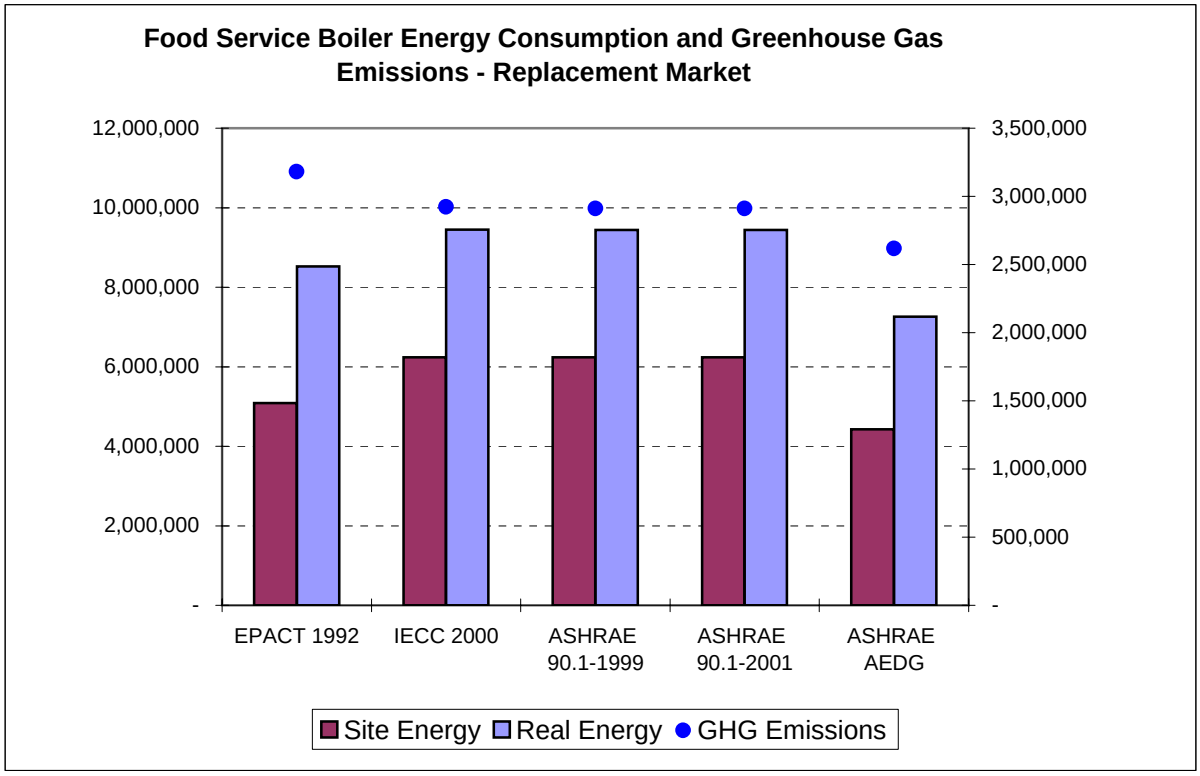
ASHRAE AEDG	44,275,738	72,626,120	26,179,347



Food Service Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

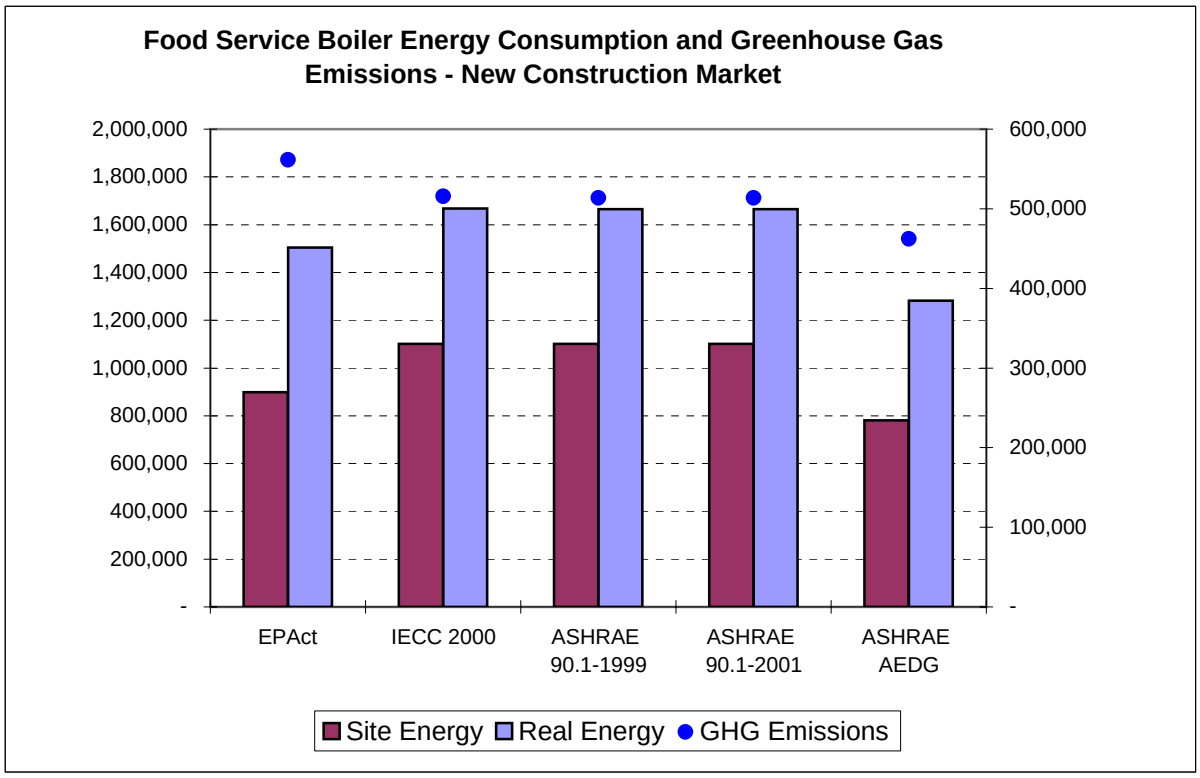
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,089,859	8,523,881	3,180,688
IECC 2000	6,237,914	9,449,088	2,922,112
ASHRAE 90.1-1999	6,237,956	9,438,130	2,911,346
ASHRAE 90.1-2001	6,237,956	9,438,130	2,911,346
ASHRAE AEDG	4,427,574	7,262,612	2,617,935



Food Service Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

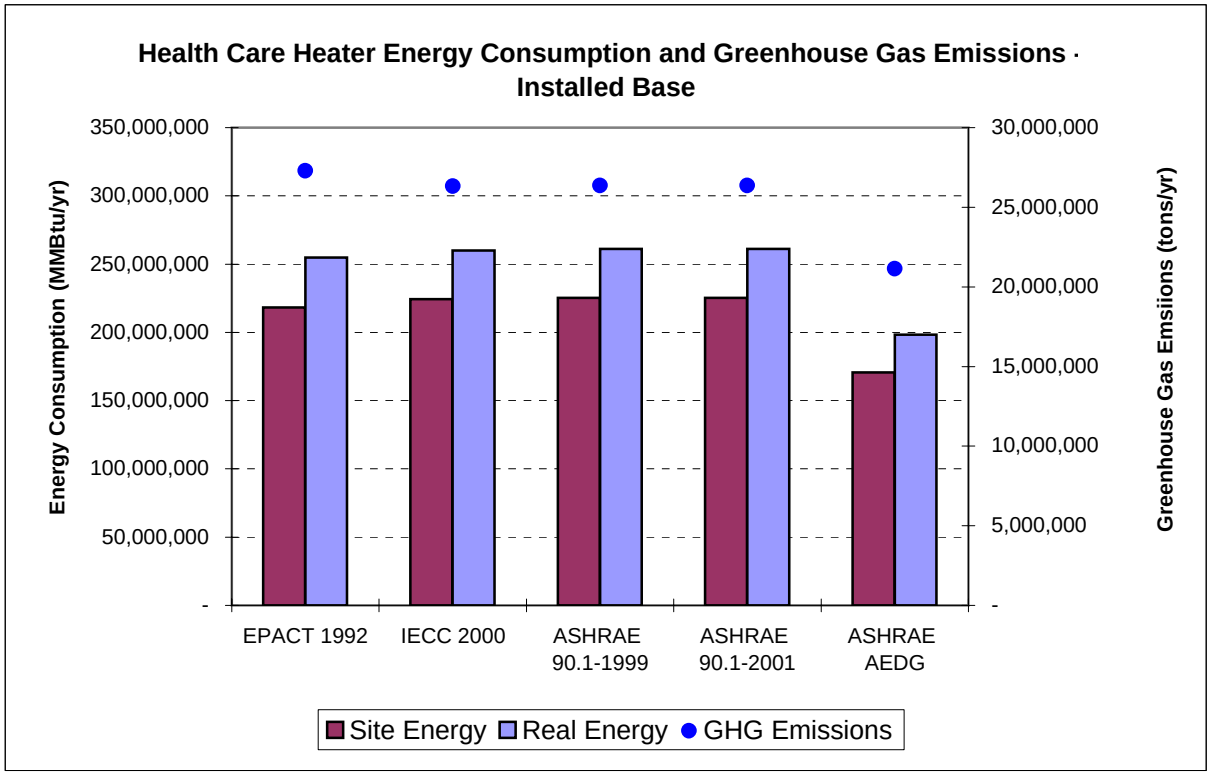
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	898,210	1,504,214	561,298
IECC 2000	1,100,808	1,667,486	515,667
ASHRAE 90.1-1999	1,100,816	1,665,552	513,767
ASHRAE 90.1-2001	1,100,816	1,665,552	513,767
ASHRAE AEDG	781,337	1,281,637	461,988



Health Care Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

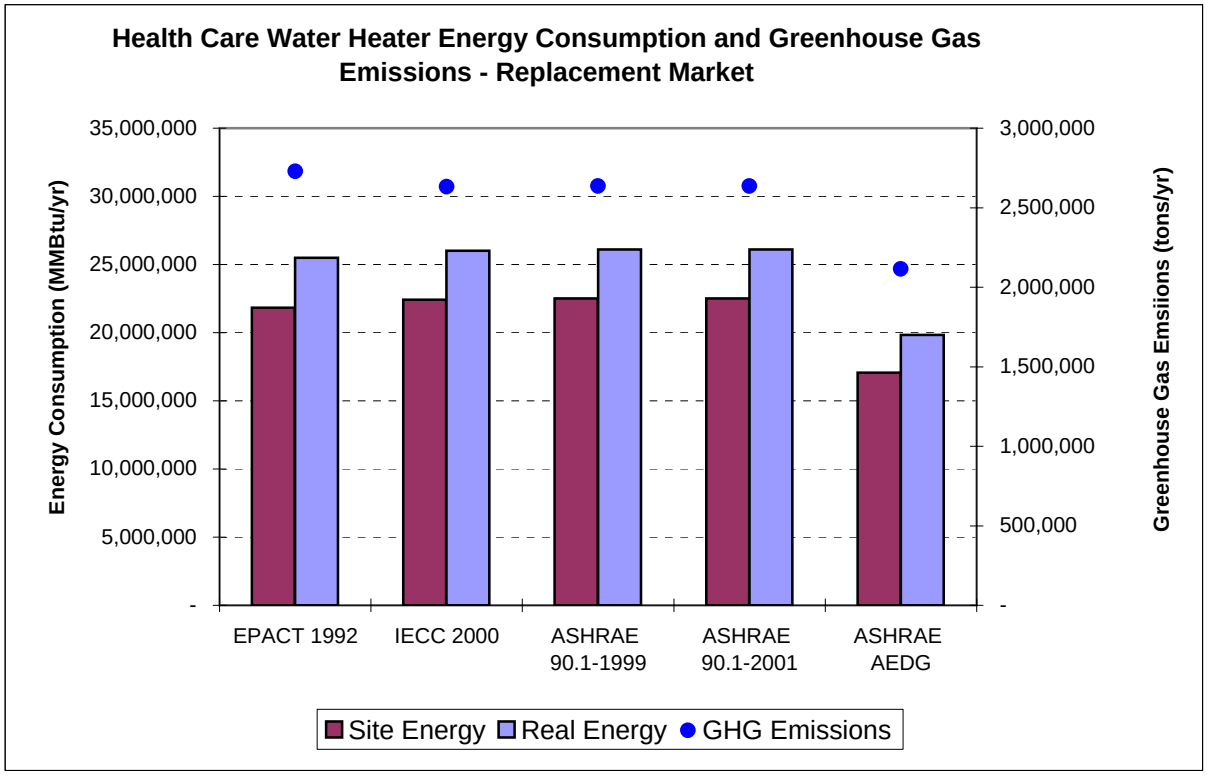
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	218,317,451	254,840,395	27,292,381
IECC 2000	224,280,705	260,056,958	26,324,983
ASHRAE 90.1-1999	225,225,984	261,086,670	26,359,413
ASHRAE 90.1-2001	225,225,984	261,086,670	26,359,413
ASHRAE AEDG	170,587,335	198,348,964	21,145,970



Health Care Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

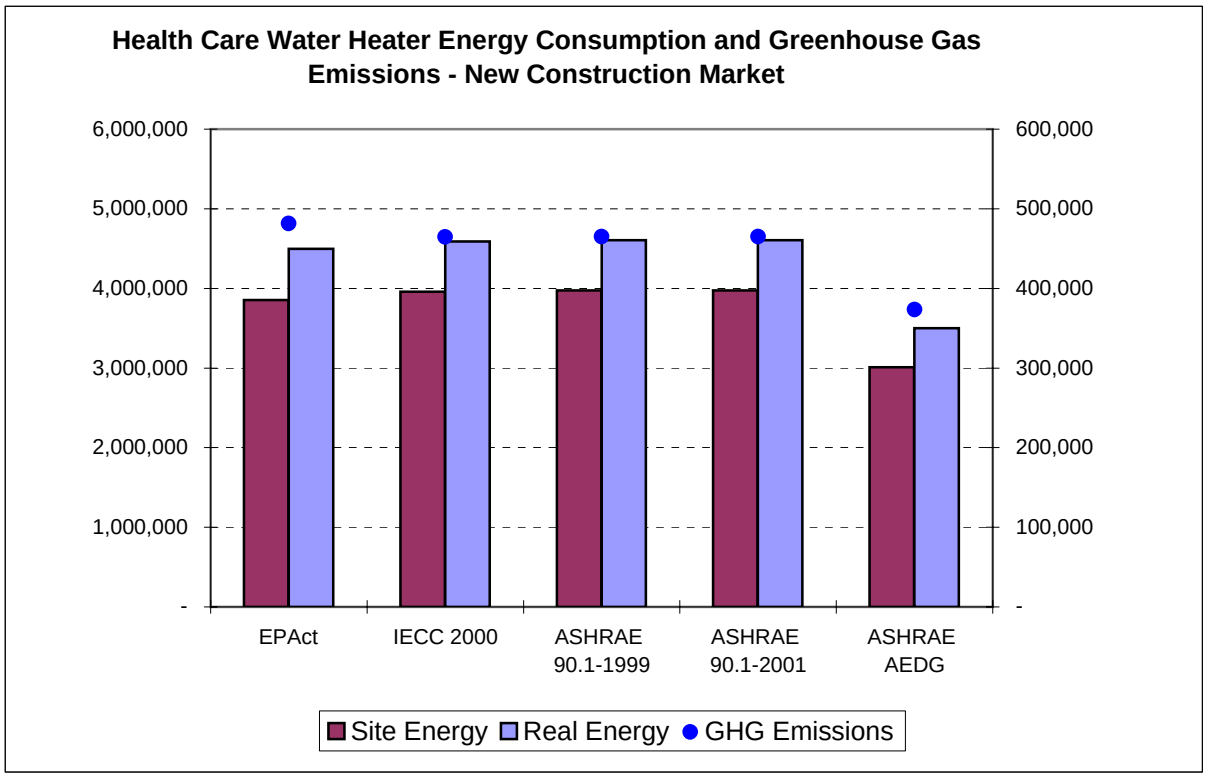
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	21,831,745	25,484,040	2,729,238
IECC 2000	22,428,071	26,005,696	2,632,498
ASHRAE 90.1-1999	22,522,598	26,108,667	2,635,941
ASHRAE 90.1-2001	22,522,598	26,108,667	2,635,941
ASHRAE AEDG	17,058,734	19,834,896	2,114,597



Health Care Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

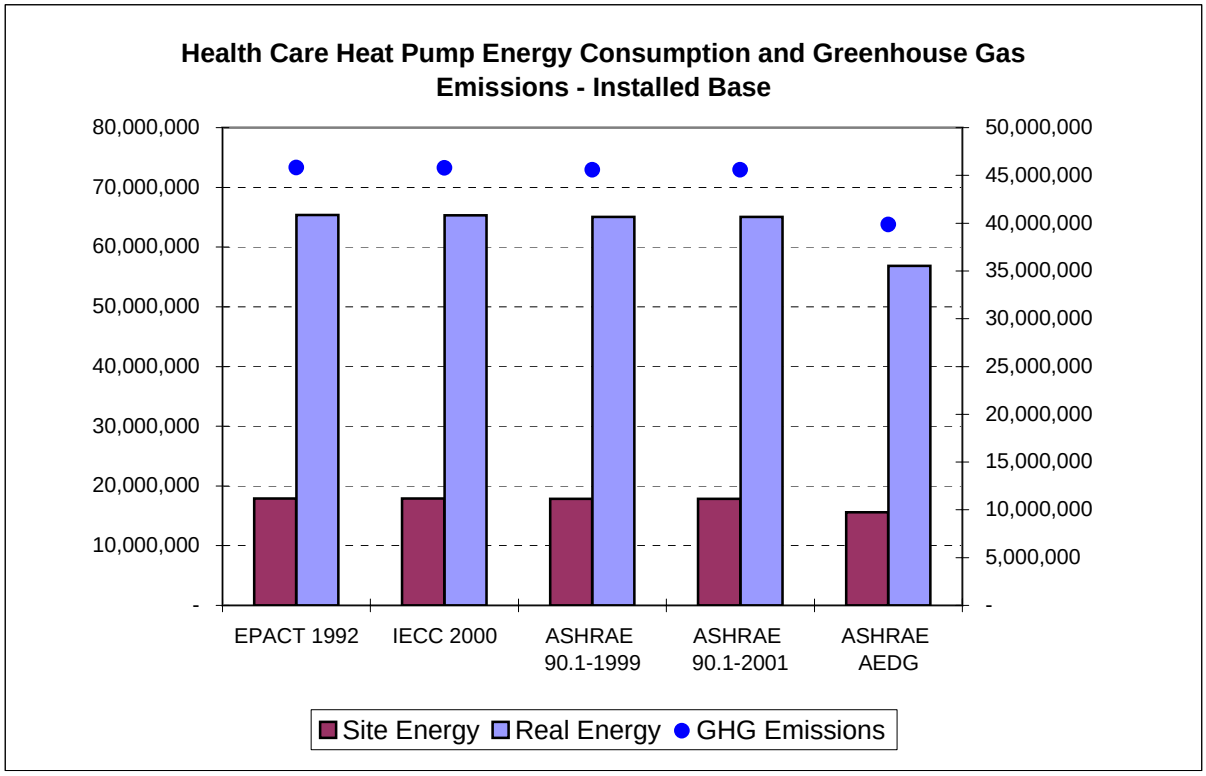
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	3,852,661	4,497,183	481,630
IECC 2000	3,957,895	4,589,240	464,559
ASHRAE 90.1-1999	3,974,576	4,607,412	465,166
ASHRAE 90.1-2001	3,974,576	4,607,412	465,166
ASHRAE AEDG	3,010,365	3,500,276	373,164



Health Care Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

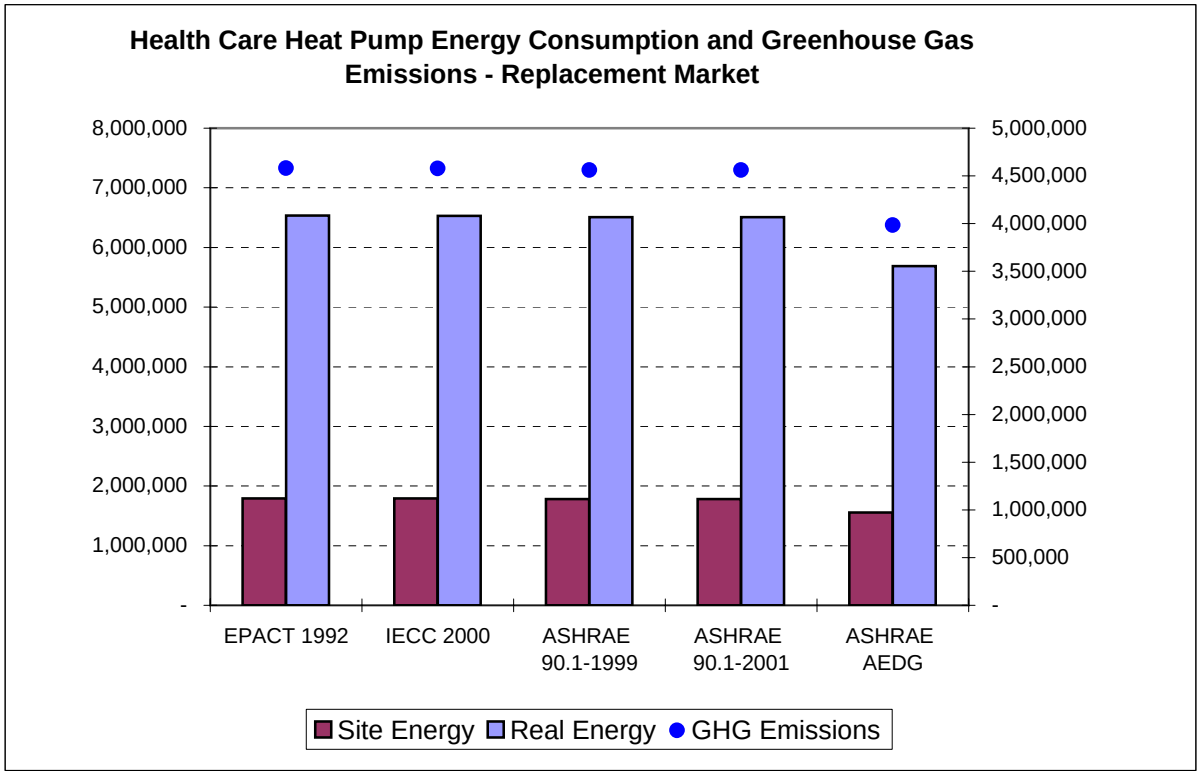
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	17,908,861	65,360,808	45,801,259
IECC 2000	17,898,568	65,323,242	45,774,935
ASHRAE 90.1-1999	17,828,040	65,065,841	45,594,563
ASHRAE 90.1-2001	17,828,040	65,065,841	45,594,563
ASHRAE AEDG	15,579,220	56,858,469	39,843,288



Health Care Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

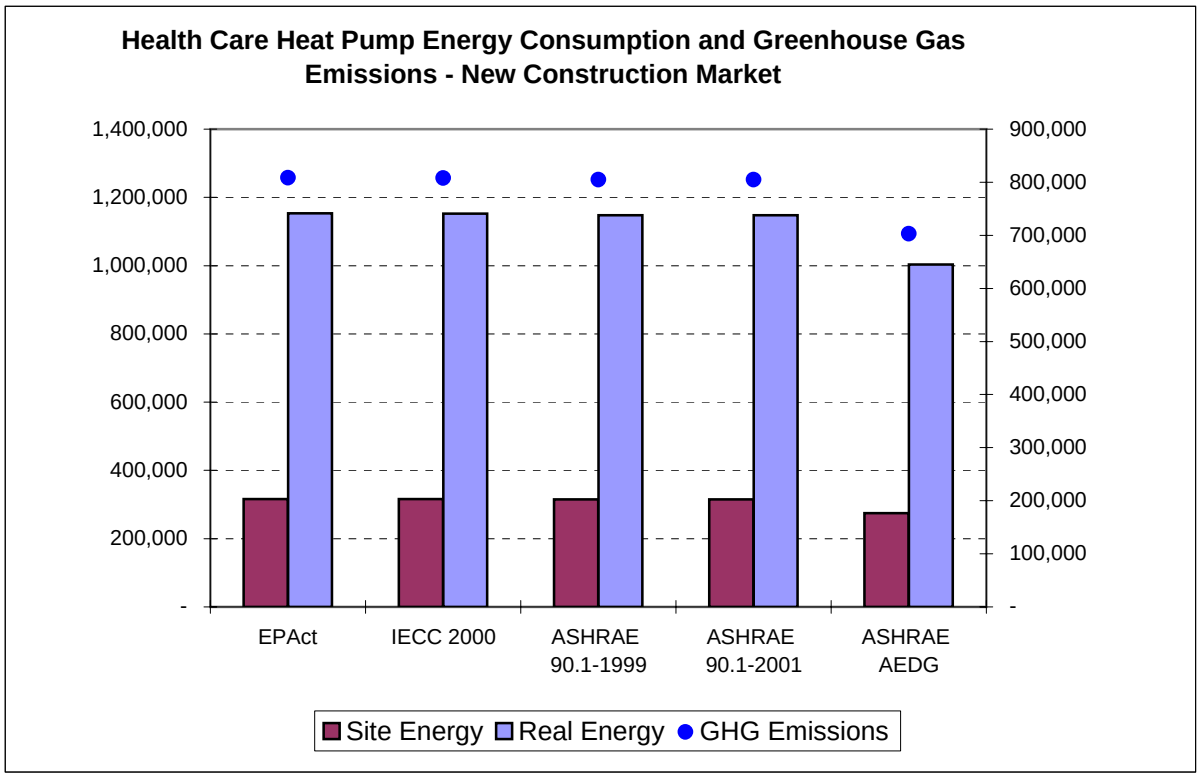
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,790,886	6,536,081	4,580,126
IECC 2000	1,789,857	6,532,324	4,577,494
ASHRAE 90.1-1999	1,782,804	6,506,584	4,559,456
ASHRAE 90.1-2001	1,782,804	6,506,584	4,559,456
ASHRAE AEDG	1,557,922	5,685,847	3,984,329



Health Care Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

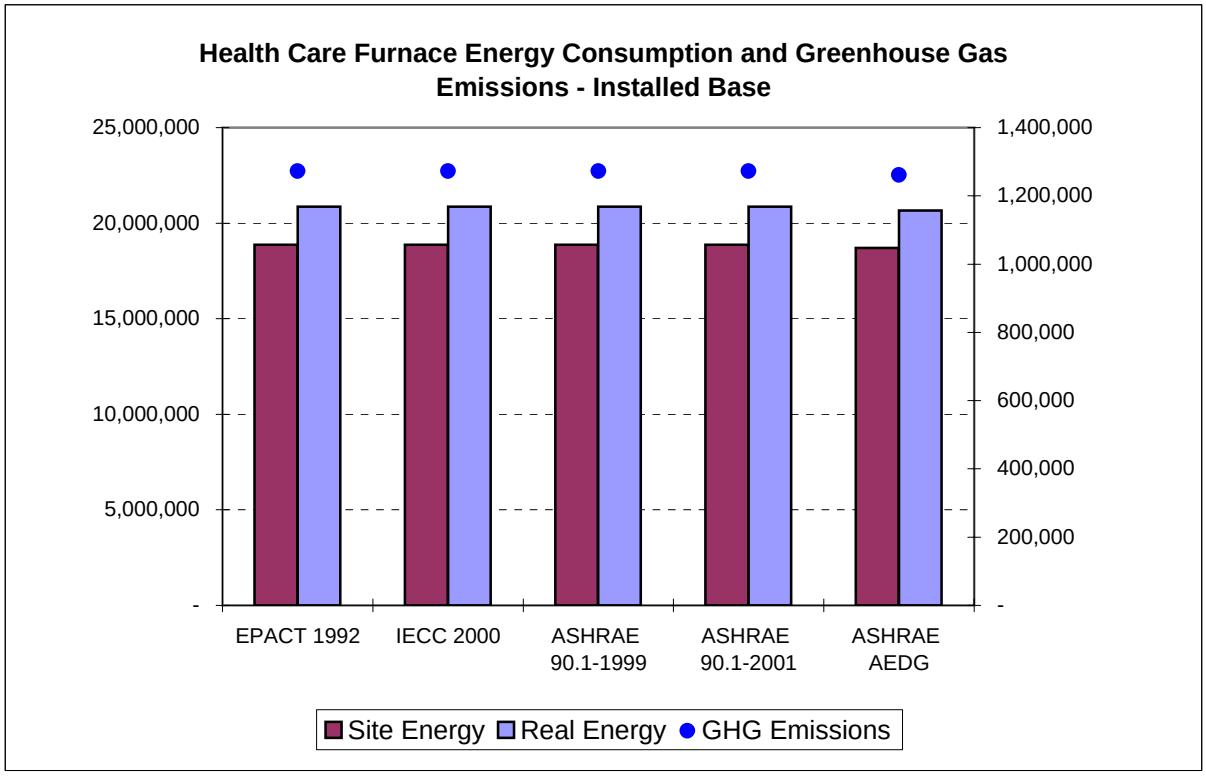
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	316,039	1,153,426	808,258
IECC 2000	315,857	1,152,763	807,793
ASHRAE 90.1-1999	314,612	1,148,221	804,610
ASHRAE 90.1-2001	314,612	1,148,221	804,610
ASHRAE AEDG	274,927	1,003,385	703,117



Health Care Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	18,874,871	20,856,211	1,272,750
IECC 2000	18,874,871	20,856,211	1,272,750
ASHRAE 90.1-1999	18,874,871	20,856,211	1,272,750
ASHRAE 90.1-2001	18,874,871	20,856,211	1,272,750
ASHRAE AEDG	18,704,953	20,668,457	1,261,293

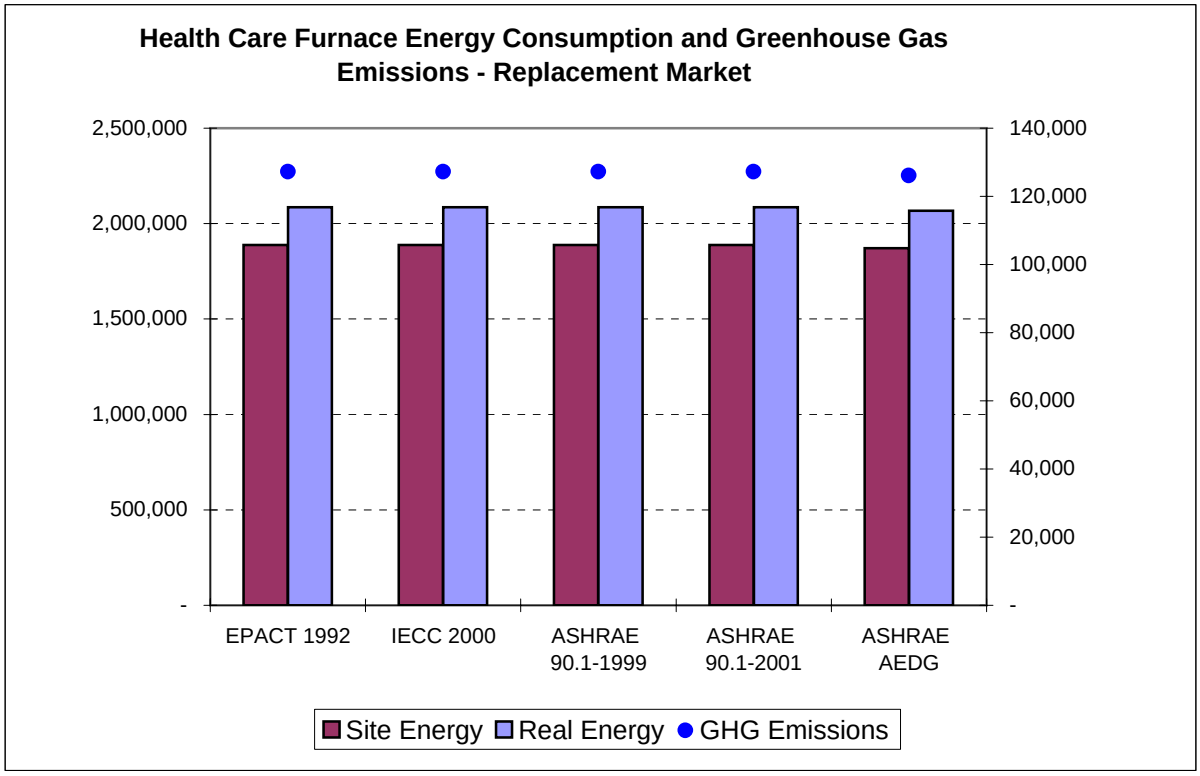


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Health Care Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,887,487	2,085,621	127,275
IECC 2000	1,887,487	2,085,621	127,275
ASHRAE 90.1-1999	1,887,487	2,085,621	127,275
ASHRAE 90.1-2001	1,887,487	2,085,621	127,275
ASHRAE AEDG	1,870,495	2,066,846	126,129

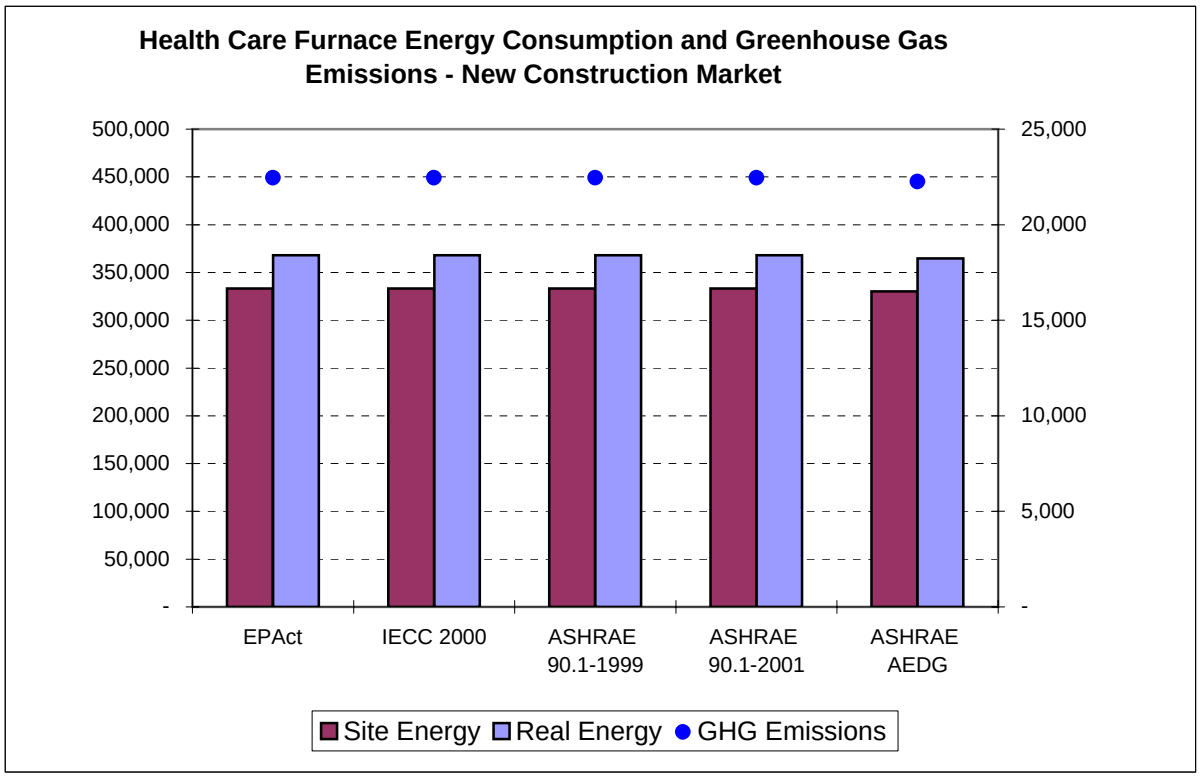


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Health Care Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	333,086	368,051	22,460
IECC 2000	333,086	368,051	22,460
ASHRAE 90.1-1999	333,086	368,051	22,460
ASHRAE 90.1-2001	333,086	368,051	22,460
ASHRAE AEDG	330,087	364,737	22,258

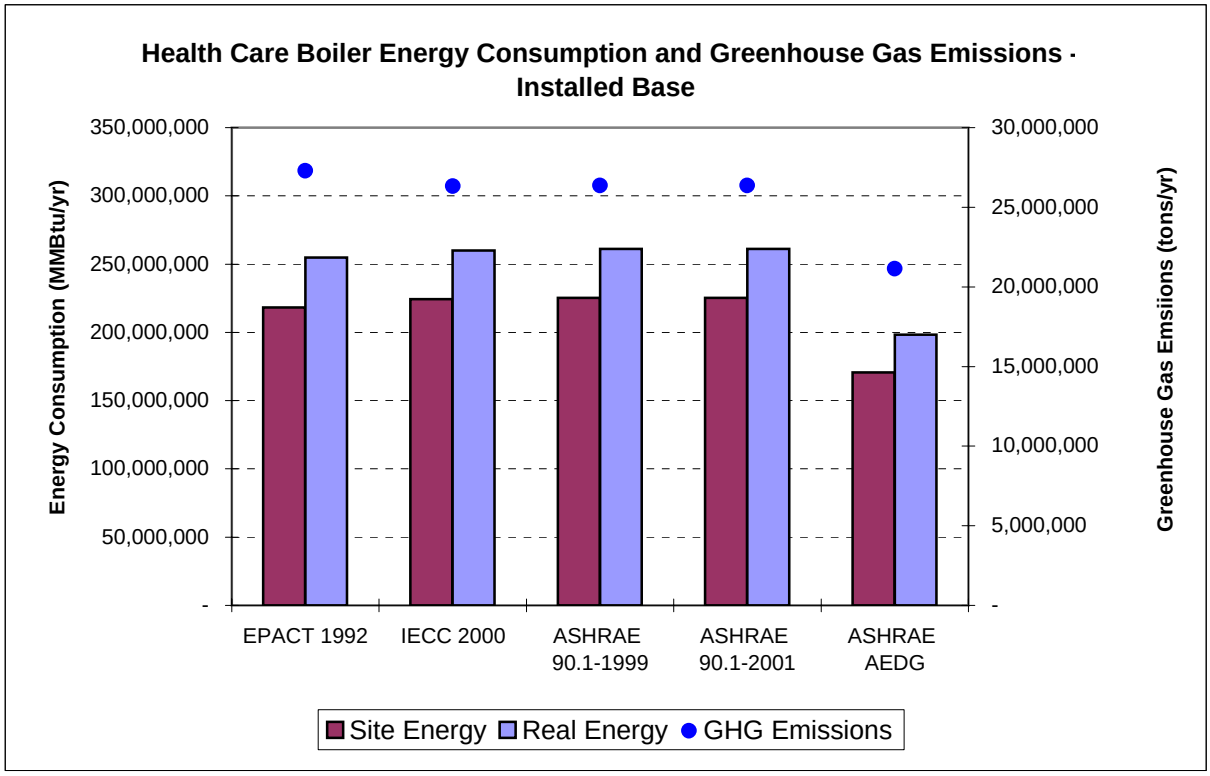


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Health Care Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

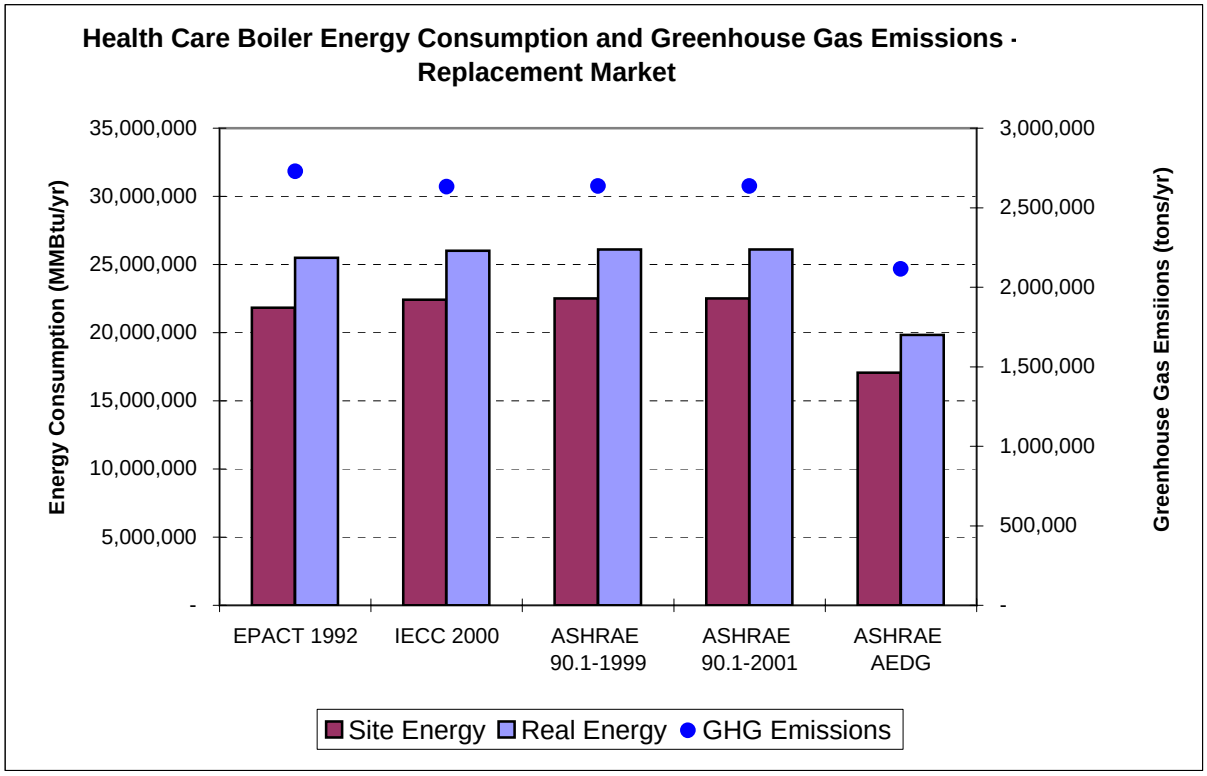
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	218,317,451	254,840,395	27,292,381
IECC 2000	224,280,705	260,056,958	26,324,983
ASHRAE 90.1-1999	225,225,984	261,086,670	26,359,413
ASHRAE 90.1-2001	225,225,984	261,086,670	26,359,413
ASHRAE AEDG	170,587,335	198,348,964	21,145,970



Health Care Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

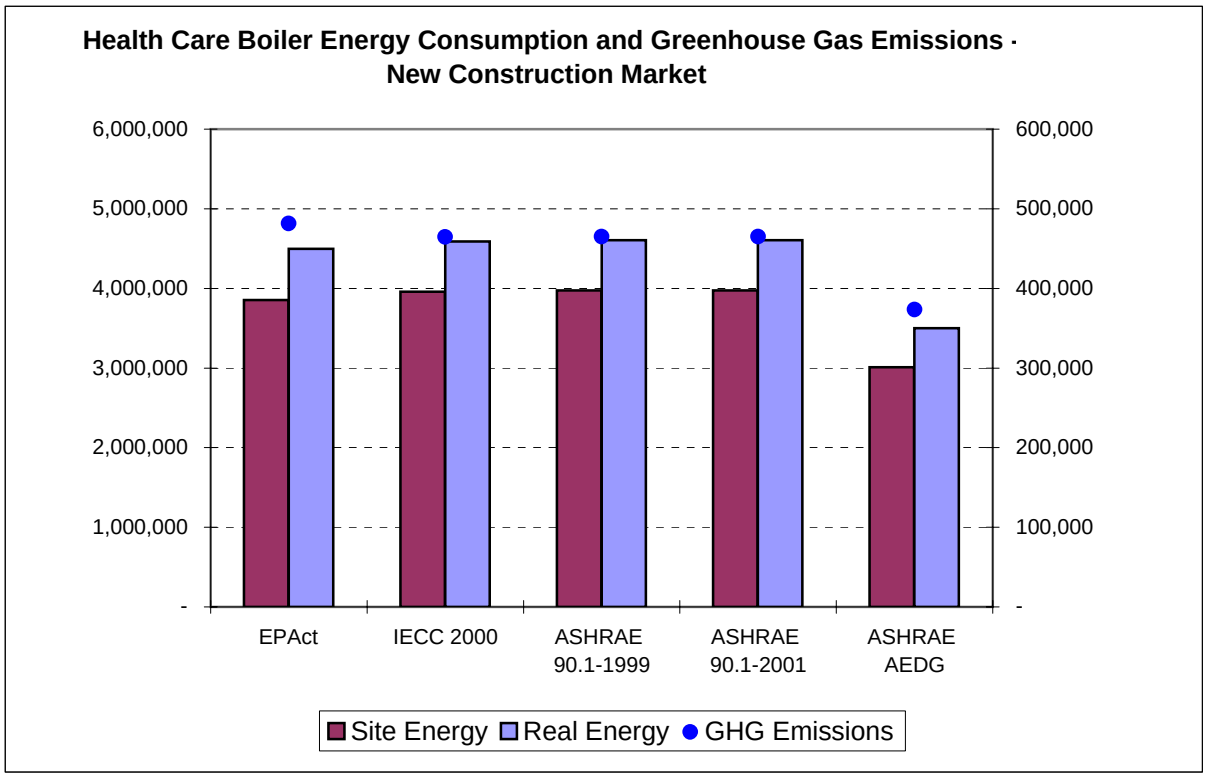
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	21,831,745	25,484,040	2,729,238
IECC 2000	22,428,071	26,005,696	2,632,498
ASHRAE 90.1-1999	22,522,598	26,108,667	2,635,941
ASHRAE 90.1-2001	22,522,598	26,108,667	2,635,941
ASHRAE AEDG	17,058,734	19,834,896	2,114,597



Health Care Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

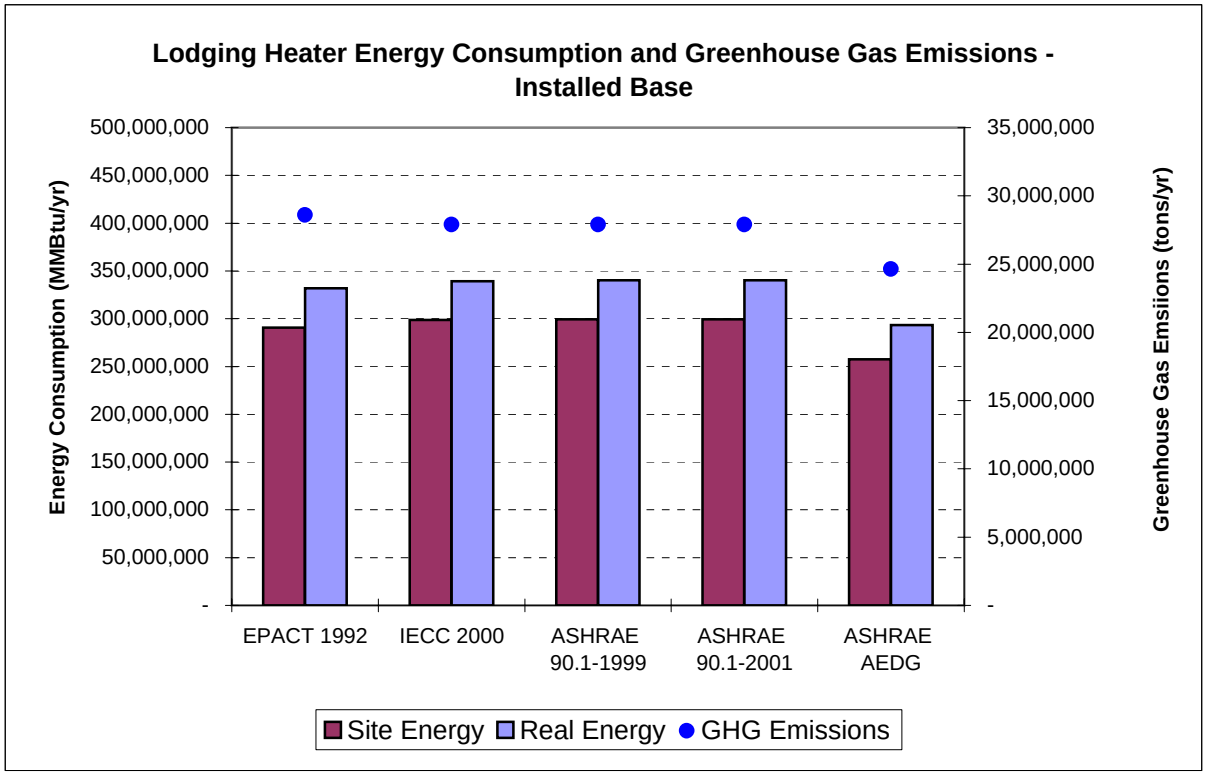
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	3,852,661	4,497,183	481,630
IECC 2000	3,957,895	4,589,240	464,559
ASHRAE 90.1-1999	3,974,576	4,607,412	465,166
ASHRAE 90.1-2001	3,974,576	4,607,412	465,166
ASHRAE AEDG	3,010,365	3,500,276	373,164



Lodging Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

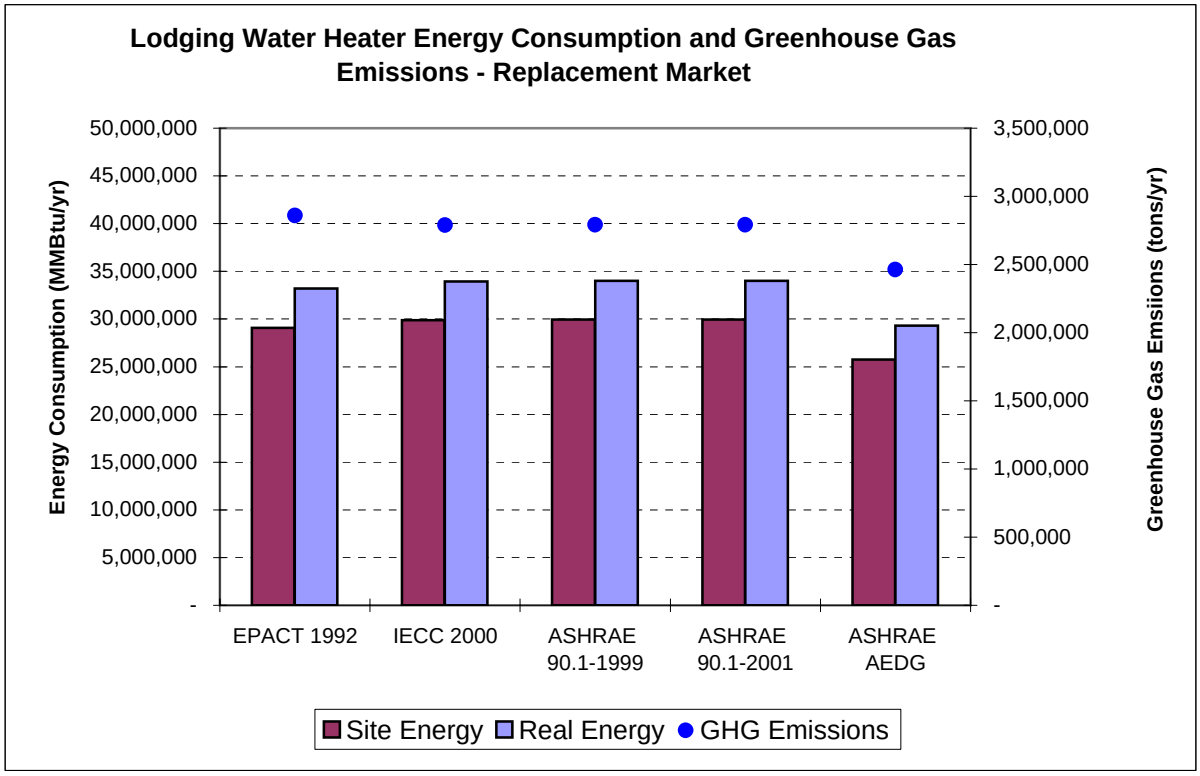
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	290,816,441	331,993,128	28,600,108
IECC 2000	298,629,413	339,411,549	27,896,955
ASHRAE 90.1-1999	299,305,271	340,119,889	27,901,443
ASHRAE 90.1-2001	299,305,271	340,119,889	27,901,443
ASHRAE AEDG	257,464,845	293,217,762	24,632,338



Lodging Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

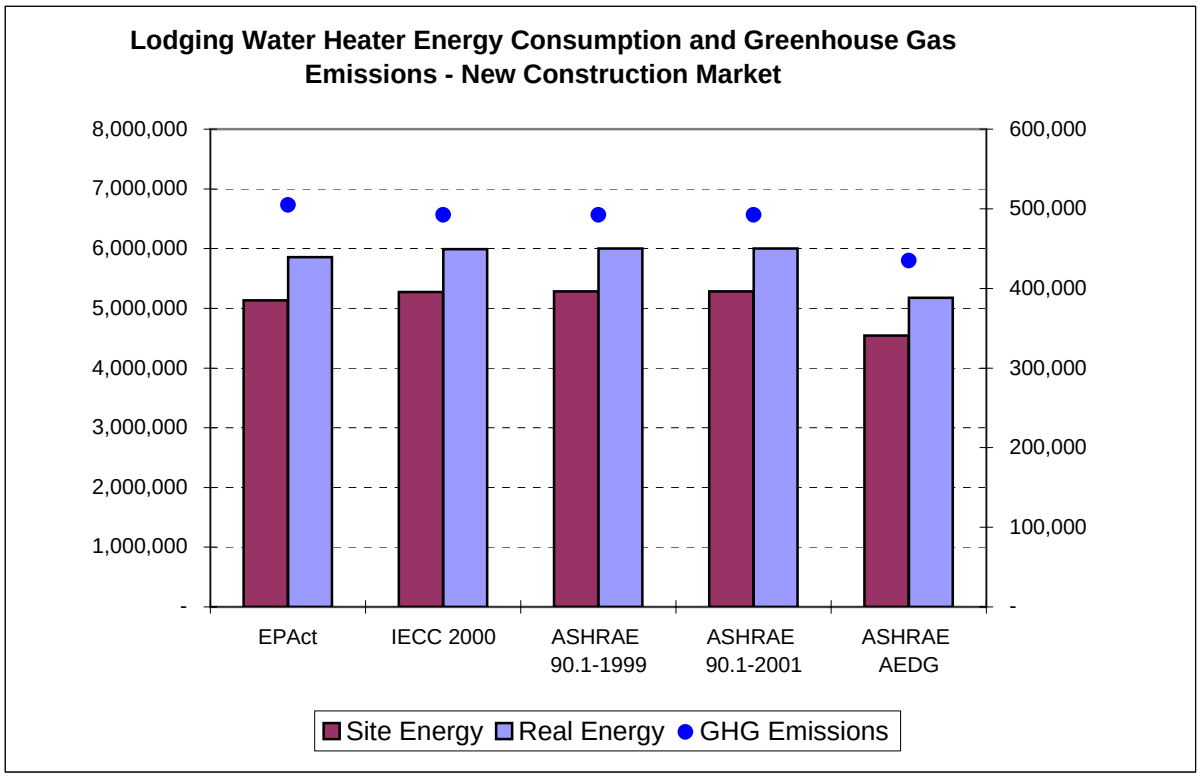
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	29,081,644	33,199,313	2,860,011
IECC 2000	29,862,941	33,941,155	2,789,696
ASHRAE 90.1-1999	29,930,527	34,011,989	2,790,144
ASHRAE 90.1-2001	29,930,527	34,011,989	2,790,144
ASHRAE AEDG	25,746,484	29,321,776	2,463,234



Lodging Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

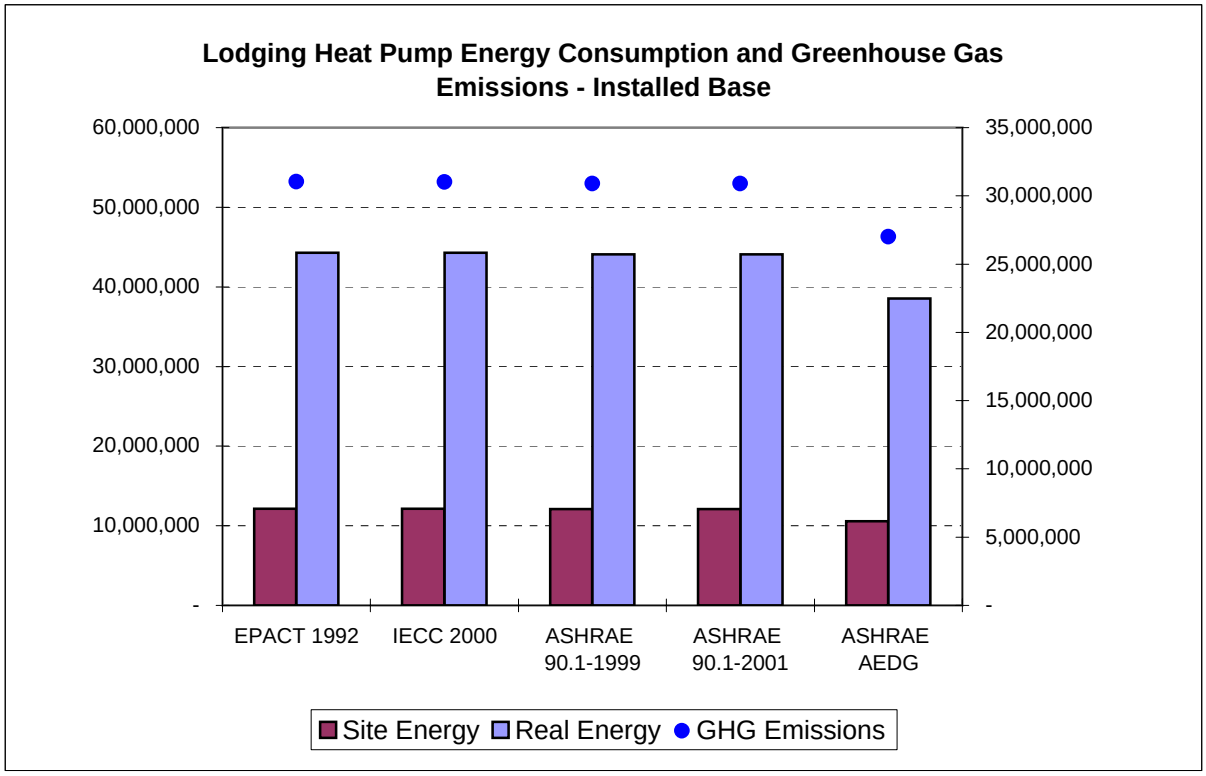
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	5,132,055	5,858,702	504,708
IECC 2000	5,269,931	5,989,616	492,299
ASHRAE 90.1-1999	5,281,858	6,002,116	492,378
ASHRAE 90.1-2001	5,281,858	6,002,116	492,378
ASHRAE AEDG	4,543,497	5,174,431	434,688



Lodging Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

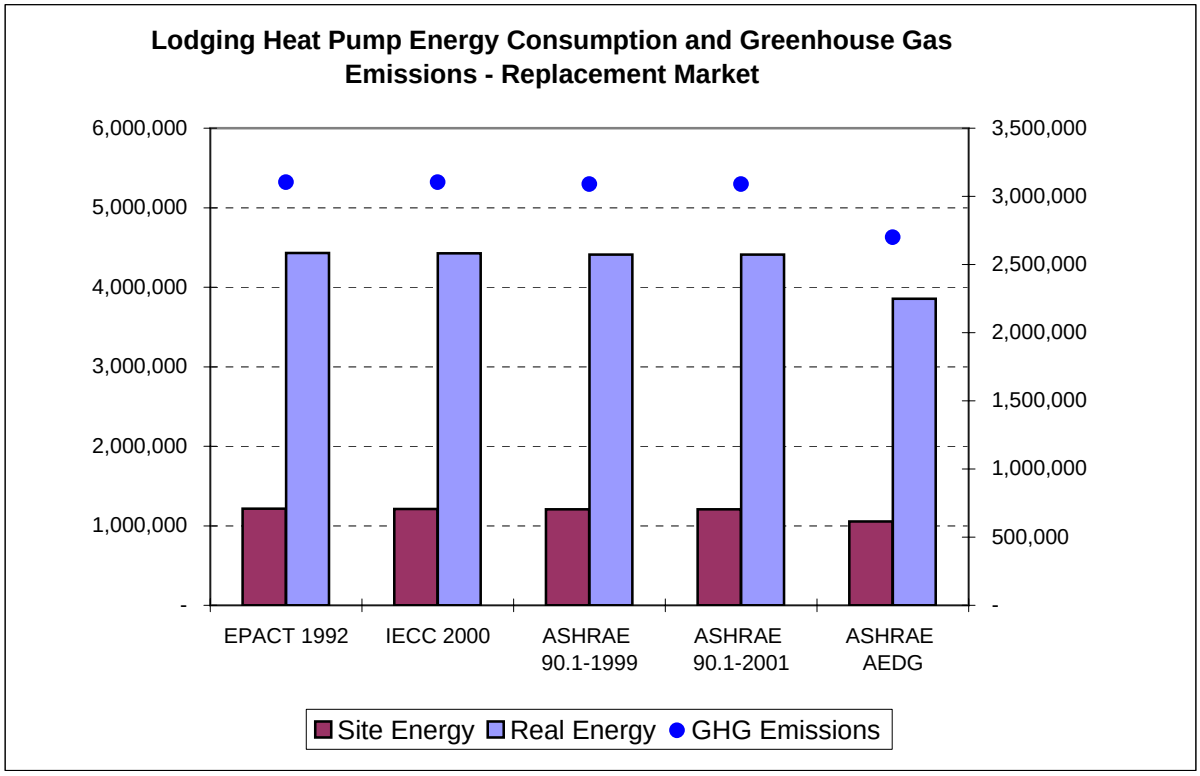
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	12,138,108	44,299,665	31,042,768
IECC 2000	12,131,132	44,274,204	31,024,927
ASHRAE 90.1-1999	12,083,330	44,099,745	30,902,675
ASHRAE 90.1-2001	12,083,330	44,099,745	30,902,675
ASHRAE AEDG	10,559,145	38,537,025	27,004,628



Lodging Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

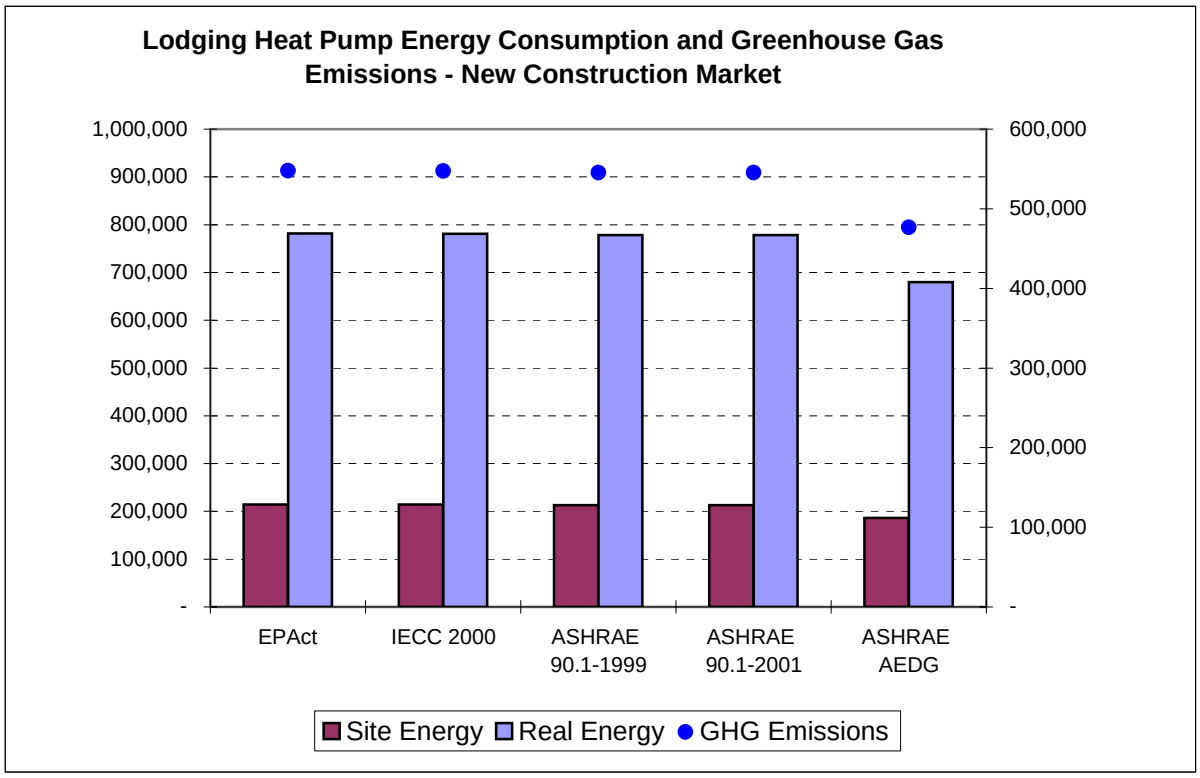
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,213,811	4,429,966	3,104,277
IECC 2000	1,213,113	4,427,420	3,102,493
ASHRAE 90.1-1999	1,208,333	4,409,974	3,090,268
ASHRAE 90.1-2001	1,208,333	4,409,974	3,090,268
ASHRAE AEDG	1,055,914	3,853,703	2,700,463



Lodging Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

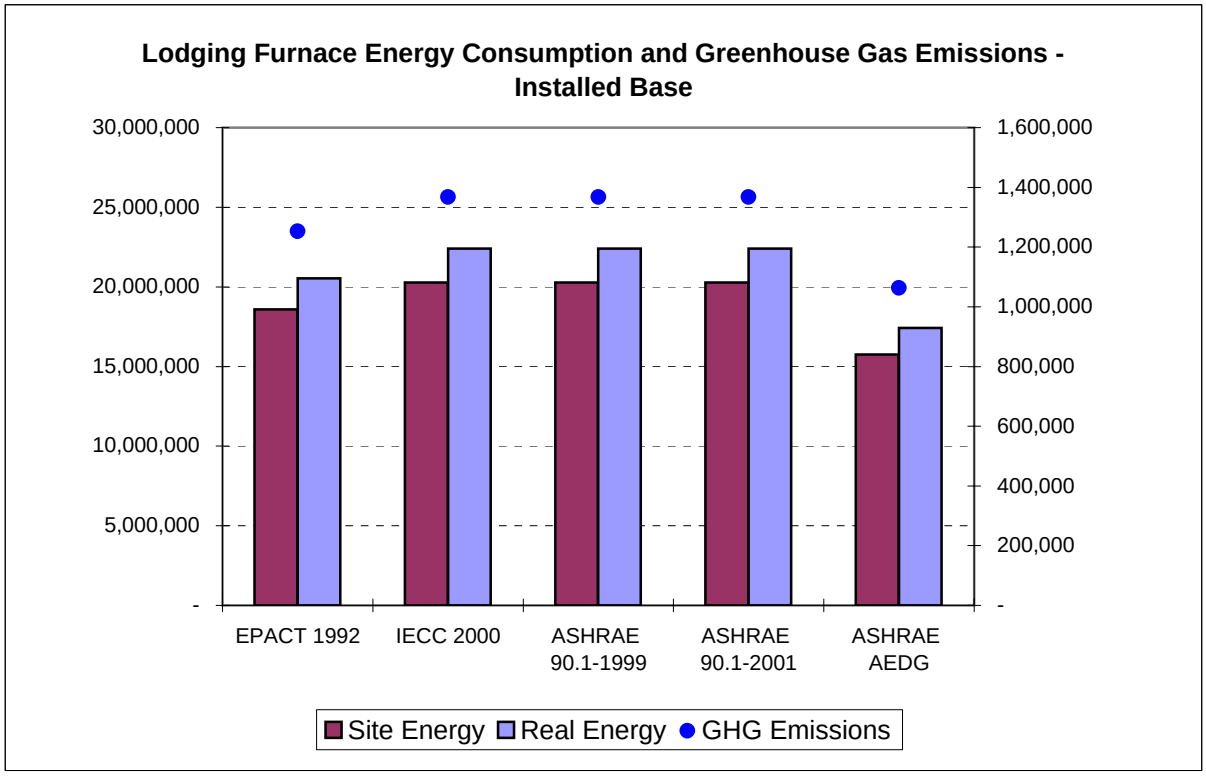
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	214,202	781,759	547,814
IECC 2000	214,079	781,309	547,499
ASHRAE 90.1-1999	213,235	778,231	545,341
ASHRAE 90.1-2001	213,235	778,231	545,341
ASHRAE AEDG	186,338	680,065	476,552



Lodging Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	18,582,662	20,533,329	1,253,046
IECC 2000	20,273,459	22,401,612	1,367,058
ASHRAE 90.1-1999	20,273,459	22,401,612	1,367,058
ASHRAE 90.1-2001	20,273,459	22,401,612	1,367,058
ASHRAE AEDG	15,762,718	17,417,368	1,062,895

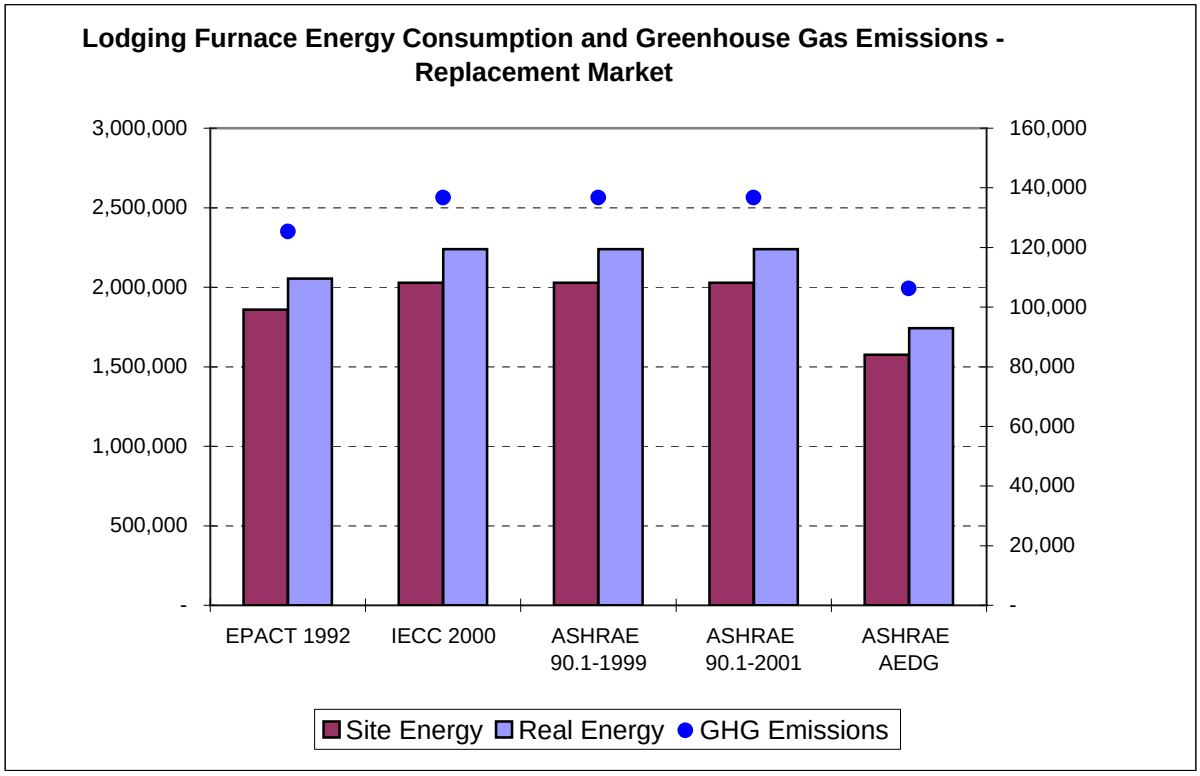


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Lodging Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,858,266	2,053,333	125,305
IECC 2000	2,027,346	2,240,161	136,706
ASHRAE 90.1-1999	2,027,346	2,240,161	136,706
ASHRAE 90.1-2001	2,027,346	2,240,161	136,706
ASHRAE AEDG	1,576,272	1,741,737	106,289

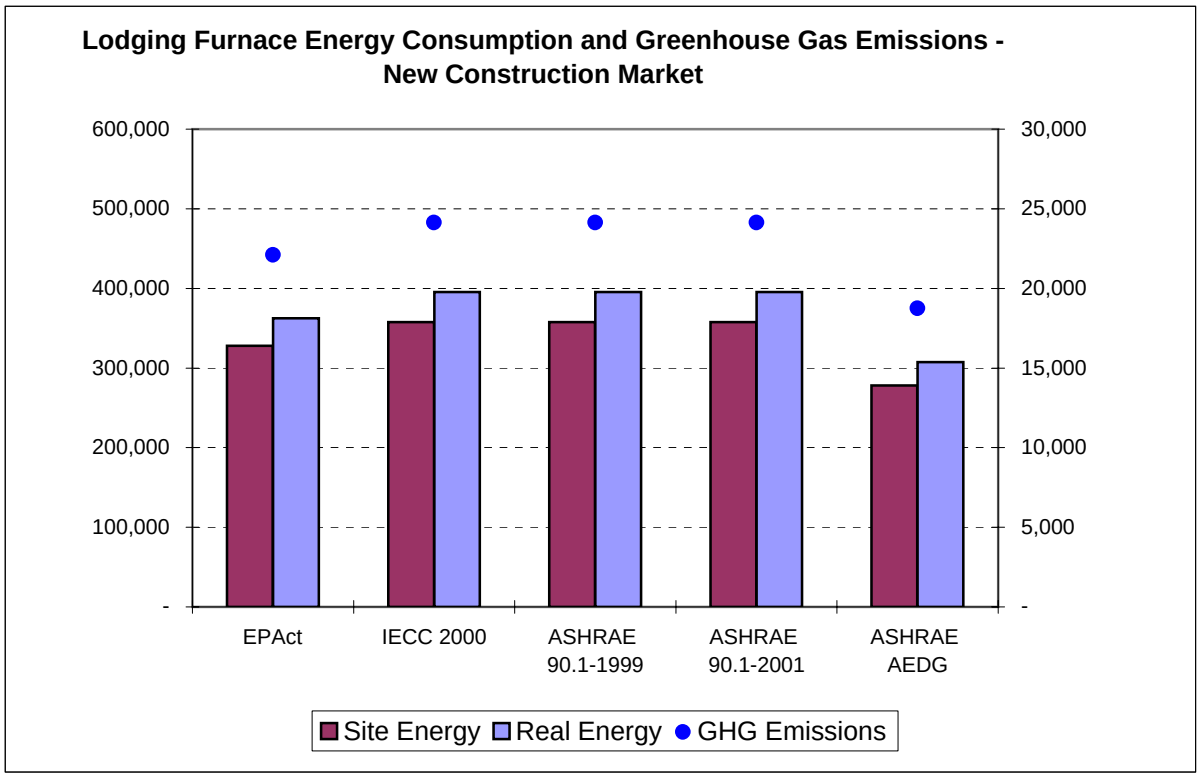


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Lodging Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	327,929	362,353	22,113
IECC 2000	357,767	395,323	24,125
ASHRAE 90.1-1999	357,767	395,323	24,125
ASHRAE 90.1-2001	357,767	395,323	24,125
ASHRAE AEDG	278,166	307,365	18,757



Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Lodging Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	290,816,441	331,993,128	28,600,108
IECC 2000	298,629,413	339,411,549	27,896,955
ASHRAE 90.1-1999	299,305,271	340,119,889	27,901,443
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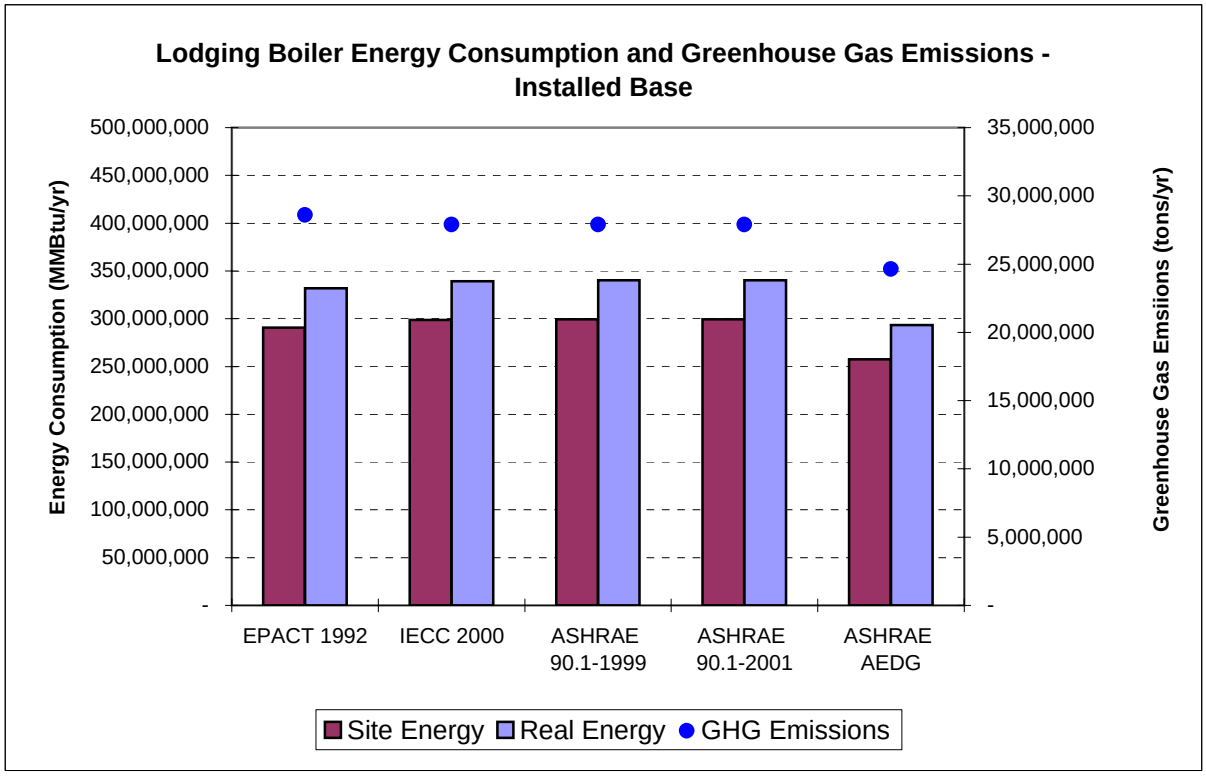
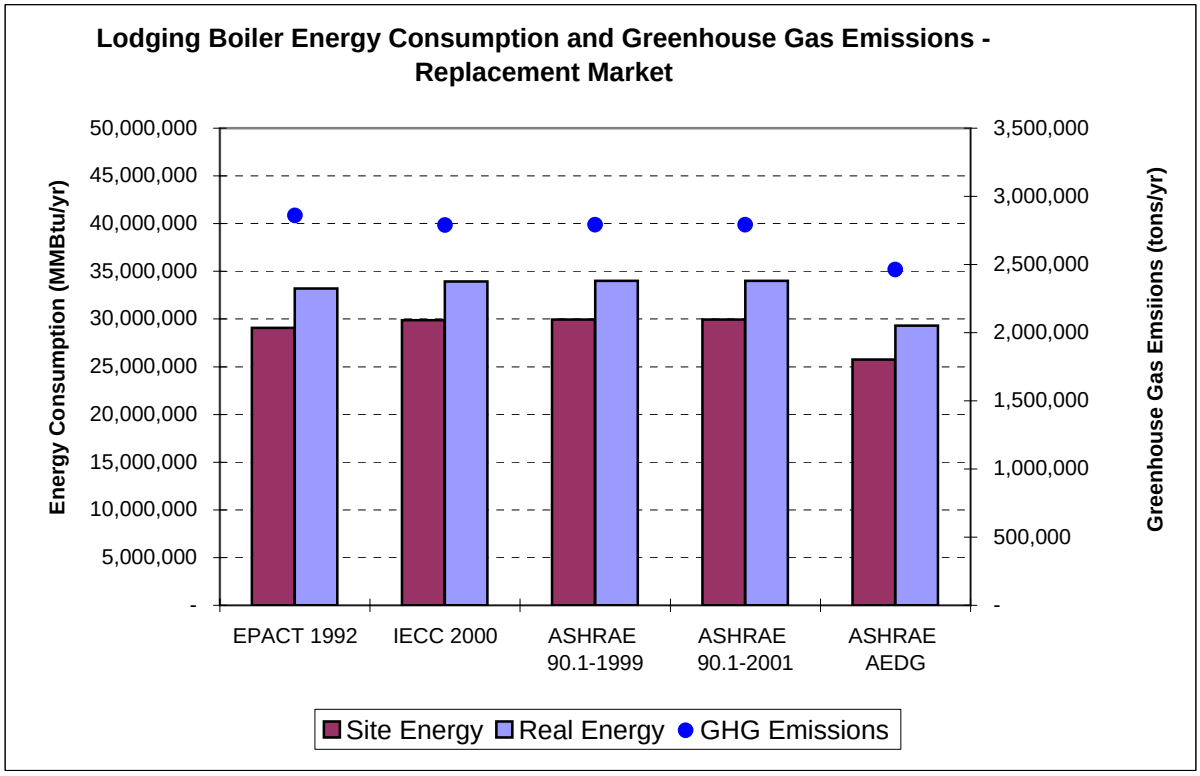
ASHRAE AEDG	257,464,845	293,217,762	24,632,338



Lodging Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

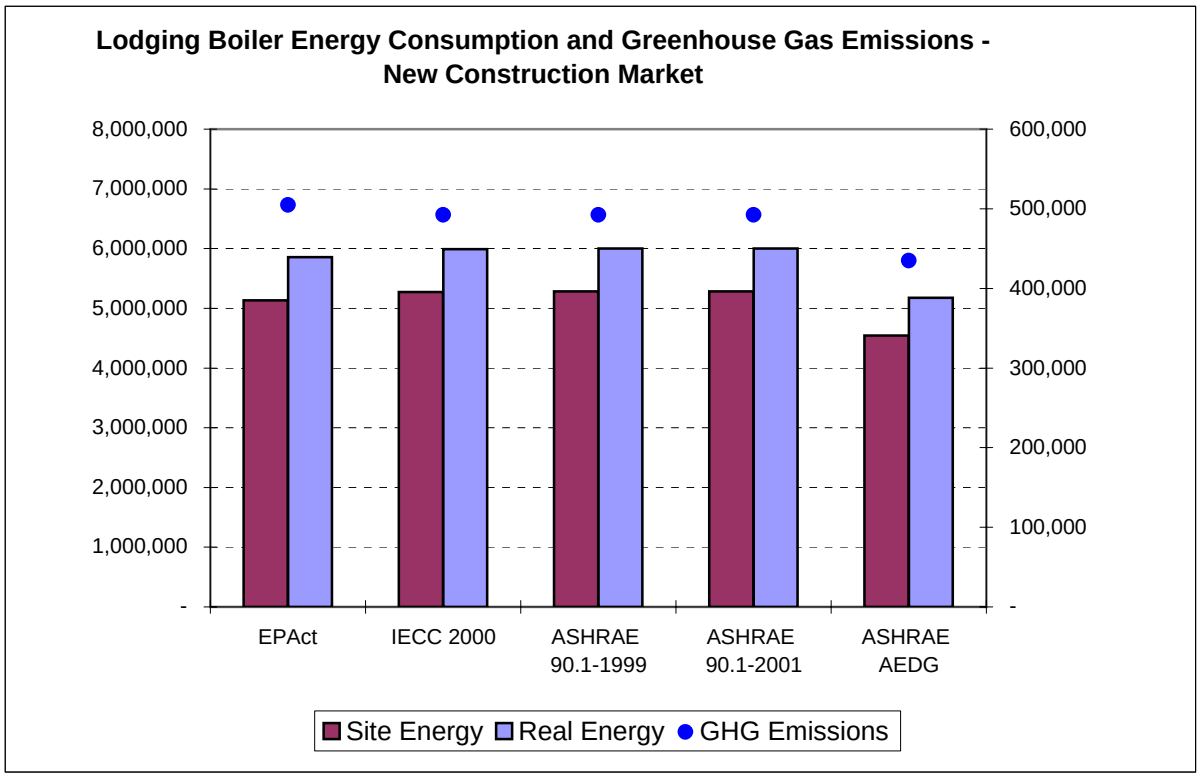
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	29,081,644	33,199,313	2,860,011
IECC 2000	29,862,941	33,941,155	2,789,696
ASHRAE 90.1-1999	29,930,527	34,011,989	2,790,144
ASHRAE 90.1-2001	29,930,527	34,011,989	2,790,144
ASHRAE AEDG	25,746,484	29,321,776	2,463,234



Lodging Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

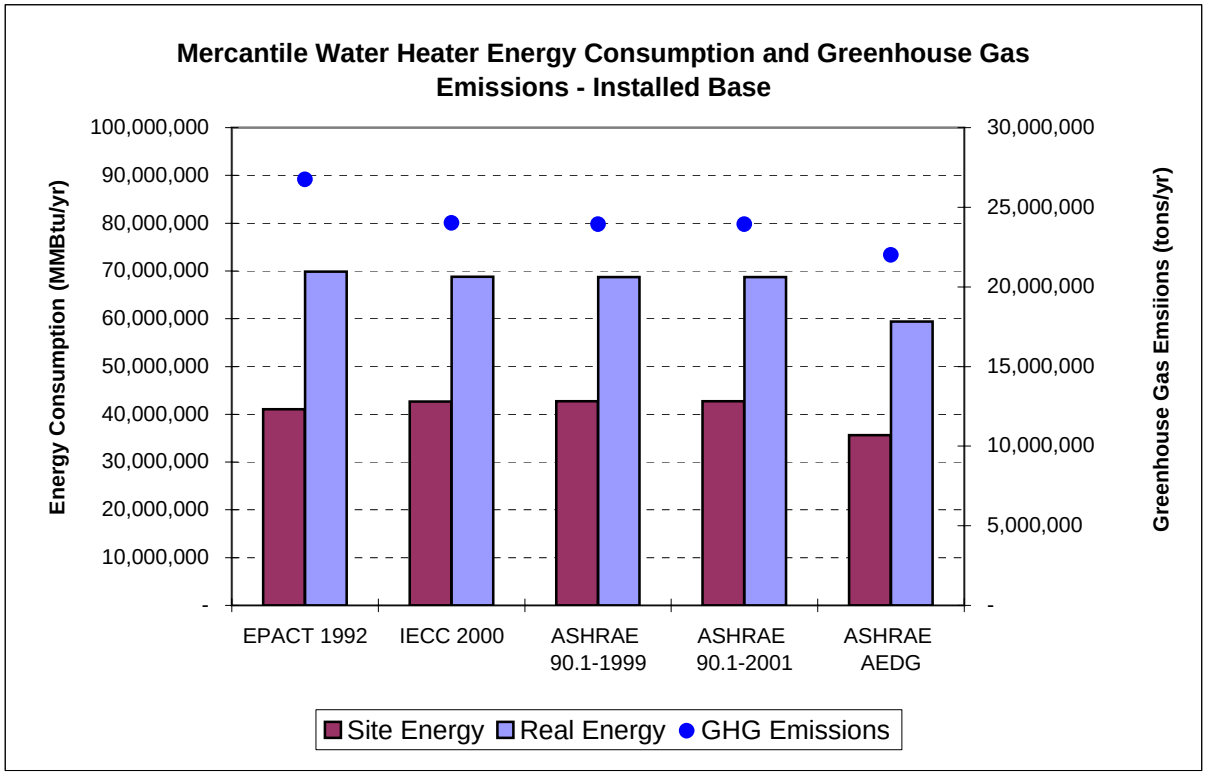
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	5,132,055	5,858,702	504,708
IECC 2000	5,269,931	5,989,616	492,299
ASHRAE 90.1-1999	5,281,858	6,002,116	492,378
ASHRAE 90.1-2001	5,281,858	6,002,116	492,378
ASHRAE AEDG	4,543,497	5,174,431	434,688



Mercantile Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

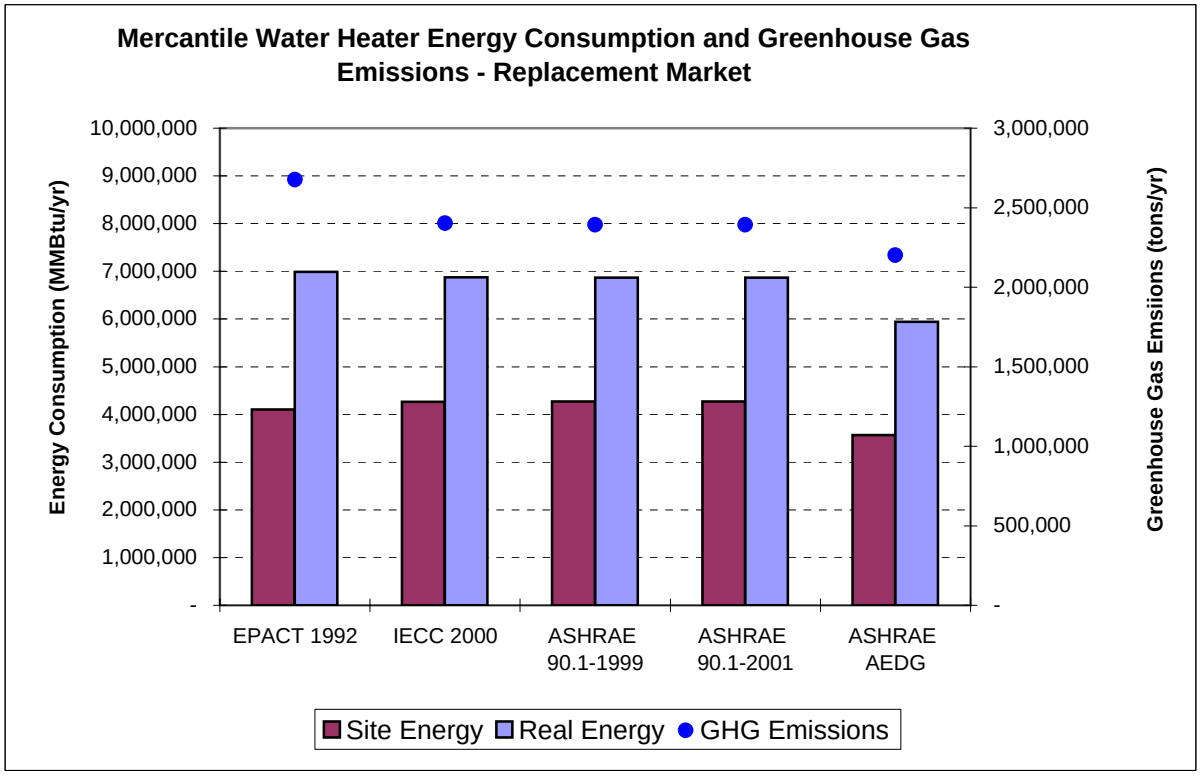
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	41,051,857	69,870,329	26,751,152
IECC 2000	42,668,997	68,755,045	24,020,323
ASHRAE 90.1-1999	42,705,897	68,702,806	23,931,796
ASHRAE 90.1-2001	42,705,897	68,702,806	23,931,796
ASHRAE AEDG	35,660,808	59,438,236	22,008,569



Mercantile Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

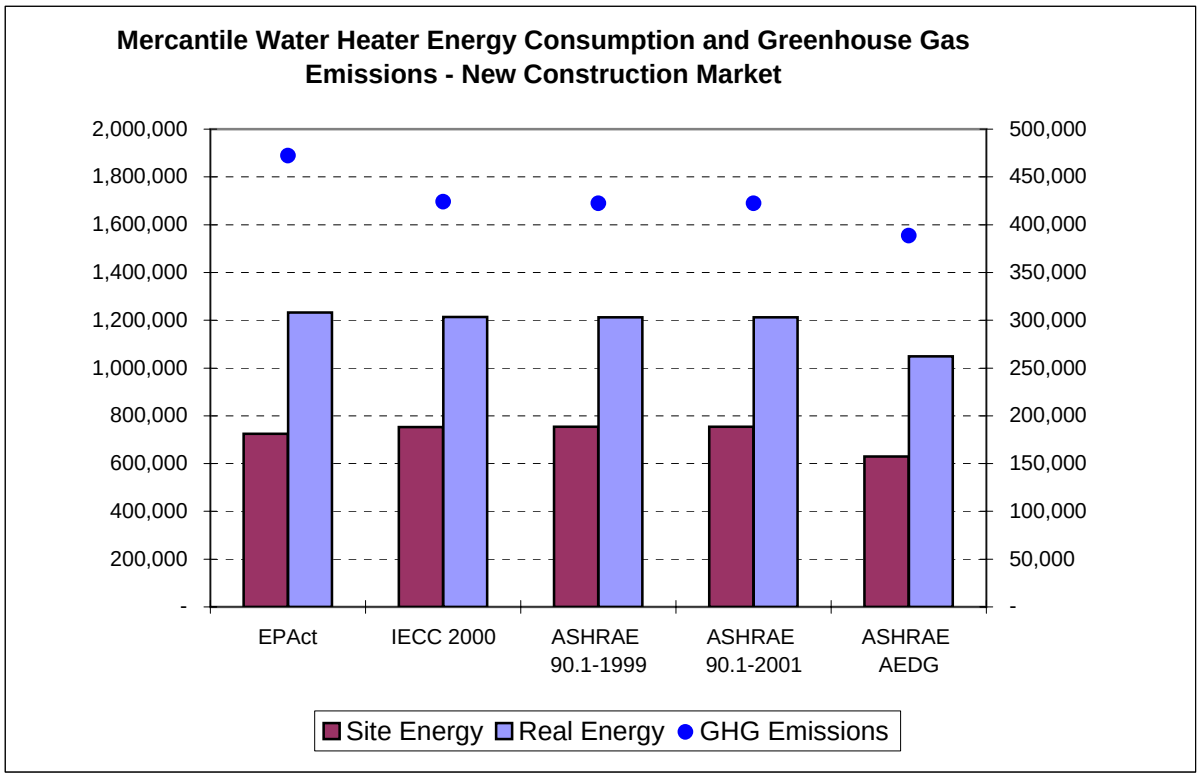
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	4,105,186	6,987,033	2,675,115
IECC 2000	4,266,900	6,875,504	2,402,032
ASHRAE 90.1-1999	4,270,590	6,870,281	2,393,180
ASHRAE 90.1-2001	4,270,590	6,870,281	2,393,180
ASHRAE AEDG	3,566,081	5,943,824	2,200,857



Mercantile Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

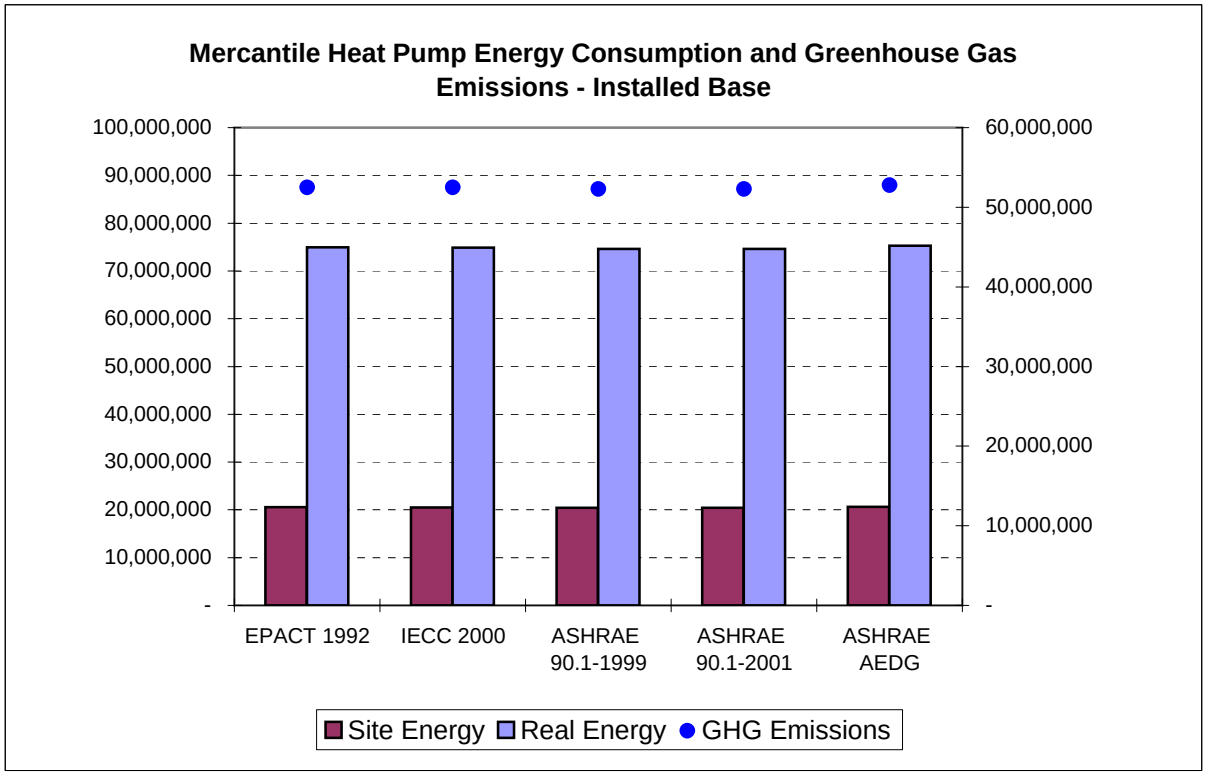
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	724,445	1,233,006	472,079
IECC 2000	752,982	1,213,324	423,888
ASHRAE 90.1-1999	753,633	1,212,402	422,326
ASHRAE 90.1-2001	753,633	1,212,402	422,326
ASHRAE AEDG	629,308	1,048,910	388,387



Mercantile Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

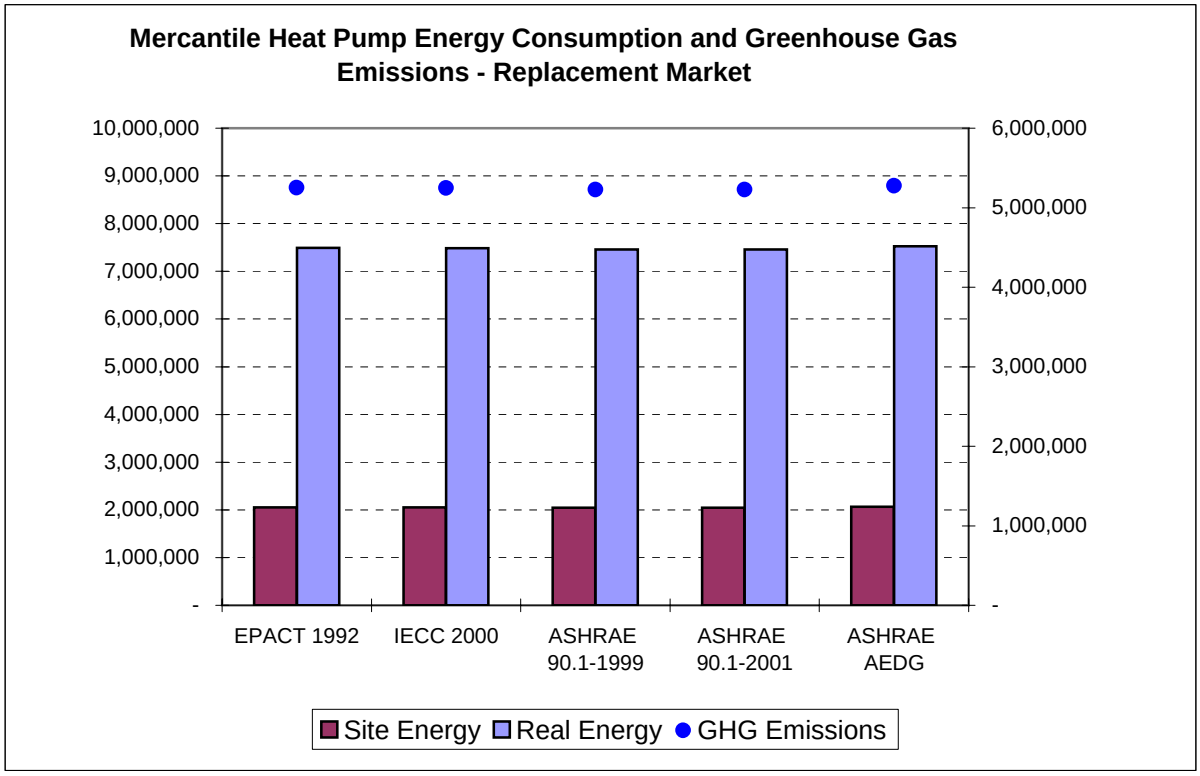
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	20,529,582	74,925,483	52,503,658
IECC 2000	20,517,783	74,882,420	52,473,482
ASHRAE 90.1-1999	20,436,934	74,587,352	52,266,714
ASHRAE 90.1-2001	20,436,934	74,587,352	52,266,714
ASHRAE AEDG	20,627,650	75,283,394	52,754,462



Mercantile Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

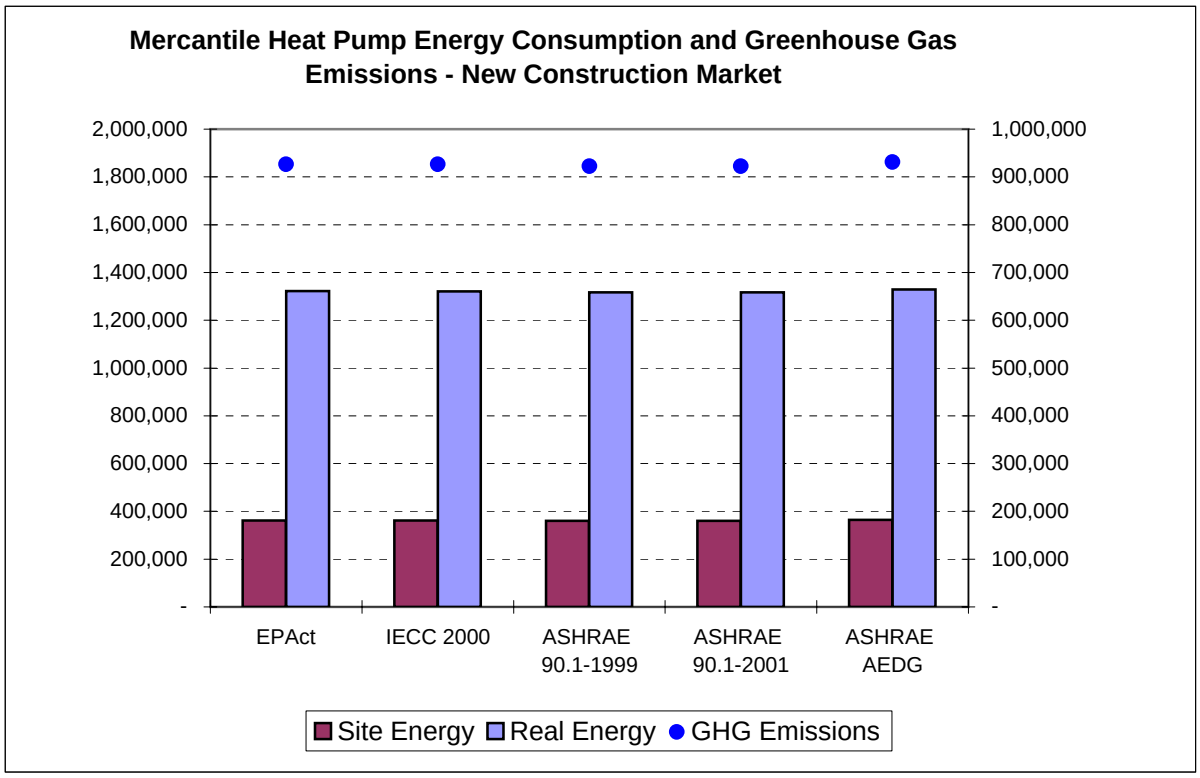
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	2,052,958	7,492,548	5,250,366
IECC 2000	2,051,778	7,488,242	5,247,348
ASHRAE 90.1-1999	2,043,693	7,458,735	5,226,671
ASHRAE 90.1-2001	2,043,693	7,458,735	5,226,671
ASHRAE AEDG	2,062,765	7,528,339	5,275,446



Mercantile Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

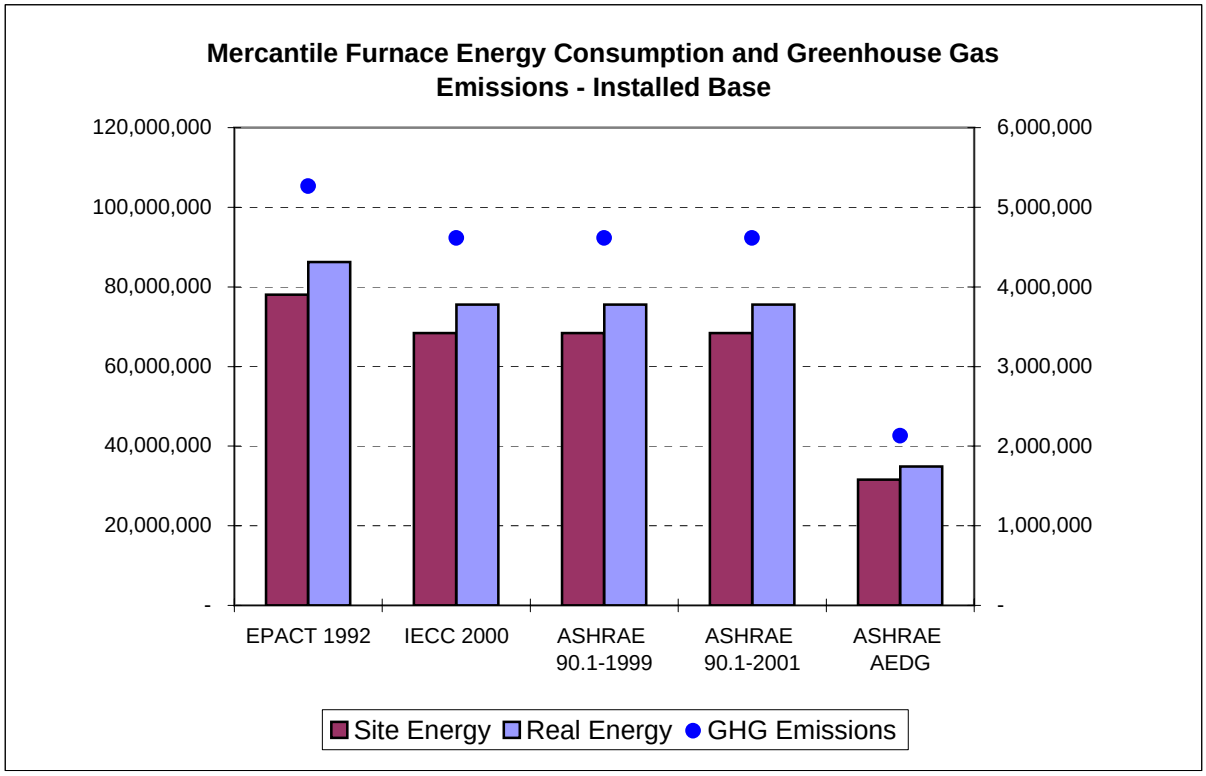
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	362,287	1,322,214	926,535
IECC 2000	362,079	1,321,454	926,003
ASHRAE 90.1-1999	360,652	1,316,247	922,354
ASHRAE 90.1-2001	360,652	1,316,247	922,354
ASHRAE AEDG	364,017	1,328,530	930,961



Mercantile Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	78,057,756	86,251,664	5,263,508
IECC 2000	68,404,736	75,585,343	4,612,596
ASHRAE 90.1-1999	68,404,736	75,585,343	4,612,596
ASHRAE 90.1-2001	68,404,736	75,585,343	4,612,596
ASHRAE AEDG	31,593,009	34,909,403	2,130,346

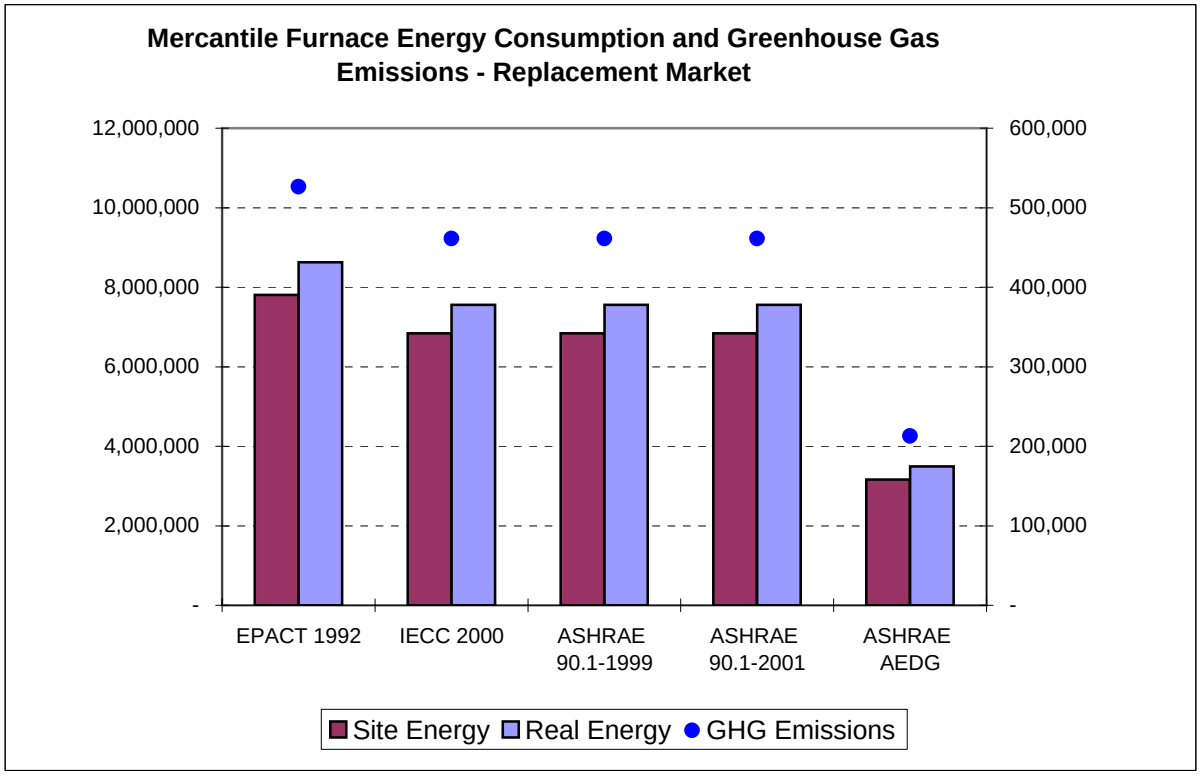


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Mercantile Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	7,805,776	8,625,166	526,351
IECC 2000	6,840,474	7,558,534	461,260
ASHRAE 90.1-1999	6,840,474	7,558,534	461,260
ASHRAE 90.1-2001	6,840,474	7,558,534	461,260
ASHRAE AEDG	3,159,301	3,490,940	213,035

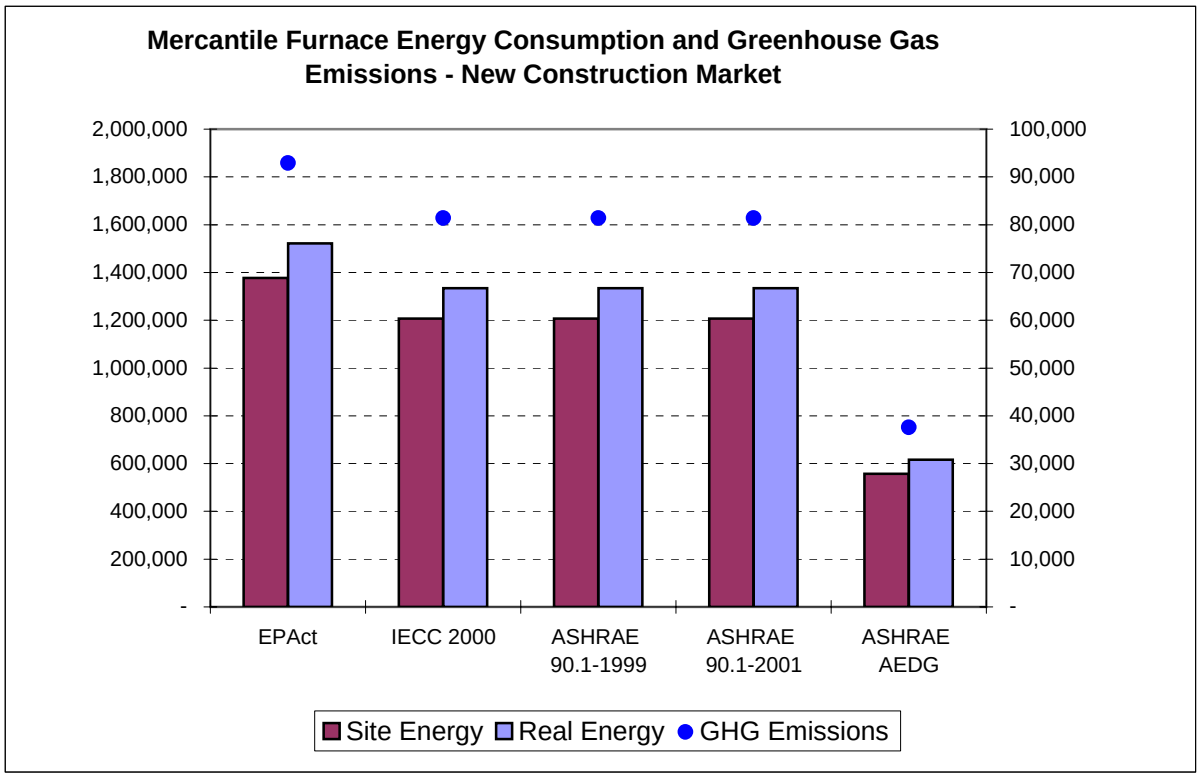


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Mercantile Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,377,490	1,522,088	92,885
IECC 2000	1,207,142	1,333,859	81,399
ASHRAE 90.1-1999	1,207,142	1,333,859	81,399
ASHRAE 90.1-2001	1,207,142	1,333,859	81,399
ASHRAE AEDG	557,524	616,048	37,594

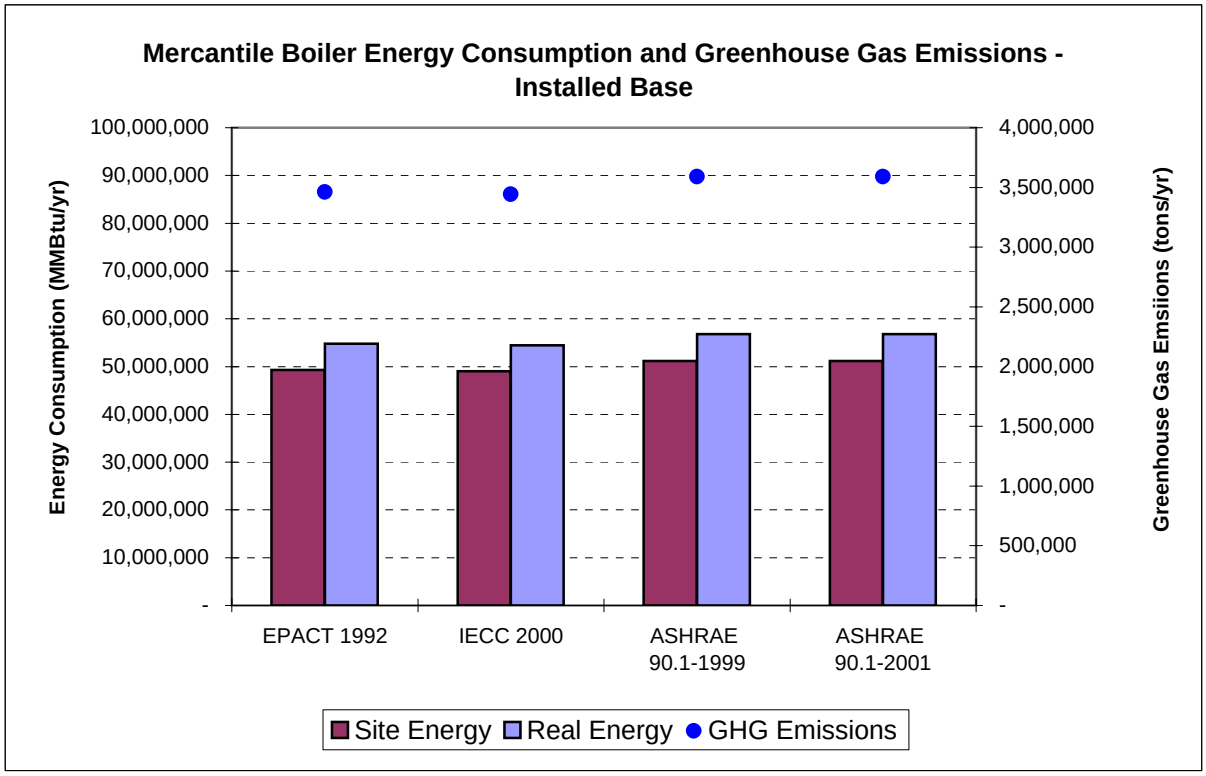


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Mercantile Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

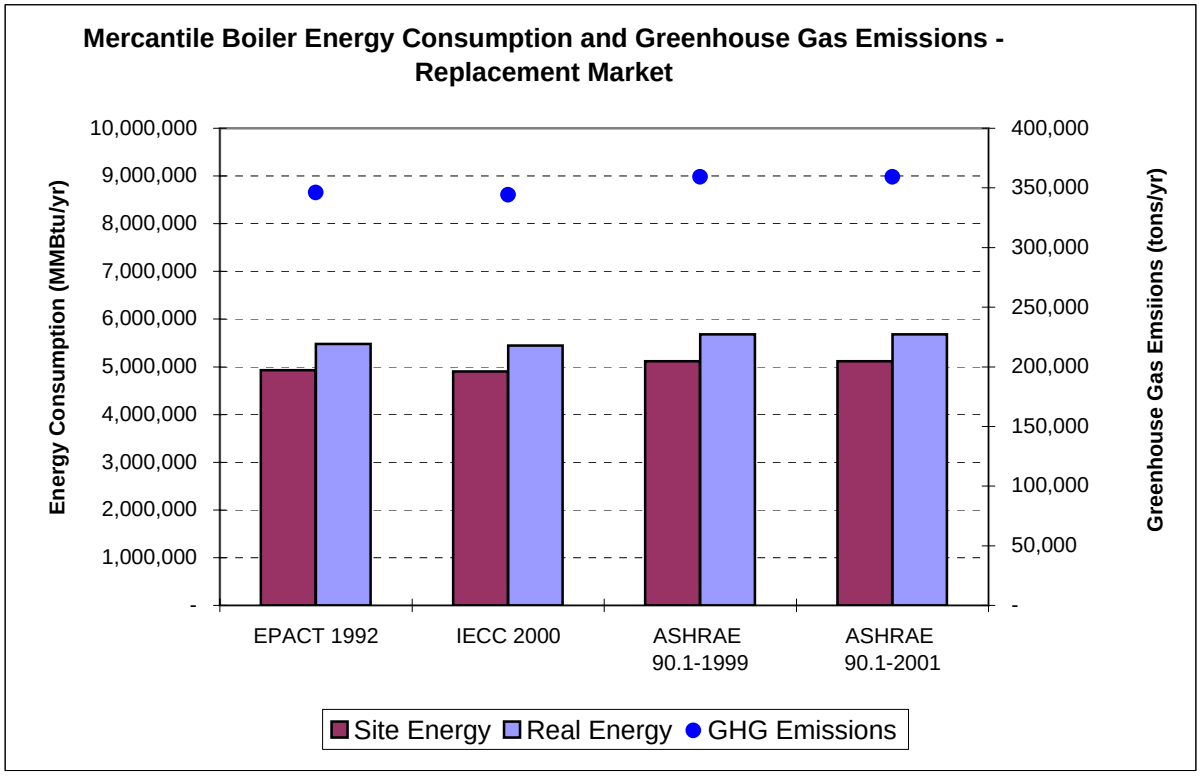
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	49,319,002	54,765,712	3,460,249
IECC 2000	49,047,148	54,465,321	3,441,918
ASHRAE 90.1-1999	51,175,065	56,827,887	3,591,037
ASHRAE 90.1-2001	51,175,065	56,827,887	3,591,037



Mercantile Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

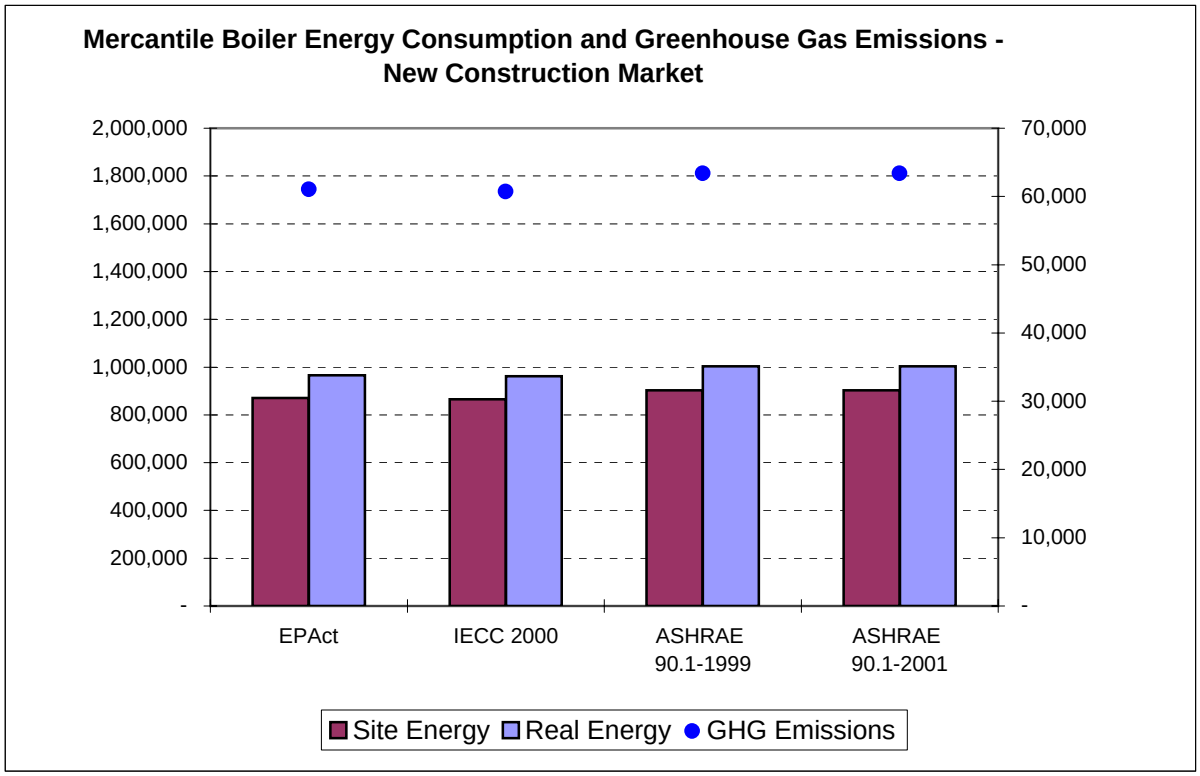
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	4,931,900	5,476,571	346,025
IECC 2000	4,904,715	5,446,532	344,192
ASHRAE 90.1-1999	5,117,506	5,682,789	359,104
ASHRAE 90.1-2001	5,117,506	5,682,789	359,104



Mercantile Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

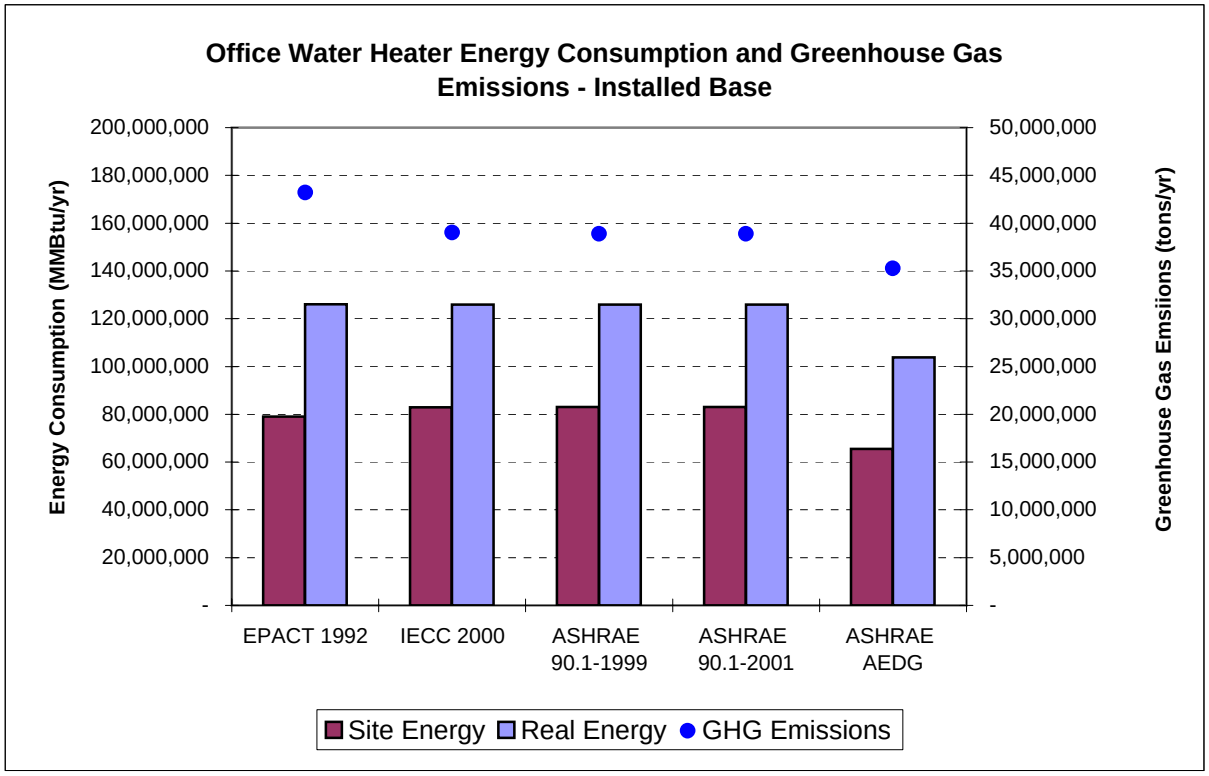
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	870,335	966,454	61,063
IECC 2000	865,538	961,153	60,740
ASHRAE 90.1-1999	903,089	1,002,845	63,371
ASHRAE 90.1-2001	903,089	1,002,845	63,371



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

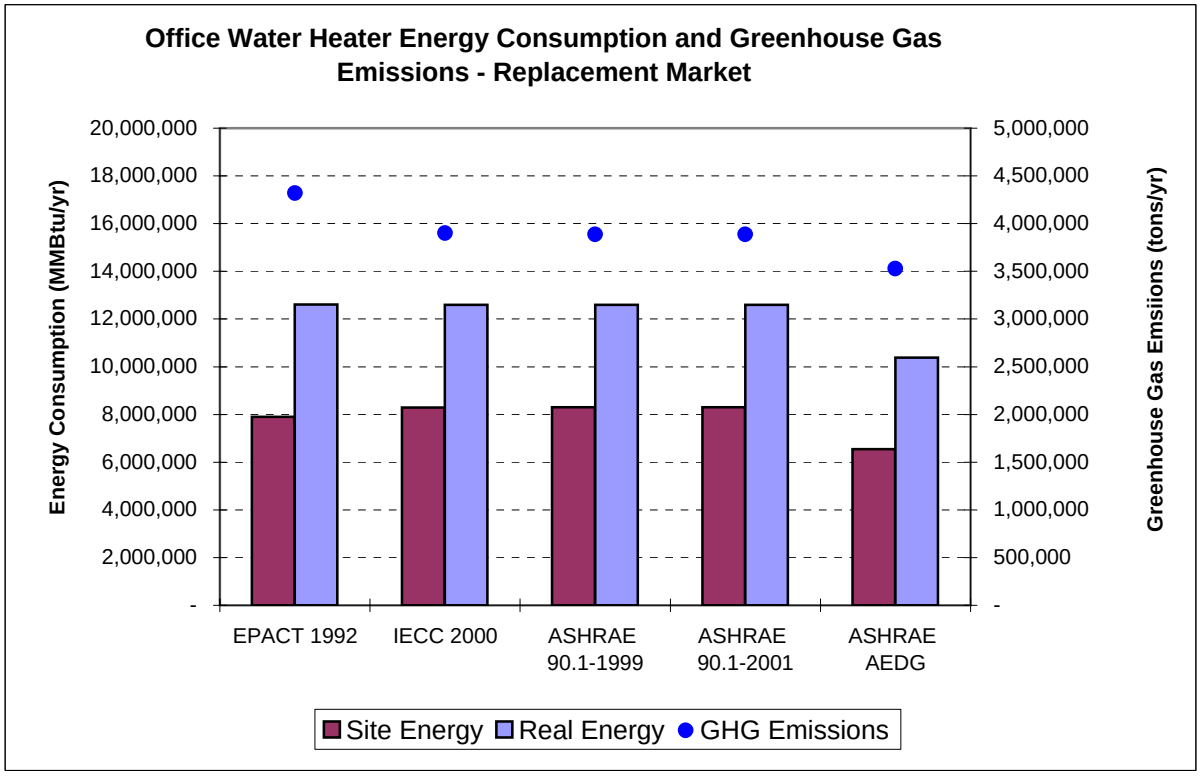
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	78,978,372	126,079,584	43,189,750
IECC 2000	82,913,034	125,889,222	39,000,257
ASHRAE 90.1-1999	83,053,718	125,902,496	38,868,600
ASHRAE 90.1-2001	83,053,718	125,902,496	38,868,600
ASHRAE AEDG	65,453,574	103,855,332	35,267,614



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

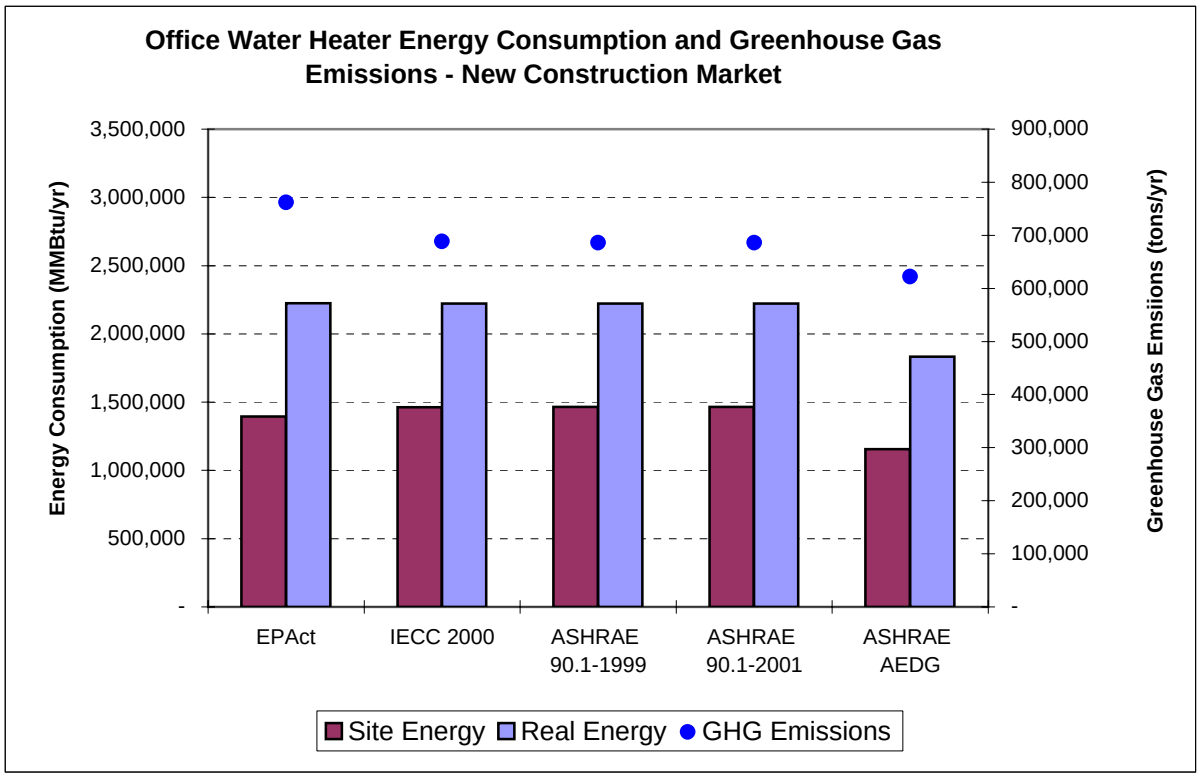
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	7,897,837	12,607,958	4,318,975
IECC 2000	8,291,303	12,588,922	3,900,026
ASHRAE 90.1-1999	8,305,372	12,590,250	3,886,860
ASHRAE 90.1-2001	8,305,372	12,590,250	3,886,860
ASHRAE AEDG	6,545,357	10,385,533	3,526,761



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

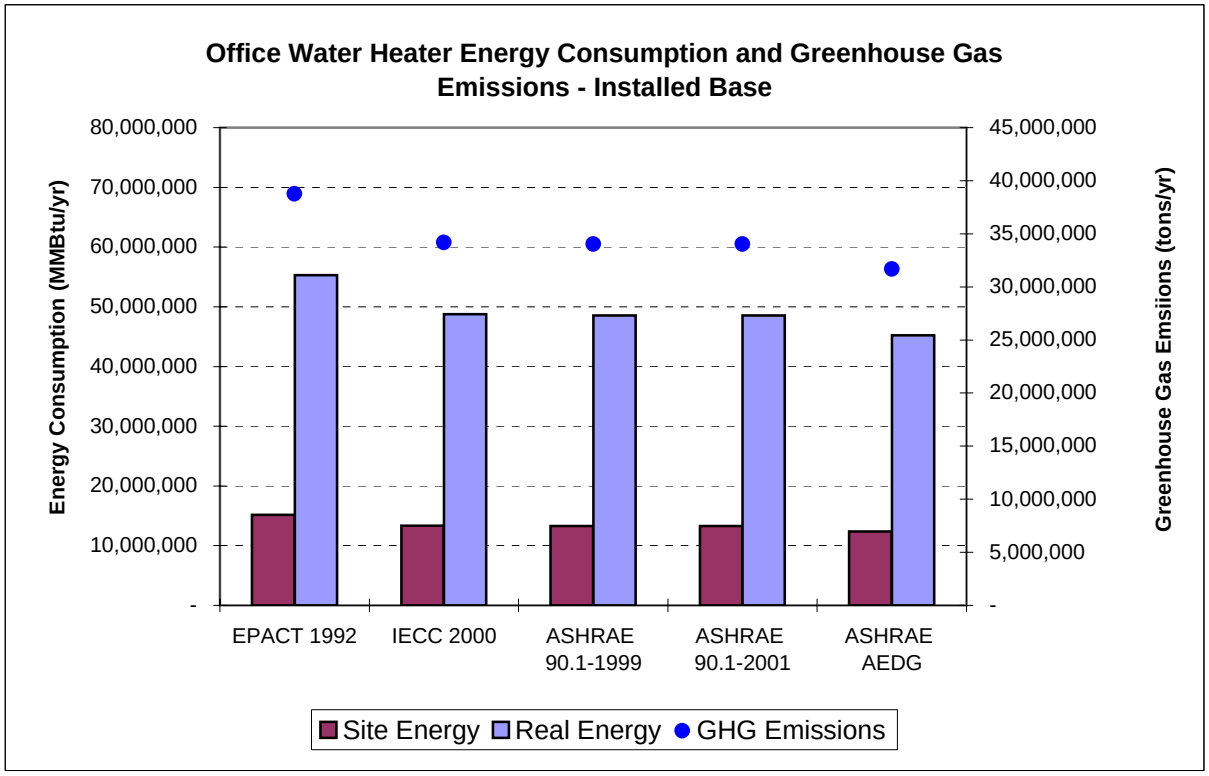
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,393,736	2,224,934	762,172
IECC 2000	1,463,171	2,221,575	688,240
ASHRAE 90.1-1999	1,465,654	2,221,809	685,916
ASHRAE 90.1-2001	1,465,654	2,221,809	685,916
ASHRAE AEDG	1,155,063	1,832,741	622,370



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

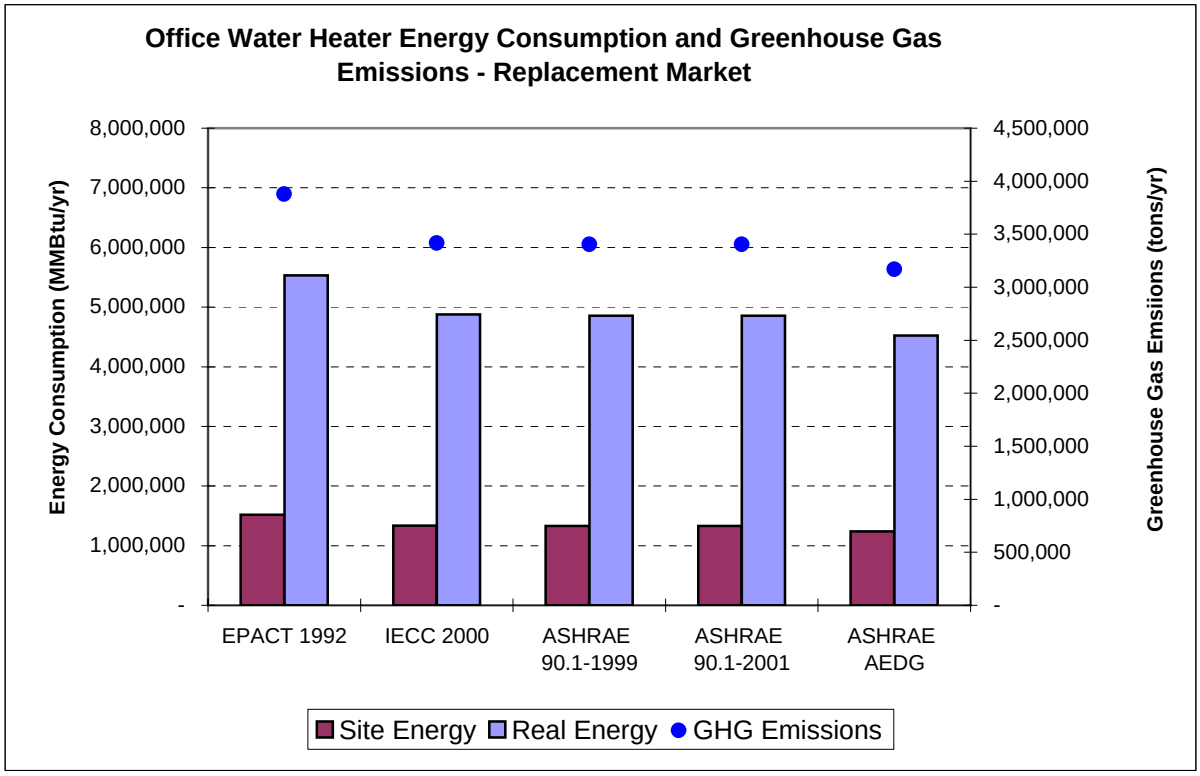
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	15,158,872	55,324,350	38,768,262
IECC 2000	13,363,879	48,773,282	34,177,634
ASHRAE 90.1-1999	13,306,351	48,563,326	34,030,508
ASHRAE 90.1-2001	13,306,351	48,563,326	34,030,508
ASHRAE AEDG	12,391,010	45,222,664	31,689,556



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

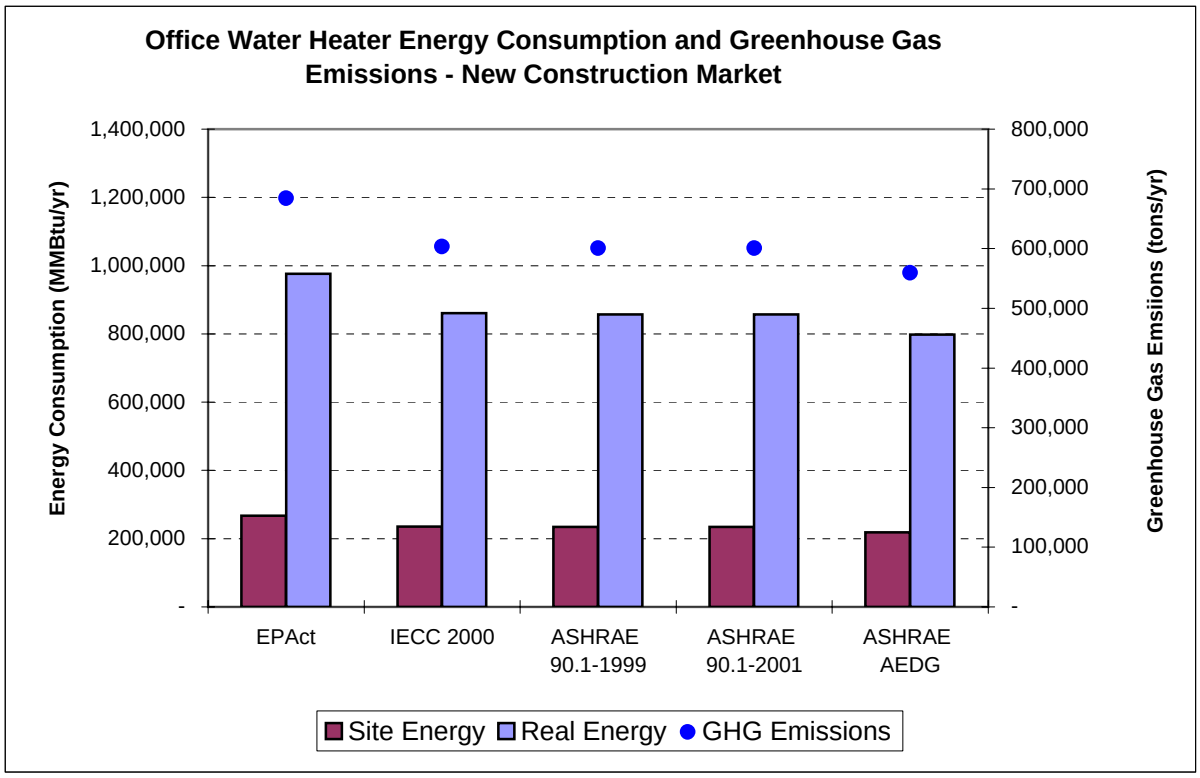
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,515,887	5,532,435	3,876,826
IECC 2000	1,336,388	4,877,328	3,417,763
ASHRAE 90.1-1999	1,330,635	4,856,333	3,403,051
ASHRAE 90.1-2001	1,330,635	4,856,333	3,403,051
ASHRAE AEDG	1,239,101	4,522,266	3,168,956



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

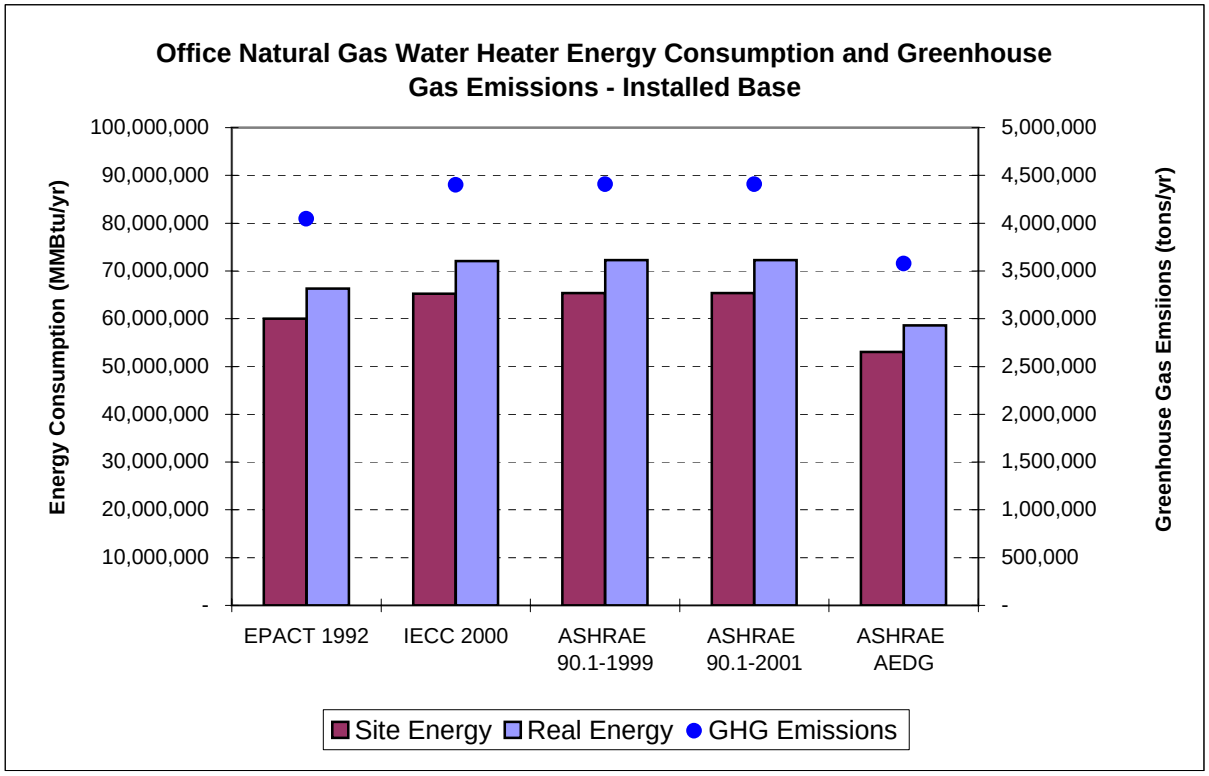
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	267,510	976,312	684,146
IECC 2000	235,833	860,705	603,135
ASHRAE 90.1-1999	234,818	857,000	600,538
ASHRAE 90.1-2001	234,818	857,000	600,538
ASHRAE AEDG	218,665	798,047	559,227



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

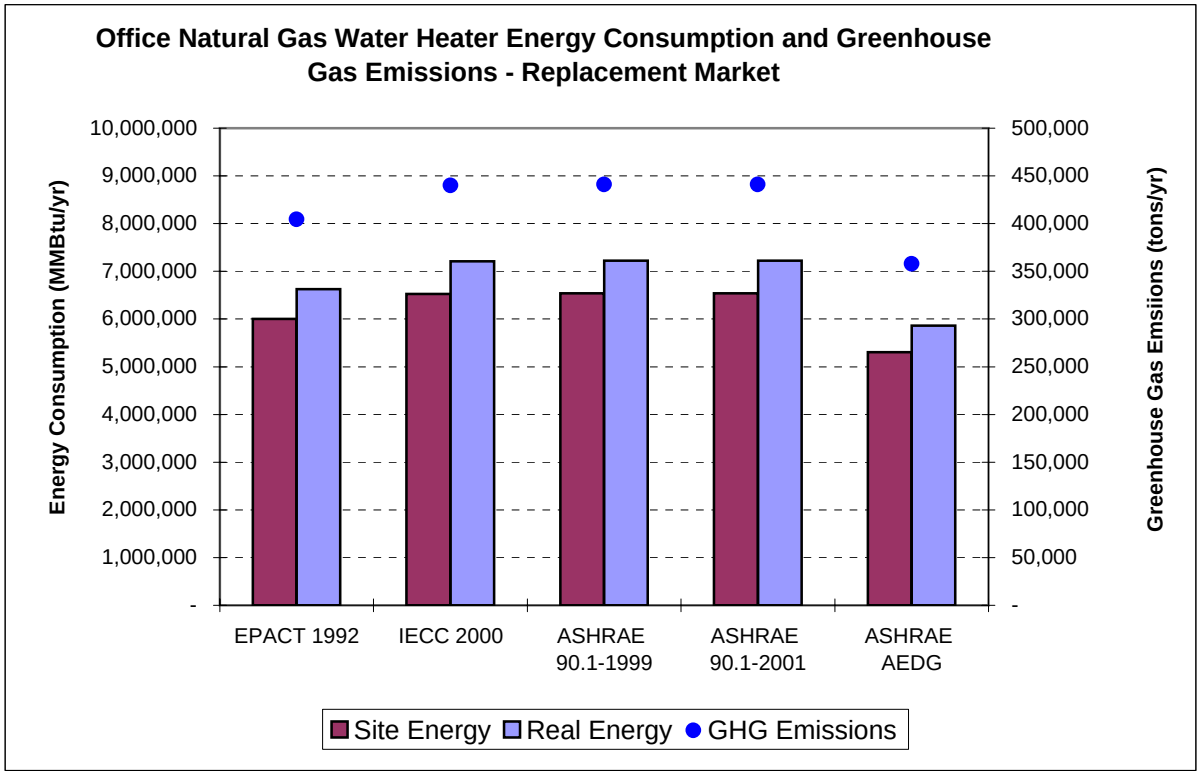
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	59,998,939	66,297,170	4,045,785
IECC 2000	65,250,387	72,099,876	4,399,895
ASHRAE 90.1-1999	65,380,555	72,243,707	4,408,672
ASHRAE 90.1-2001	65,380,555	72,243,707	4,408,672
ASHRAE AEDG	53,062,564	58,632,668	3,578,059



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

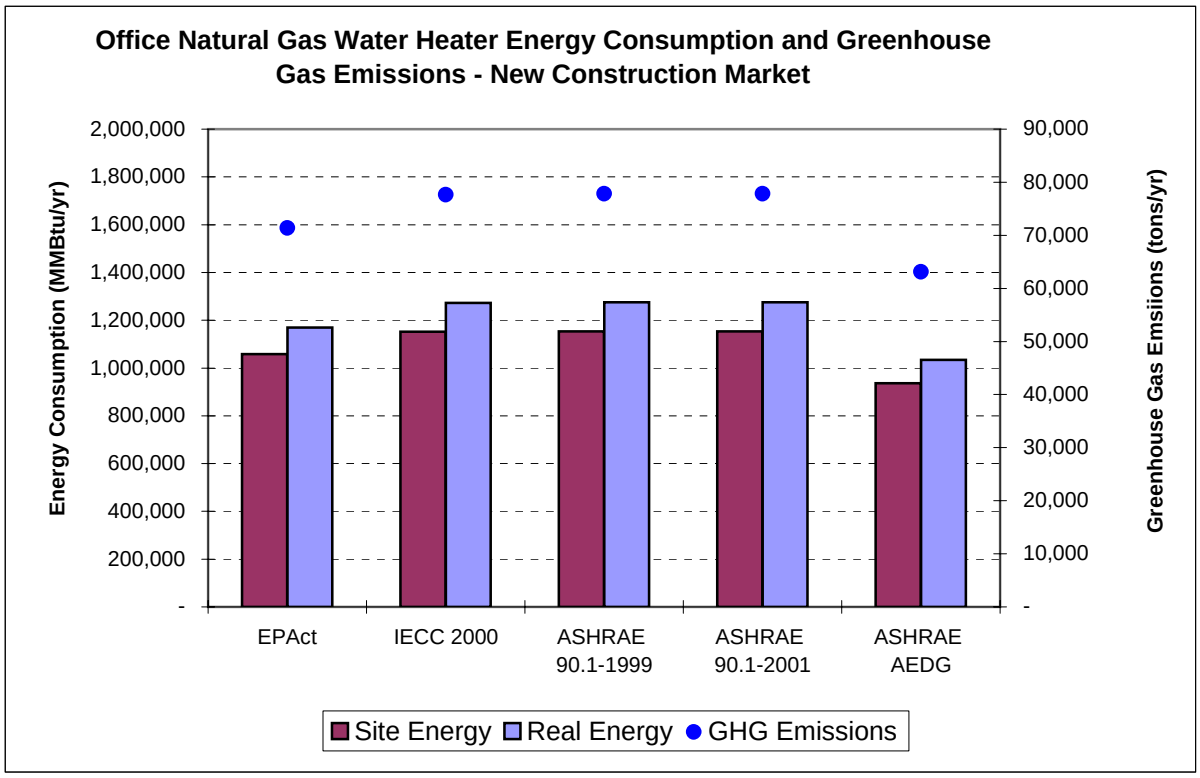
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,999,894	6,629,717	404,578
IECC 2000	6,525,039	7,209,988	439,989
ASHRAE 90.1-1999	6,538,055	7,224,371	440,867
ASHRAE 90.1-2001	6,538,055	7,224,371	440,867
ASHRAE AEDG	5,306,256	5,863,267	357,806



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

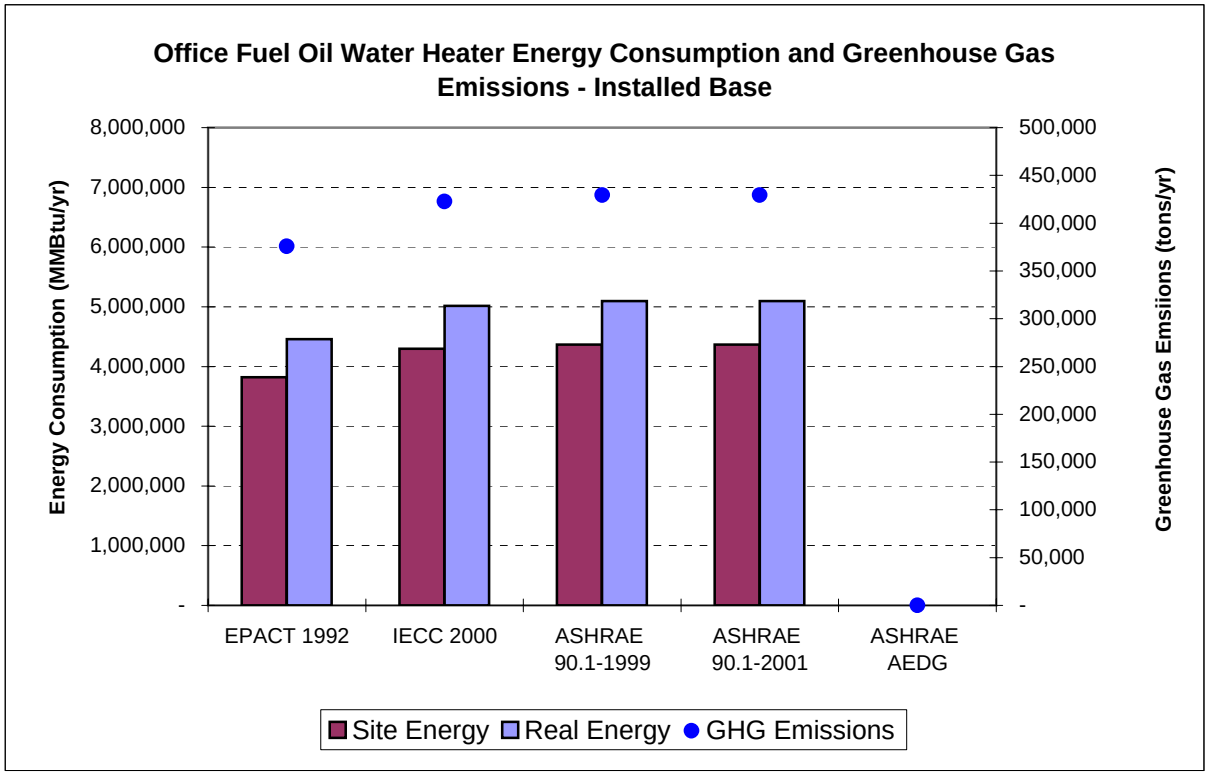
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,058,805	1,169,950	71,396
IECC 2000	1,151,477	1,272,351	77,645
ASHRAE 90.1-1999	1,153,774	1,274,889	77,800
ASHRAE 90.1-2001	1,153,774	1,274,889	77,800
ASHRAE AEDG	936,398	1,034,694	63,142



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

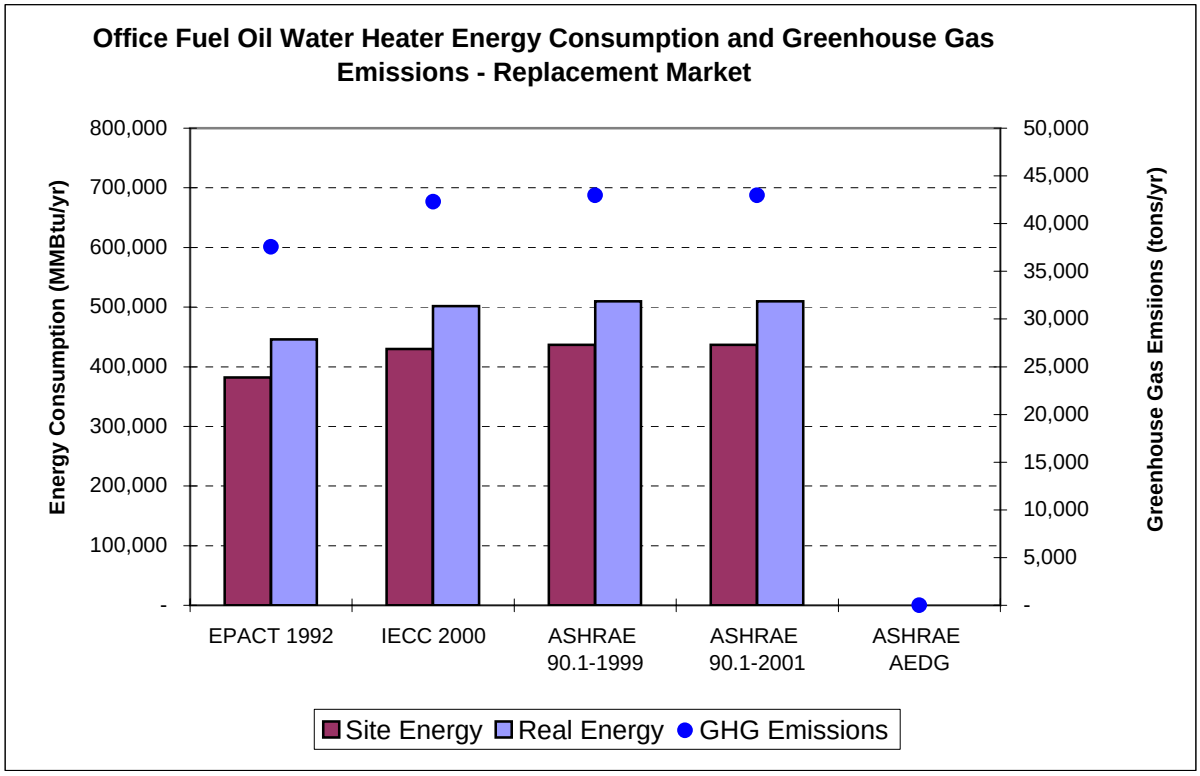
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	3,820,560	4,458,063	375,703
IECC 2000	4,298,767	5,016,064	422,729
ASHRAE 90.1-1999	4,366,811	5,095,462	429,420
ASHRAE 90.1-2001	4,366,811	5,095,462	429,420
ASHRAE AEDG	-	-	-



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

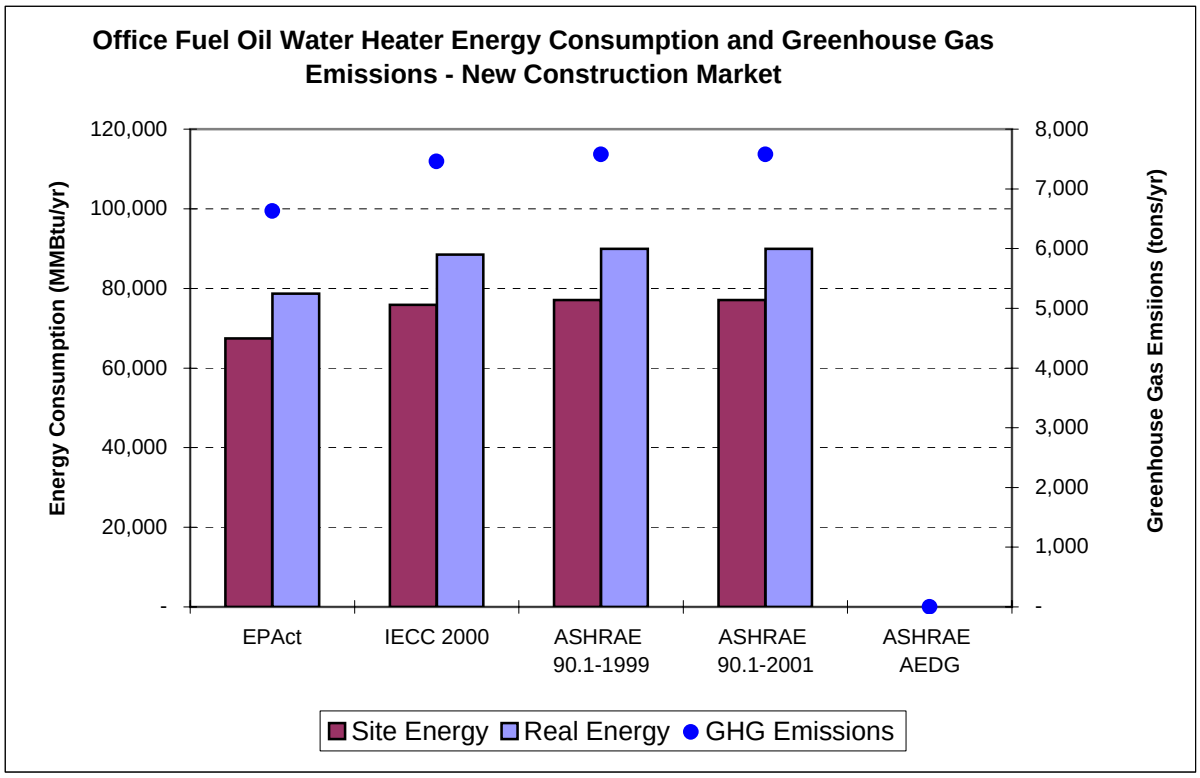
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	382,056	445,806	37,570
IECC 2000	429,877	501,606	42,273
ASHRAE 90.1-1999	436,681	509,546	42,942
ASHRAE 90.1-2001	436,681	509,546	42,942
ASHRAE AEDG	-	-	-



Office Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

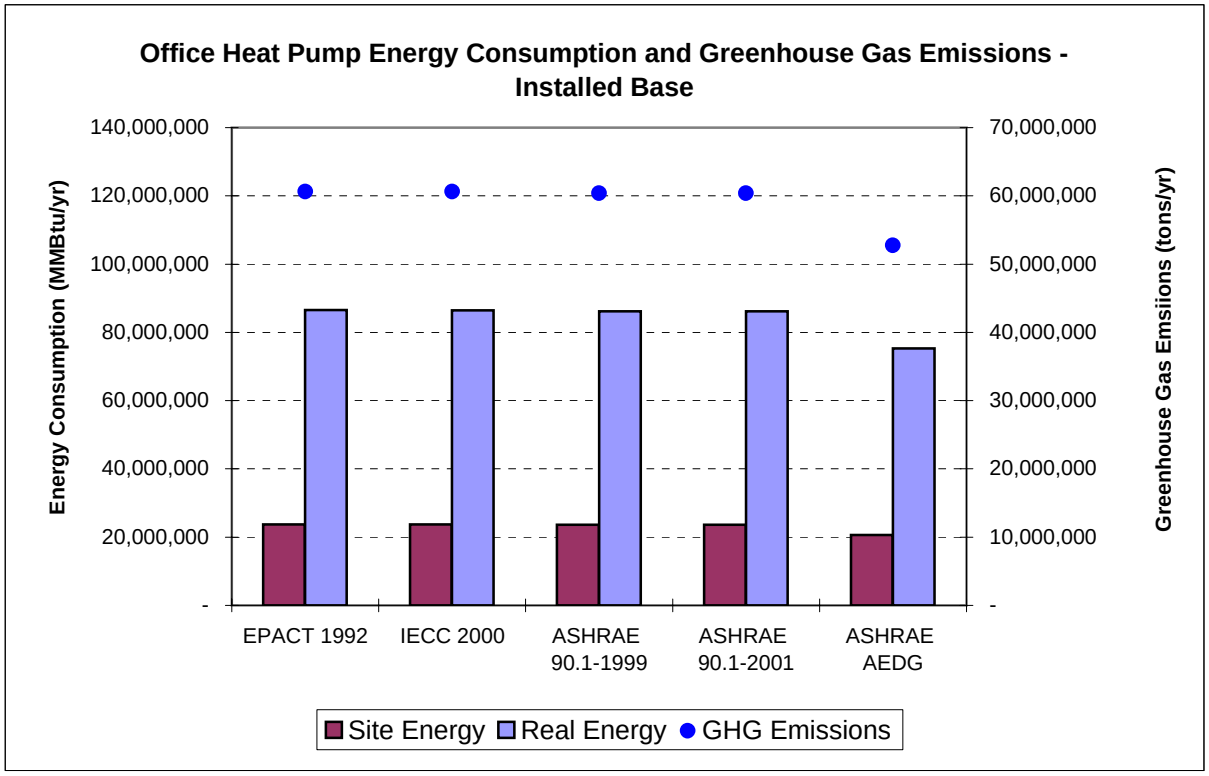
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	67,422	78,672	6,630
IECC 2000	75,861	88,519	7,460
ASHRAE 90.1-1999	77,061	89,920	7,578
ASHRAE 90.1-2001	77,061	89,920	7,578
ASHRAE AEDG	-	-	-



Office Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

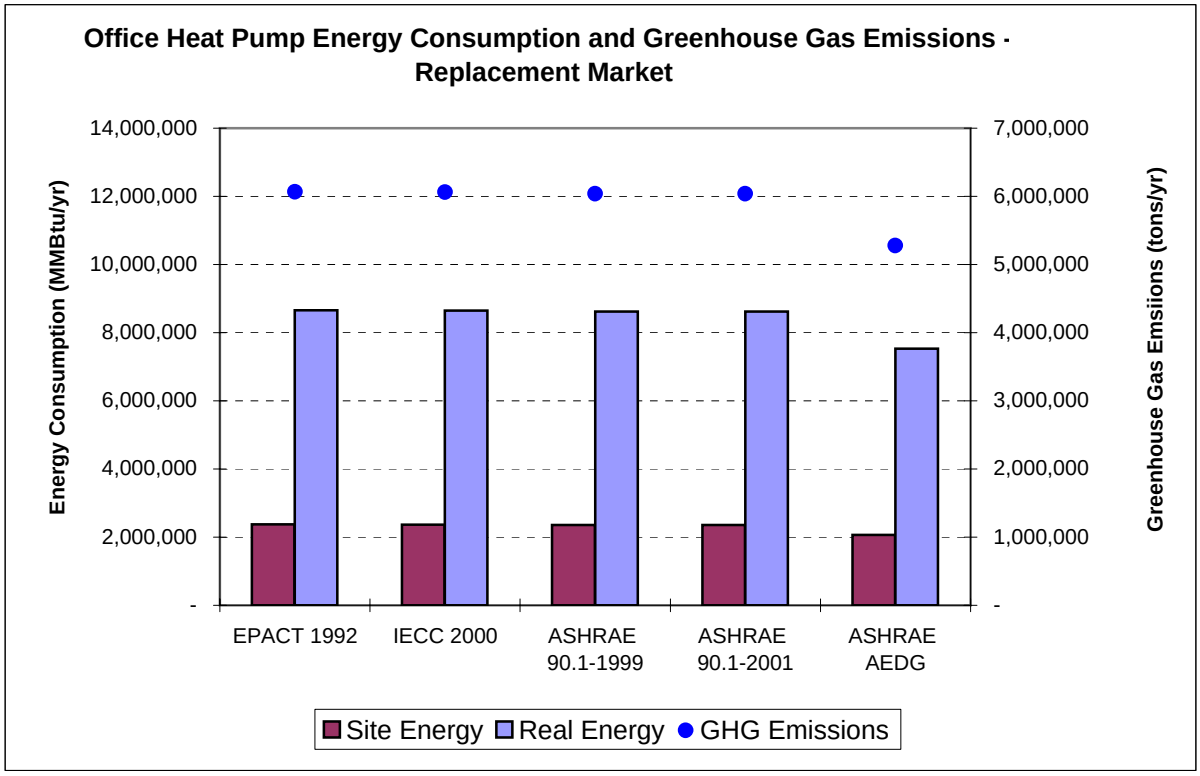
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	23,712,208	86,540,907	60,643,108
IECC 2000	23,698,580	86,491,168	60,608,253
ASHRAE 90.1-1999	23,605,198	86,150,356	60,369,431
ASHRAE 90.1-2001	23,605,198	86,150,356	60,369,431
ASHRAE AEDG	20,627,650	75,283,394	52,754,462



Office Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

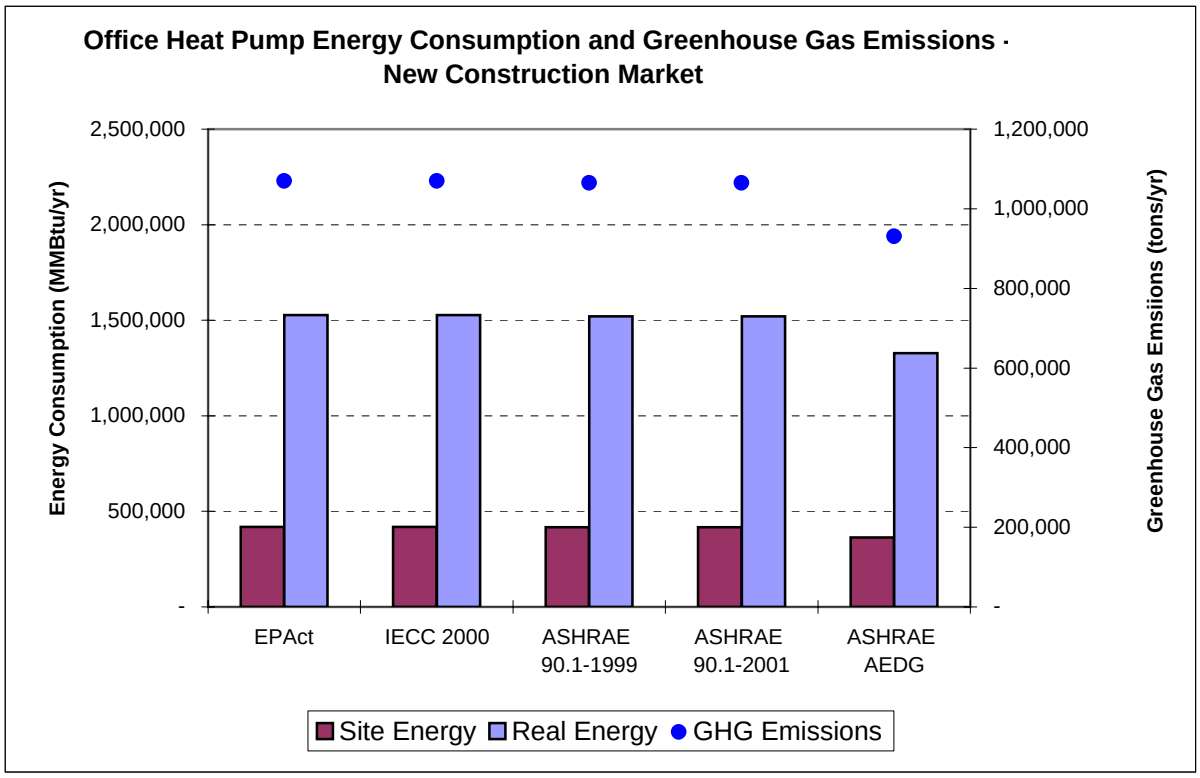
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	2,371,221	8,654,091	6,064,311
IECC 2000	2,369,858	8,649,117	6,060,825
ASHRAE 90.1-1999	2,360,520	8,615,036	6,036,943
ASHRAE 90.1-2001	2,360,520	8,615,036	6,036,943
ASHRAE AEDG	2,062,765	7,528,339	5,275,446



Office Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

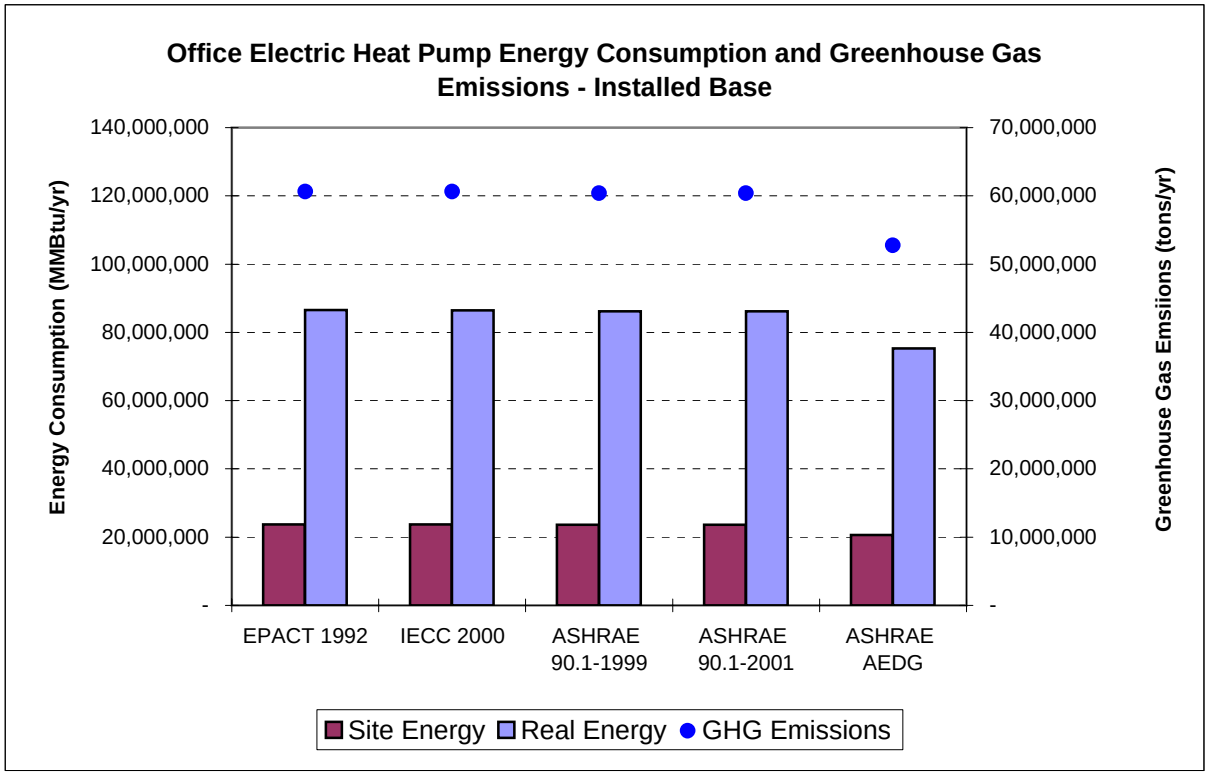
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	418,451	1,527,192	1,070,172
IECC 2000	418,210	1,526,315	1,069,557
ASHRAE 90.1-1999	416,562	1,520,300	1,065,343
ASHRAE 90.1-2001	416,562	1,520,300	1,065,343
ASHRAE AEDG	364,017	1,328,530	930,961



Office Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

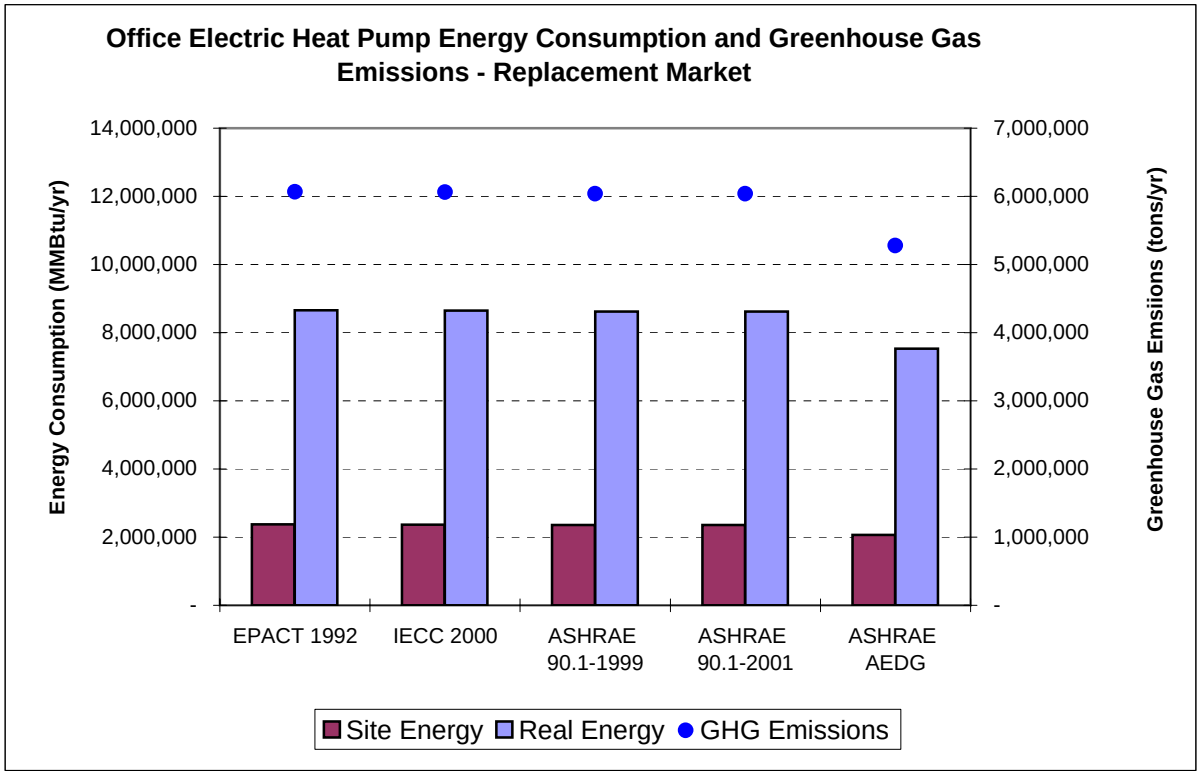
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	23,712,208	86,540,907	60,643,108
IECC 2000	23,698,580	86,491,168	60,608,253
ASHRAE 90.1-1999	23,605,198	86,150,356	60,369,431
ASHRAE 90.1-2001	23,605,198	86,150,356	60,369,431
ASHRAE AEDG	20,627,650	75,283,394	52,754,462



Office Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

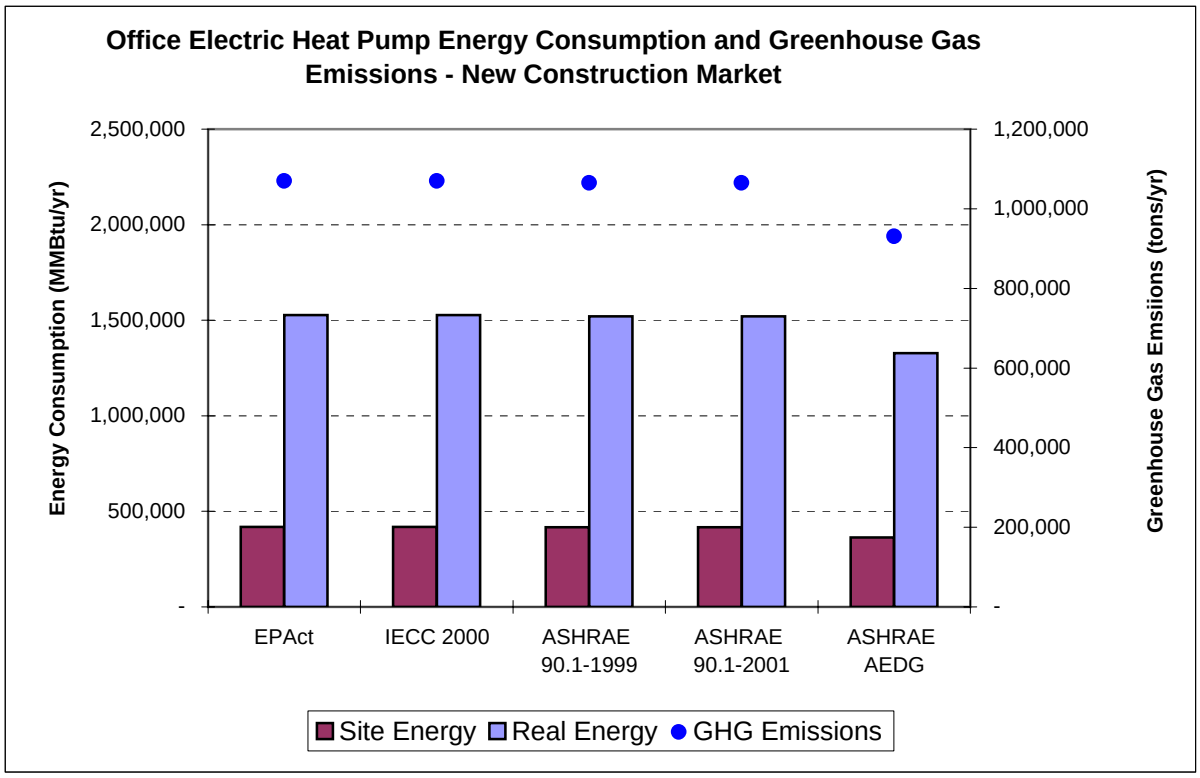
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	2,371,221	8,654,091	6,064,311
IECC 2000	2,369,858	8,649,117	6,060,825
ASHRAE 90.1-1999	2,360,520	8,615,036	6,036,943
ASHRAE 90.1-2001	2,360,520	8,615,036	6,036,943
ASHRAE AEDG	2,062,765	7,528,339	5,275,446



Office Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

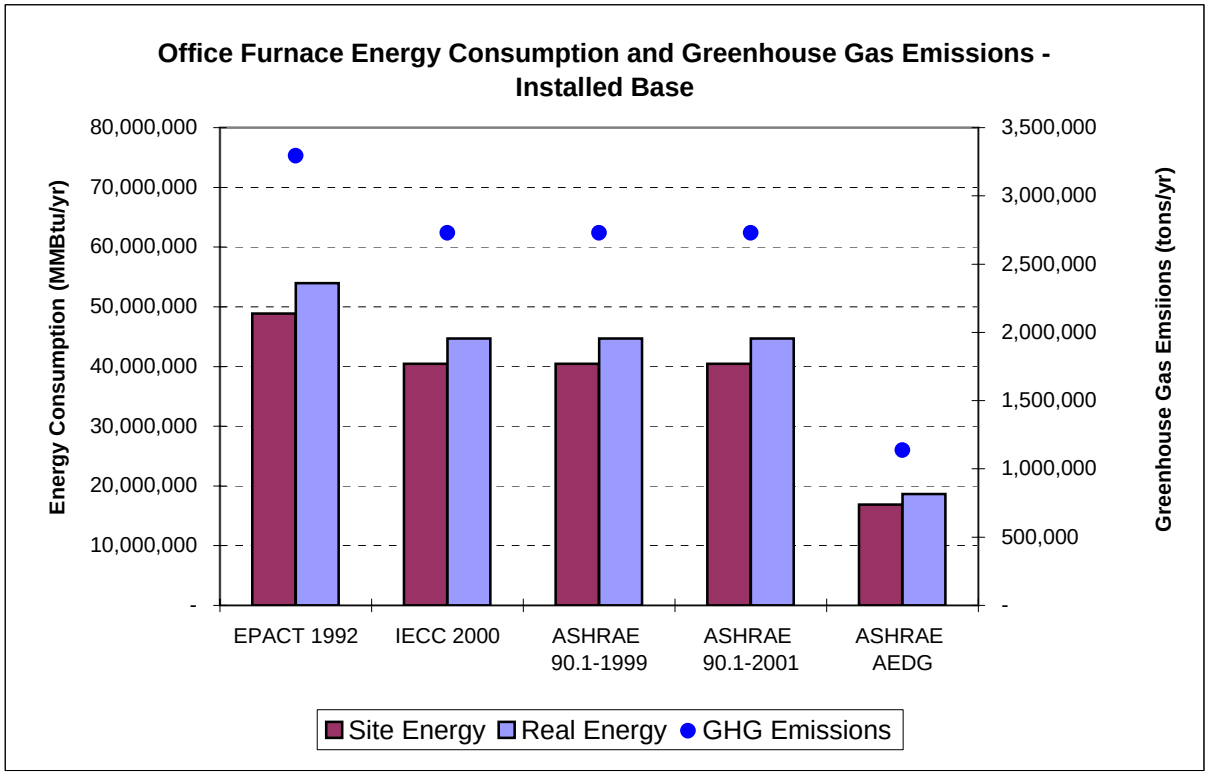
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	418,451	1,527,192	1,070,172
IECC 2000	418,210	1,526,315	1,069,557
ASHRAE 90.1-1999	416,562	1,520,300	1,065,343
ASHRAE 90.1-2001	416,562	1,520,300	1,065,343
ASHRAE AEDG	364,017	1,328,530	930,961



Office Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	48,841,758	53,968,793	3,293,446
IECC 2000	40,455,678	44,702,407	2,727,964
ASHRAE 90.1-1999	40,455,678	44,702,407	2,727,964
ASHRAE 90.1-2001	40,455,678	44,702,407	2,727,964
ASHRAE AEDG	16,868,844	18,639,606	1,137,482

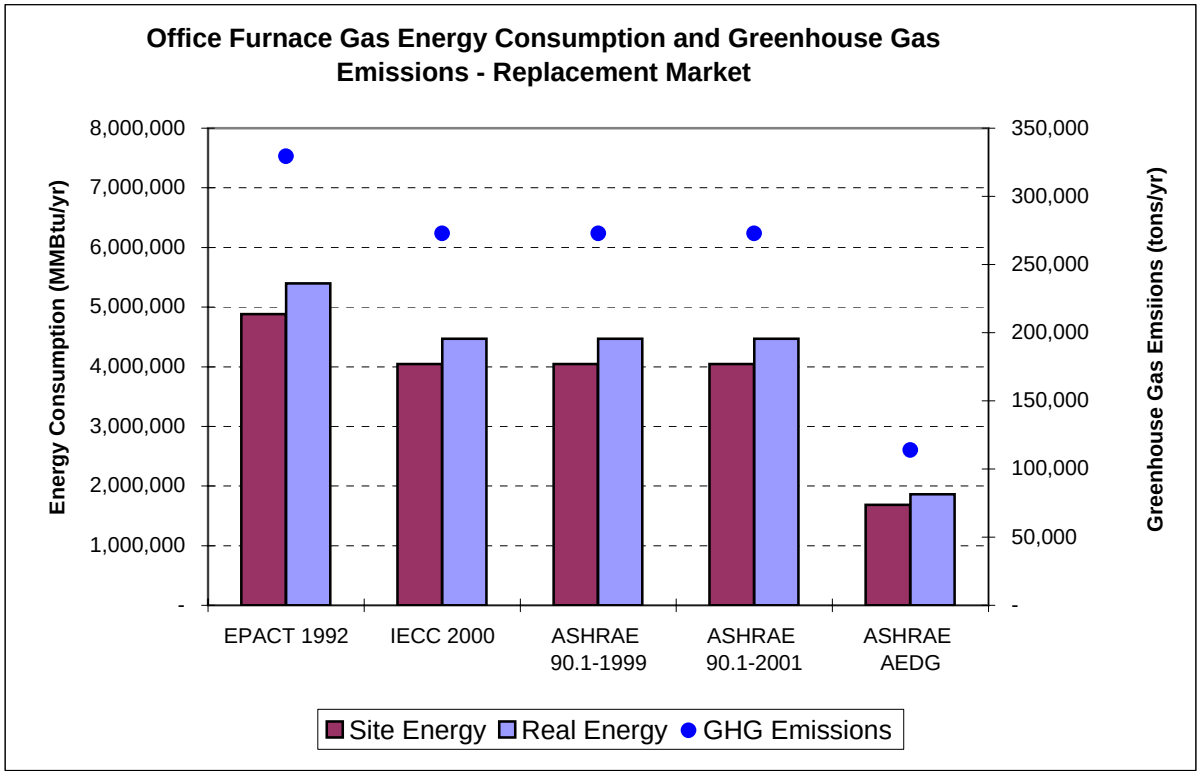


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Office Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	4,884,176	5,396,879	329,345
IECC 2000	4,045,568	4,470,241	272,796
ASHRAE 90.1-1999	4,045,568	4,470,241	272,796
ASHRAE 90.1-2001	4,045,568	4,470,241	272,796
ASHRAE AEDG	1,686,884	1,863,961	113,748

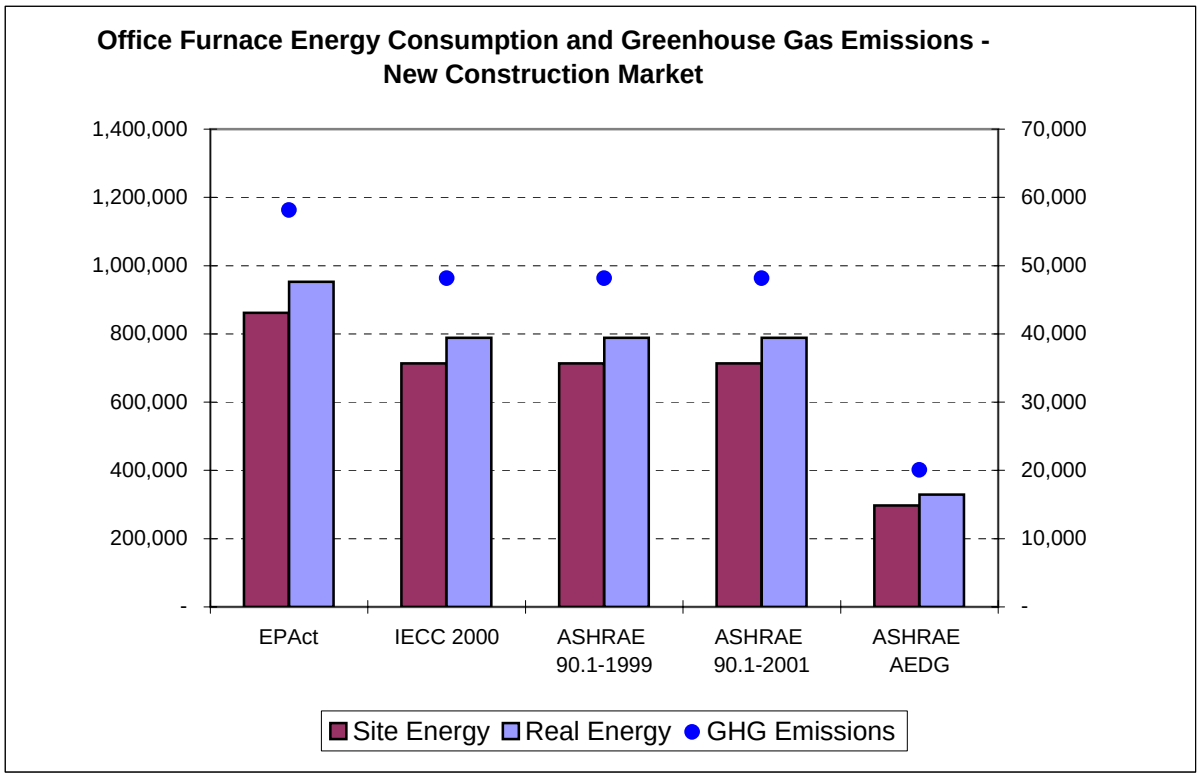


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Office Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	861,913	952,390	58,120
IECC 2000	713,924	788,866	48,141
ASHRAE 90.1-1999	713,924	788,866	48,141
ASHRAE 90.1-2001	713,924	788,866	48,141
ASHRAE AEDG	297,685	328,934	20,073

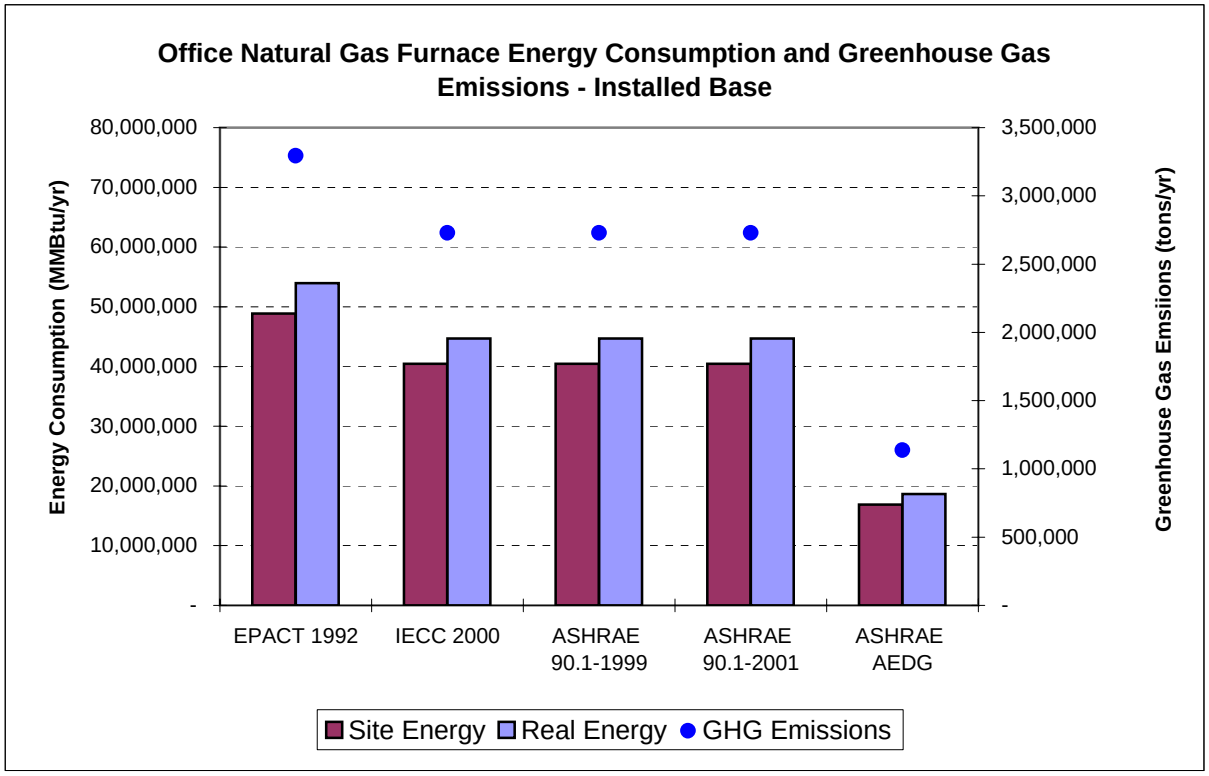


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Office Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	48,841,758	53,968,793	3,293,446
IECC 2000	40,455,678	44,702,407	2,727,964
ASHRAE 90.1-1999	40,455,678	44,702,407	2,727,964
ASHRAE 90.1-2001	40,455,678	44,702,407	2,727,964
ASHRAE AEDG	16,868,844	18,639,606	1,137,482

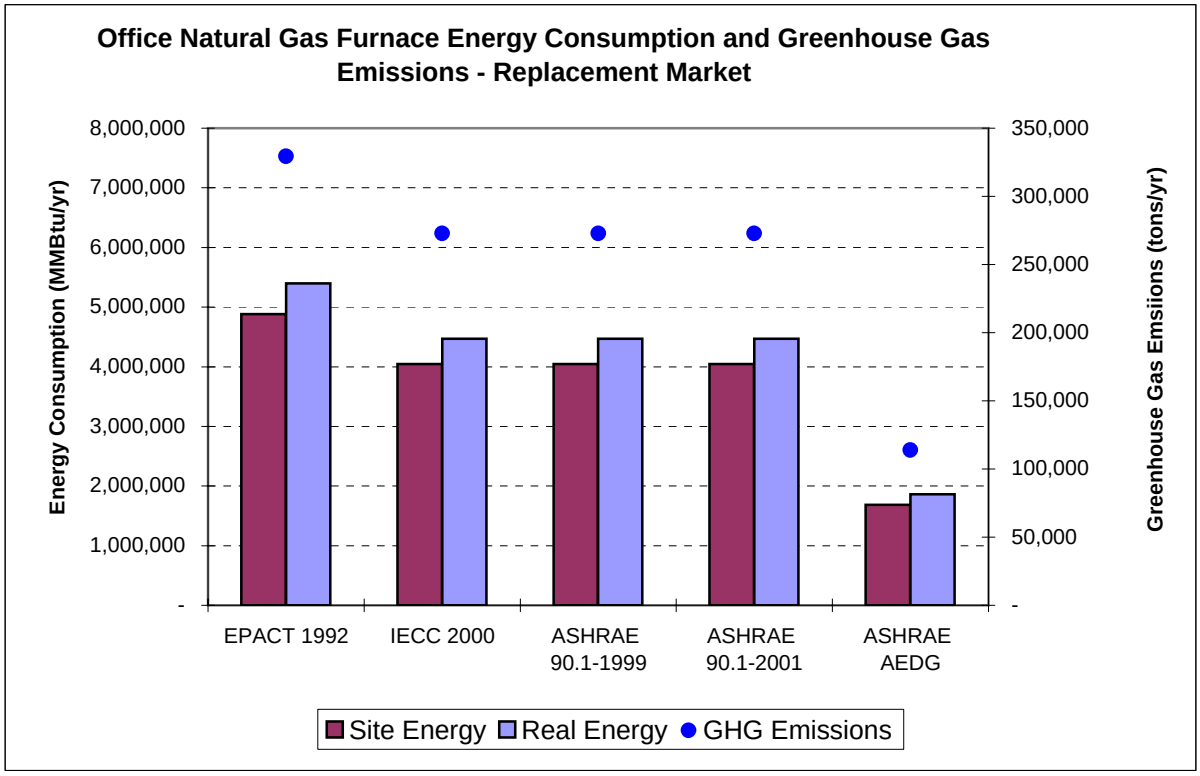


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Office Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	4,884,176	5,396,879	329,345
IECC 2000	4,045,568	4,470,241	272,796
ASHRAE 90.1-1999	4,045,568	4,470,241	272,796
ASHRAE 90.1-2001	4,045,568	4,470,241	272,796
ASHRAE AEDG	1,686,884	1,863,961	113,748

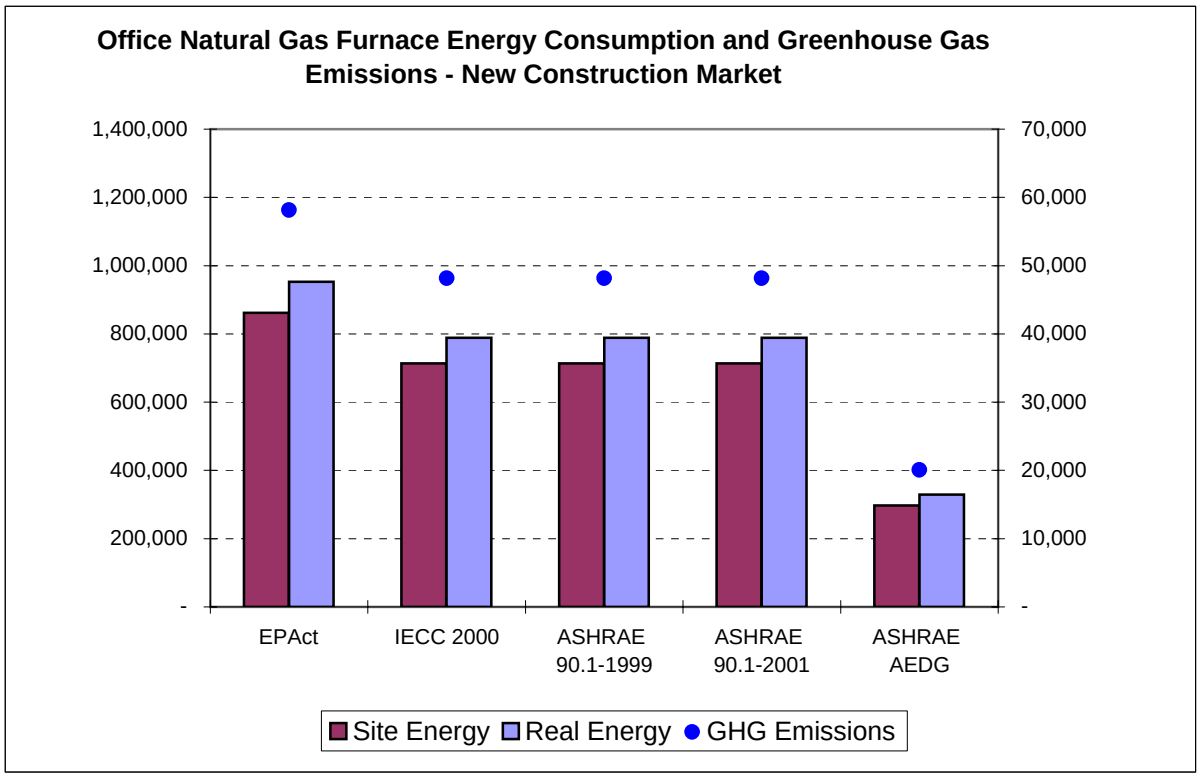


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Office Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	861,913	952,390	58,120
IECC 2000	713,924	788,866	48,141
ASHRAE 90.1-1999	713,924	788,866	48,141
ASHRAE 90.1-2001	713,924	788,866	48,141
ASHRAE AEDG	297,685	328,934	20,073

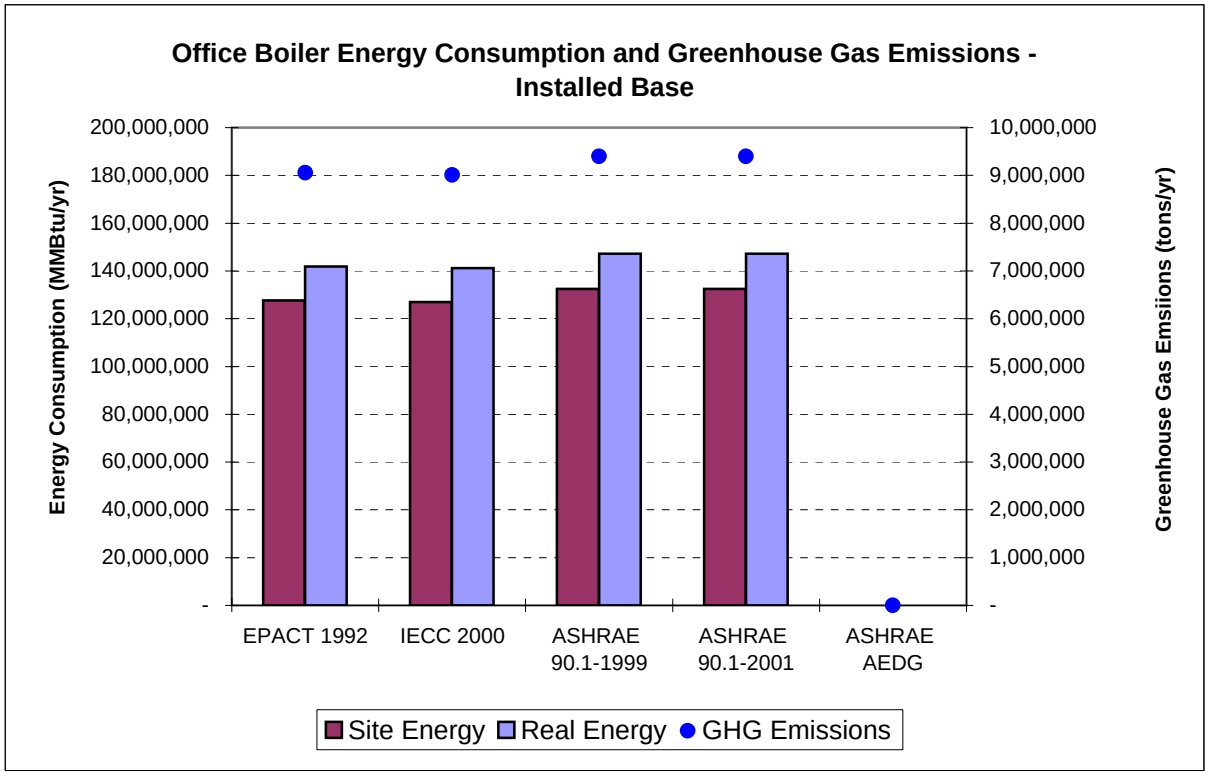


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

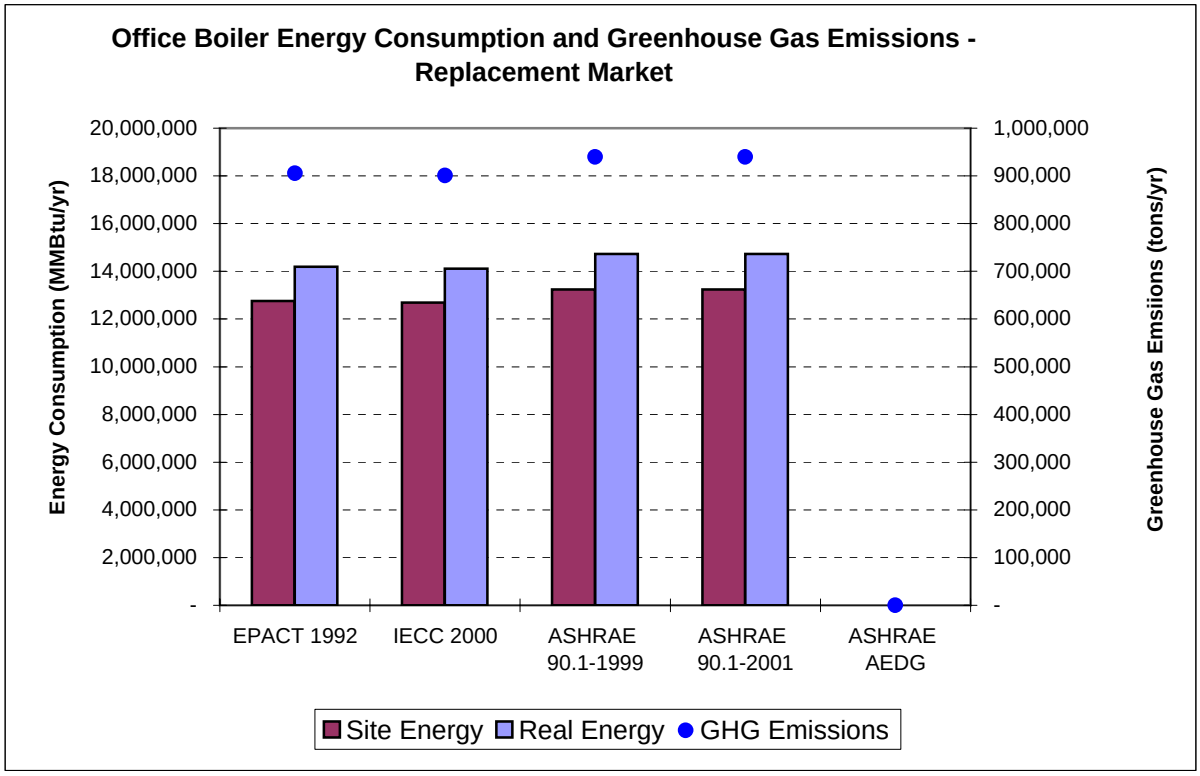
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	127,609,607	141,904,170	9,053,822
IECC 2000	126,925,894	141,148,686	9,007,718
ASHRAE 90.1-1999	132,427,037	147,264,905	9,397,447
ASHRAE 90.1-2001	132,427,037	147,264,905	9,397,447
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

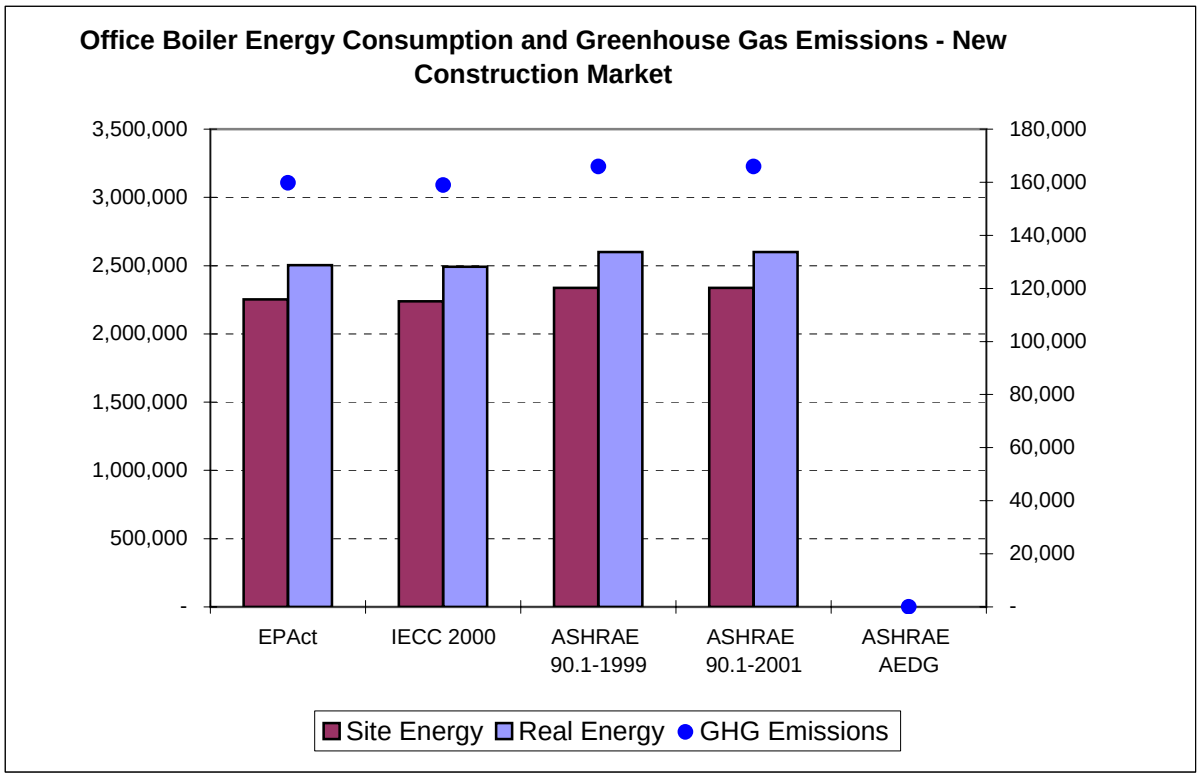
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	12,760,961	14,190,417	905,382
IECC 2000	12,692,589	14,114,869	900,772
ASHRAE 90.1-1999	13,242,704	14,726,491	939,745
ASHRAE 90.1-2001	13,242,704	14,726,491	939,745
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

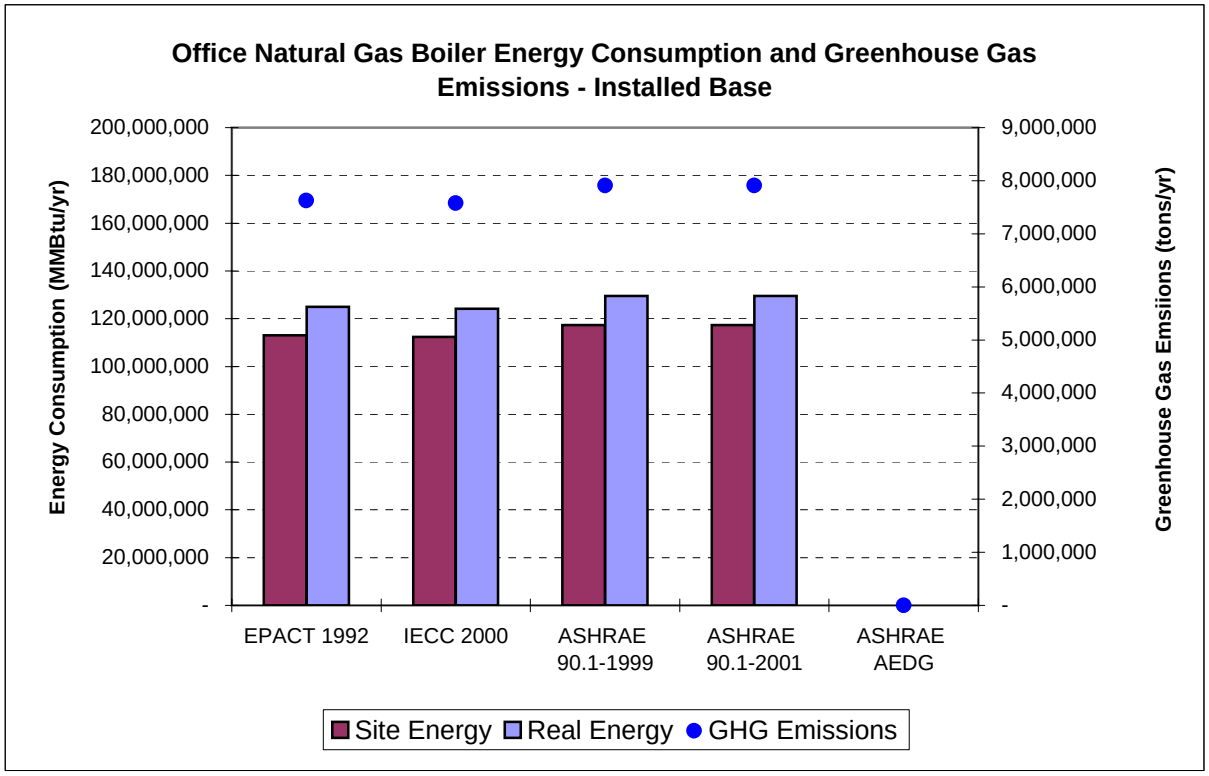
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	2,251,934	2,504,191	159,773
IECC 2000	2,239,869	2,490,859	158,960
ASHRAE 90.1-1999	2,336,948	2,598,792	165,837
ASHRAE 90.1-2001	2,336,948	2,598,792	165,837
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

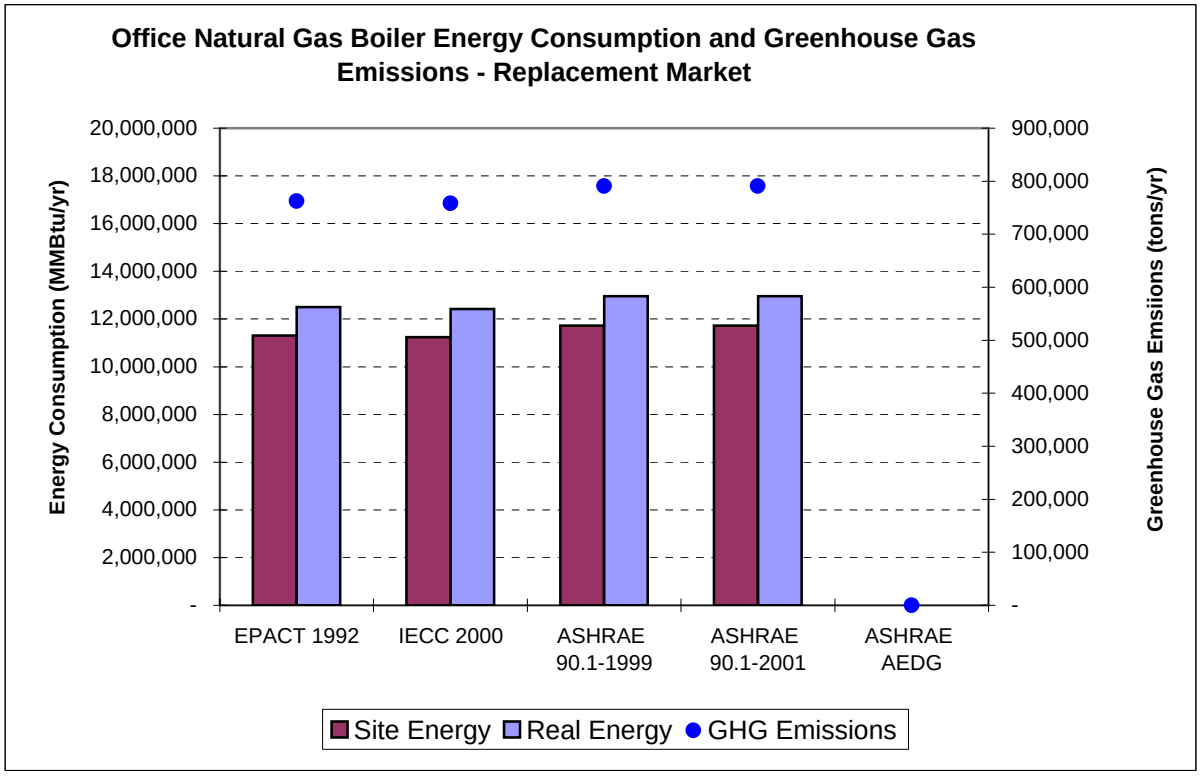
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	113,082,266	124,952,780	7,625,243
IECC 2000	112,398,553	124,197,296	7,579,140
ASHRAE 90.1-1999	117,292,012	129,604,433	7,909,111
ASHRAE 90.1-2001	117,292,012	129,604,433	7,909,111
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

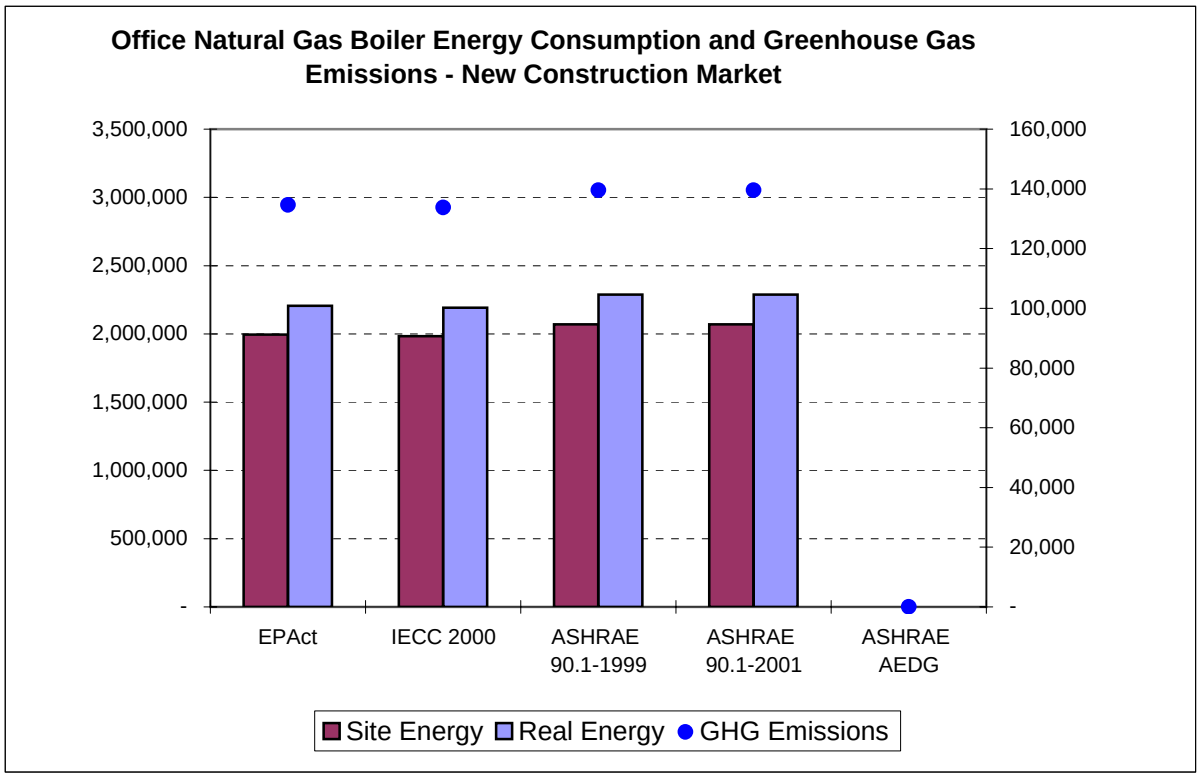
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	11,308,227	12,495,278	762,524
IECC 2000	11,239,855	12,419,730	757,914
ASHRAE 90.1-1999	11,729,201	12,960,443	790,911
ASHRAE 90.1-2001	11,729,201	12,960,443	790,911
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

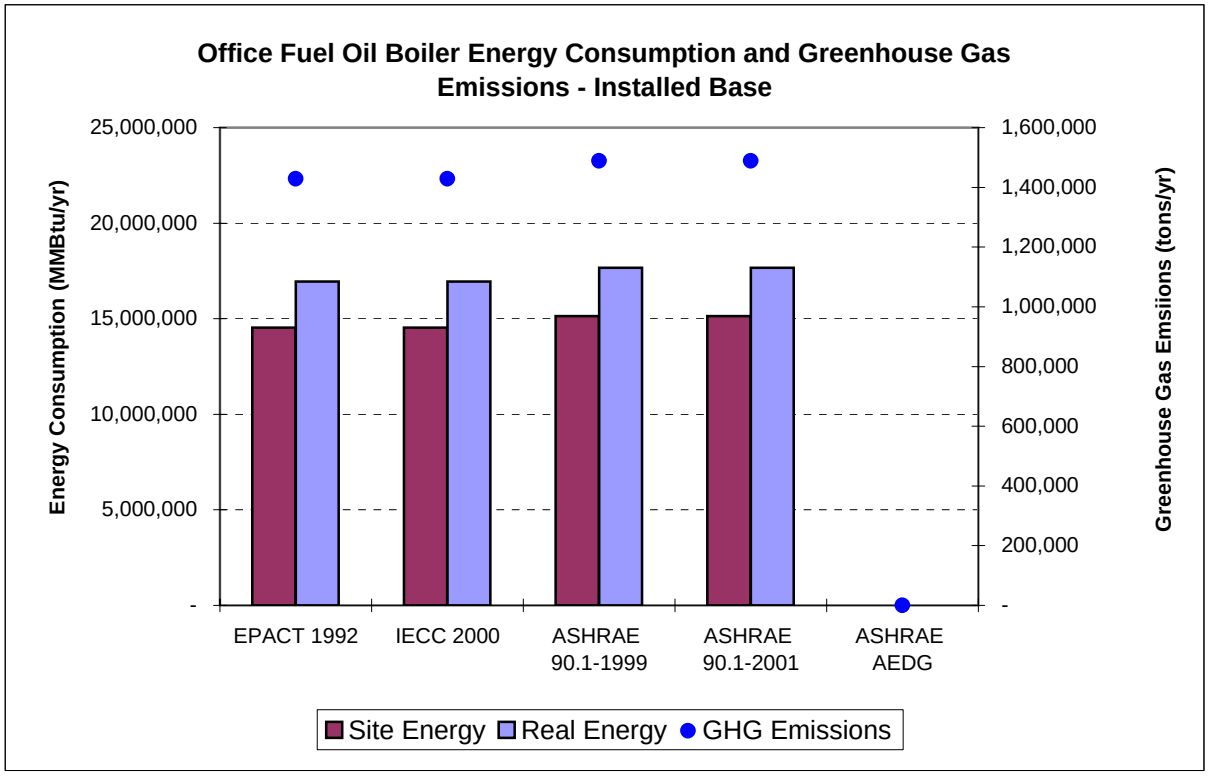
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,995,569	2,205,049	134,563
IECC 2000	1,983,504	2,191,717	133,750
ASHRAE 90.1-1999	2,069,859	2,287,137	139,573
ASHRAE 90.1-2001	2,069,859	2,287,137	139,573
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

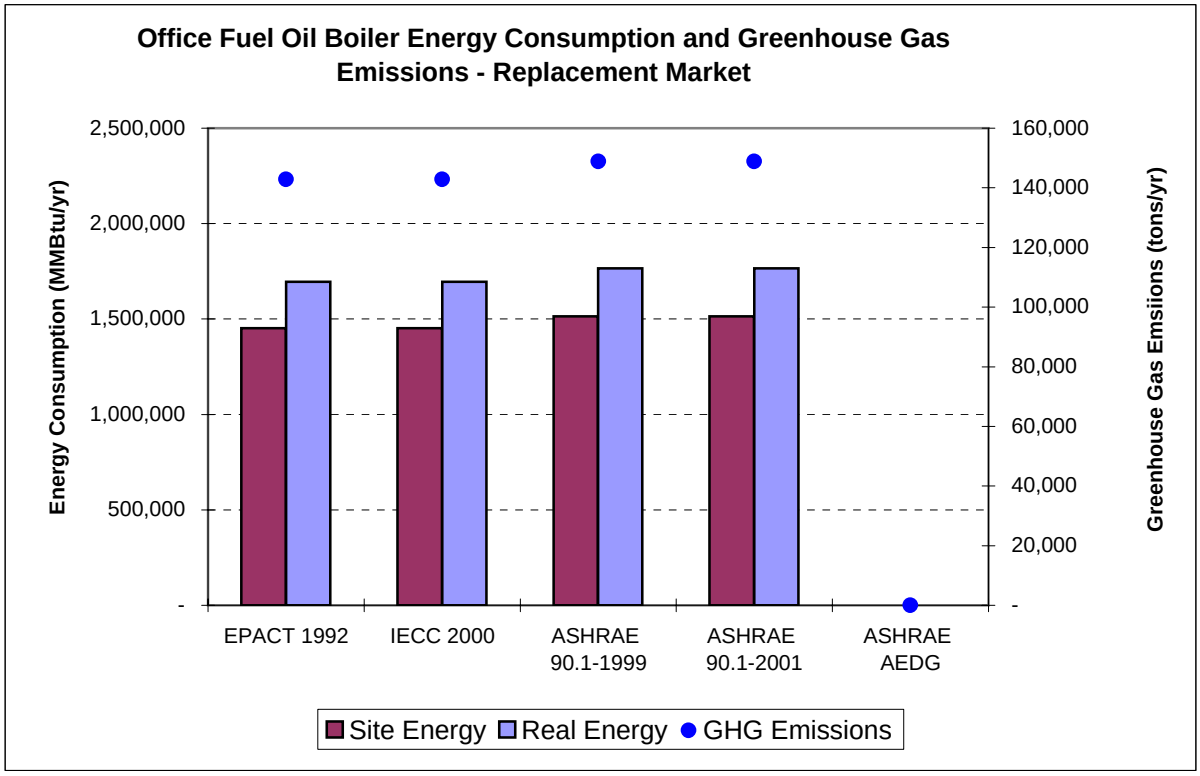
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	14,527,341	16,951,389	1,428,578
IECC 2000	14,527,341	16,951,389	1,428,578
ASHRAE 90.1-1999	15,135,025	17,660,472	1,488,336
ASHRAE 90.1-2001	15,135,025	17,660,472	1,488,336
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

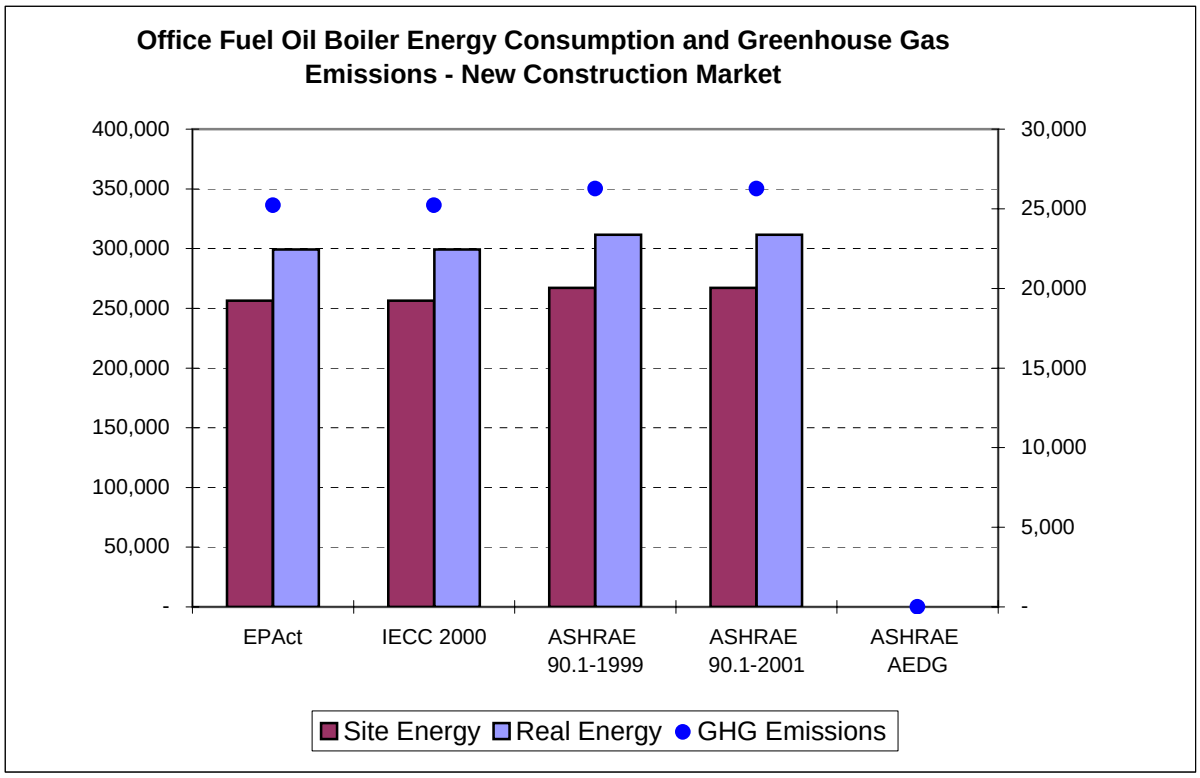
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,452,734	1,695,139	142,858
IECC 2000	1,452,734	1,695,139	142,858
ASHRAE 90.1-1999	1,513,502	1,766,047	148,834
ASHRAE 90.1-2001	1,513,502	1,766,047	148,834
ASHRAE AEDG	-	-	-



Office Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

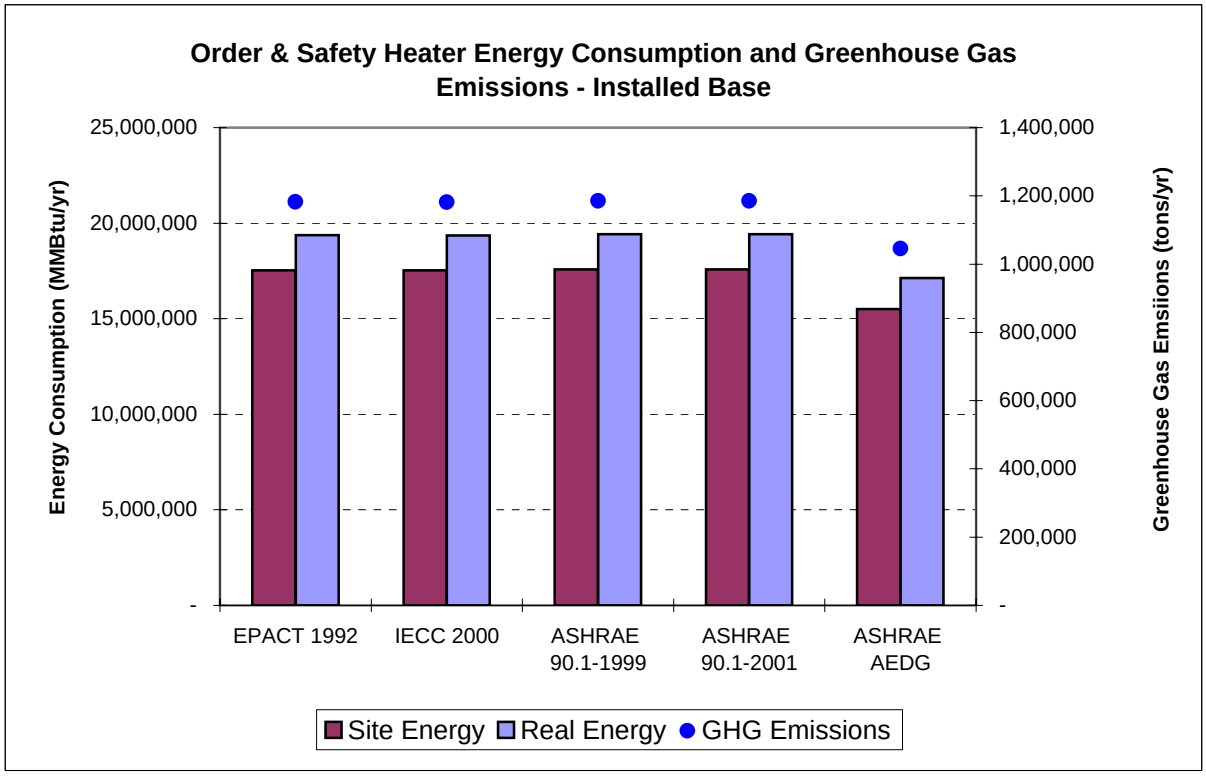
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	256,365	299,142	25,210
IECC 2000	256,365	299,142	25,210
ASHRAE 90.1-1999	267,089	311,655	26,265
ASHRAE 90.1-2001	267,089	311,655	26,265
ASHRAE AEDG	-	-	-



Order & Safety Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

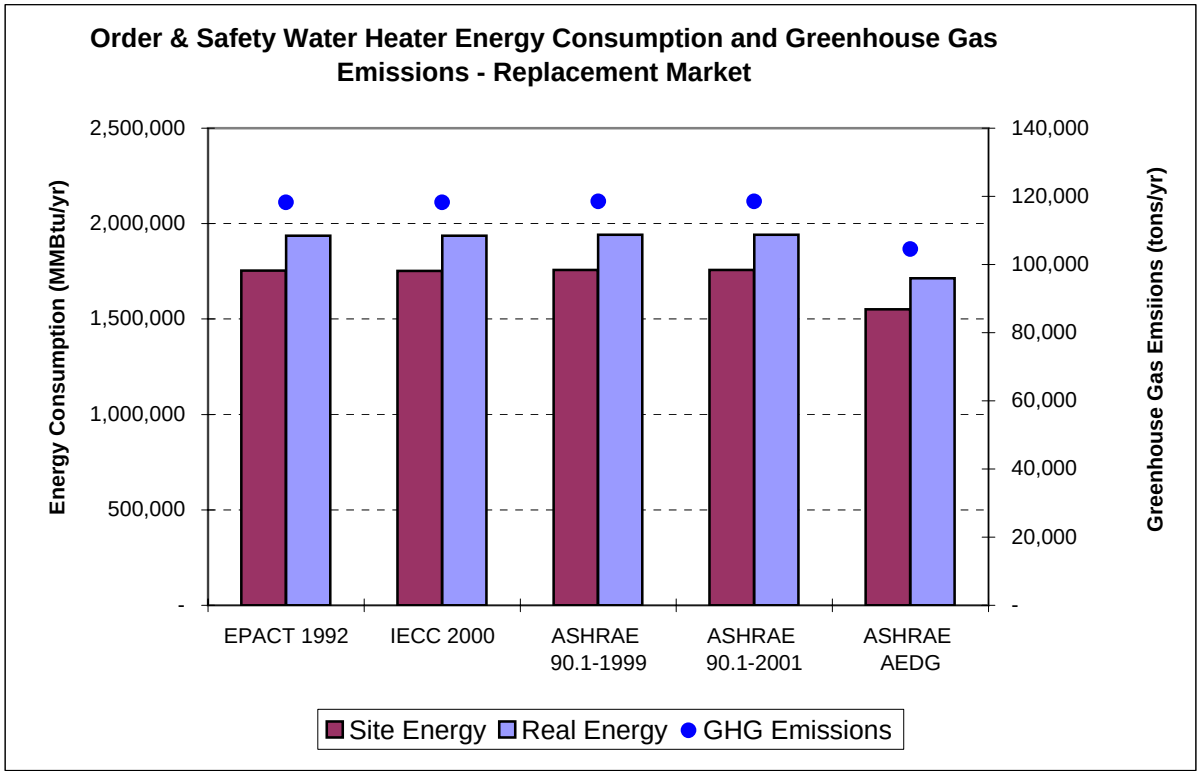
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	17,532,609	19,373,048	1,182,240
IECC 2000	17,525,023	19,364,666	1,181,729
ASHRAE 90.1-1999	17,577,766	19,422,946	1,185,285
ASHRAE 90.1-2001	17,577,766	19,422,946	1,185,285
ASHRAE AEDG	15,501,639	17,128,882	1,045,290



Order & Safety Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

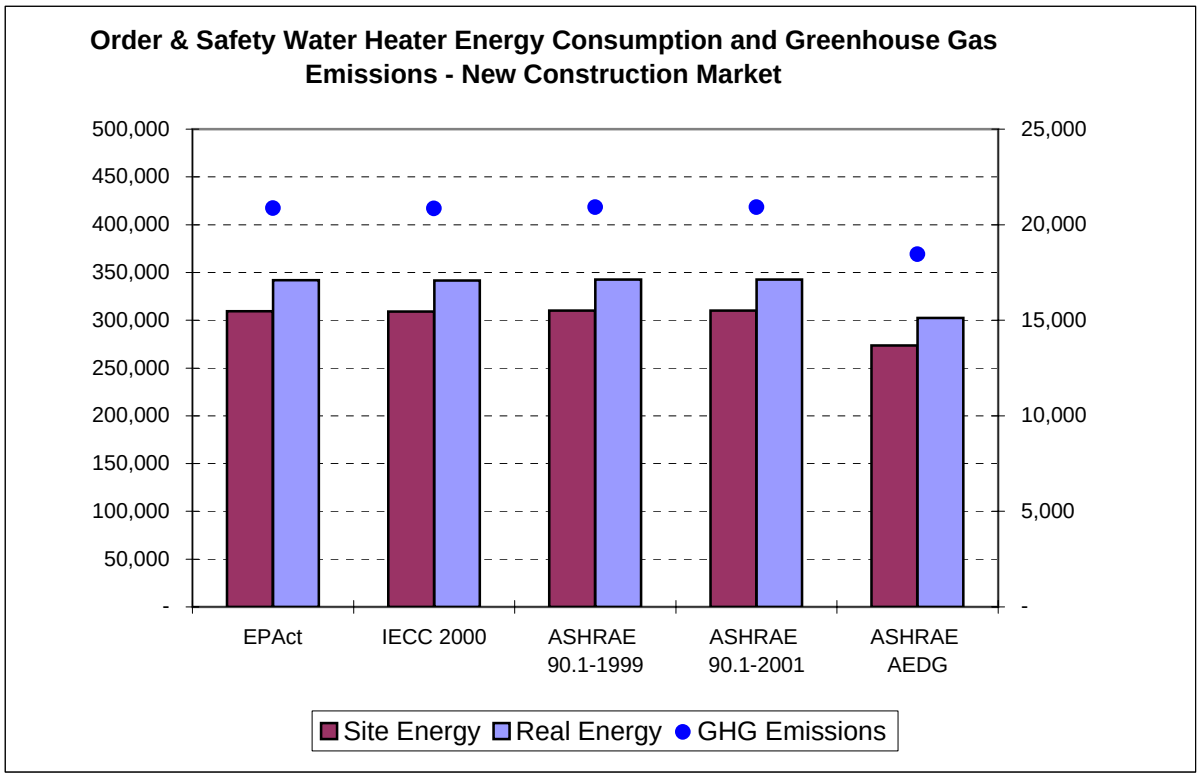
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,753,261	1,937,305	118,224
IECC 2000	1,752,502	1,936,467	118,173
ASHRAE 90.1-1999	1,757,777	1,942,295	118,529
ASHRAE 90.1-2001	1,757,777	1,942,295	118,529
ASHRAE AEDG	1,550,164	1,712,888	104,529



Order & Safety Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

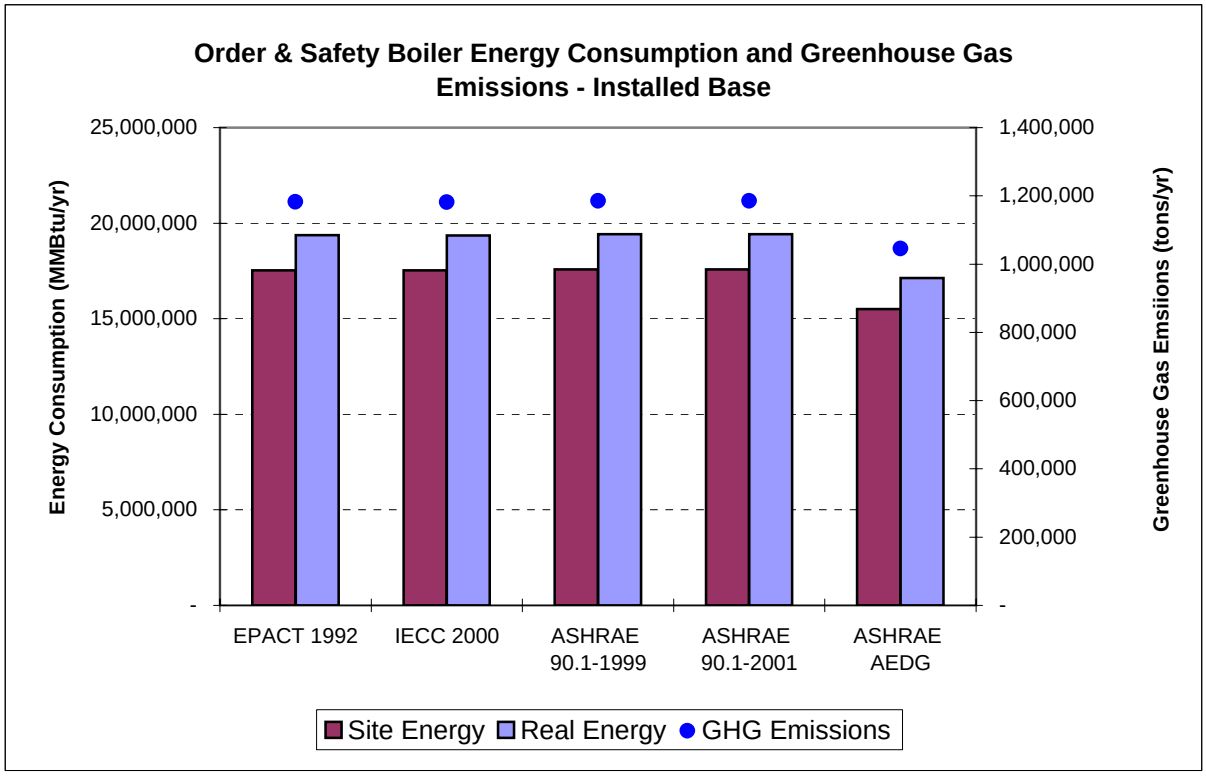
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	309,399	341,877	20,863
IECC 2000	309,265	341,729	20,854
ASHRAE 90.1-1999	310,196	342,758	20,917
ASHRAE 90.1-2001	310,196	342,758	20,917
ASHRAE AEDG	273,558	302,274	18,446



Order & Safety Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

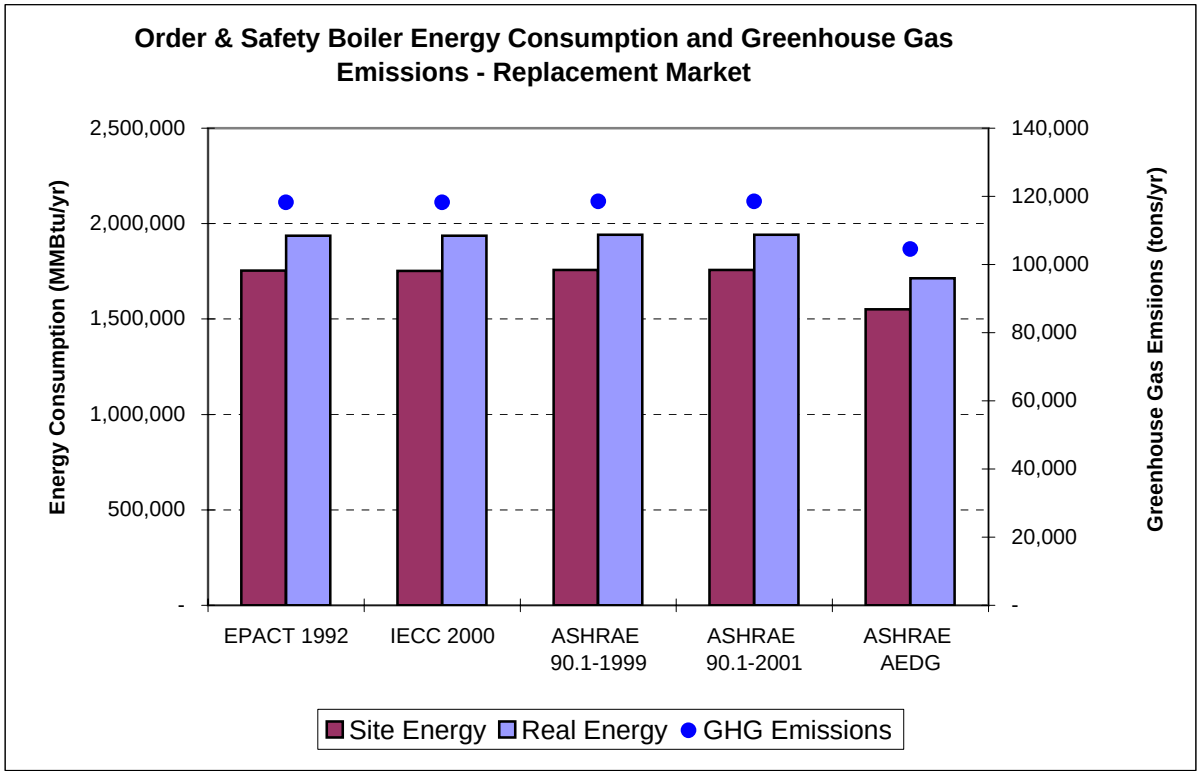
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	17,532,609	19,373,048	1,182,240
IECC 2000	17,525,023	19,364,666	1,181,729
ASHRAE 90.1-1999	17,577,766	19,422,946	1,185,285
ASHRAE 90.1-2001	17,577,766	19,422,946	1,185,285
ASHRAE AEDG	15,501,639	17,128,882	1,045,290



Order & Safety Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

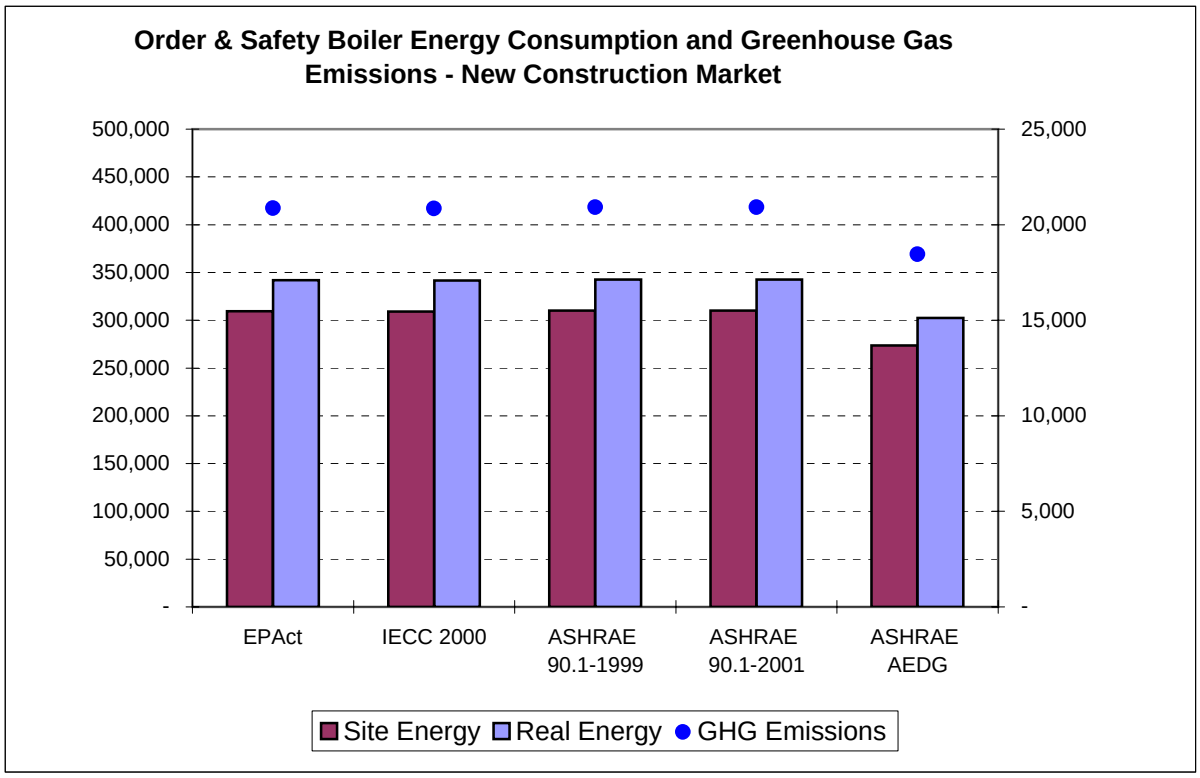
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,753,261	1,937,305	118,224
IECC 2000	1,752,502	1,936,467	118,173
ASHRAE 90.1-1999	1,757,777	1,942,295	118,529
ASHRAE 90.1-2001	1,757,777	1,942,295	118,529
ASHRAE AEDG	1,550,164	1,712,888	104,529



Order & Safety Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

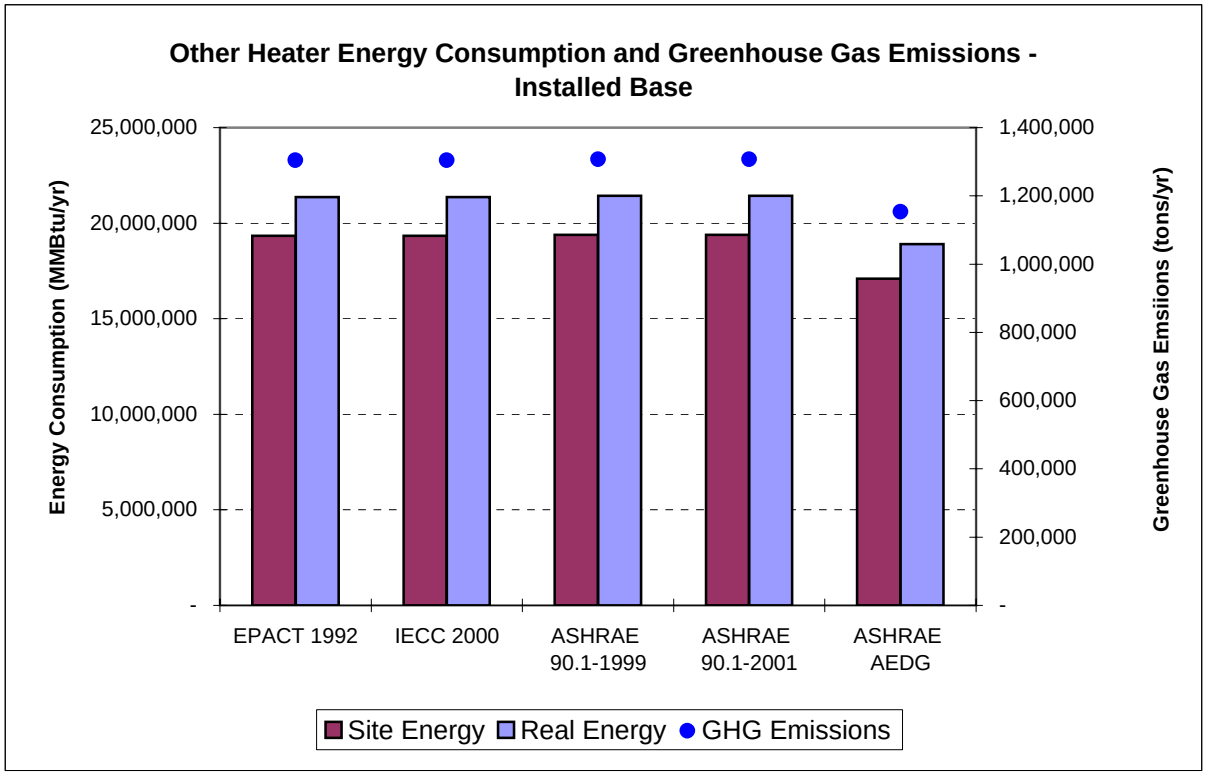
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	309,399	341,877	20,863
IECC 2000	309,265	341,729	20,854
ASHRAE 90.1-1999	310,196	342,758	20,917
ASHRAE 90.1-2001	310,196	342,758	20,917
ASHRAE AEDG	273,558	302,274	18,446



Other Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

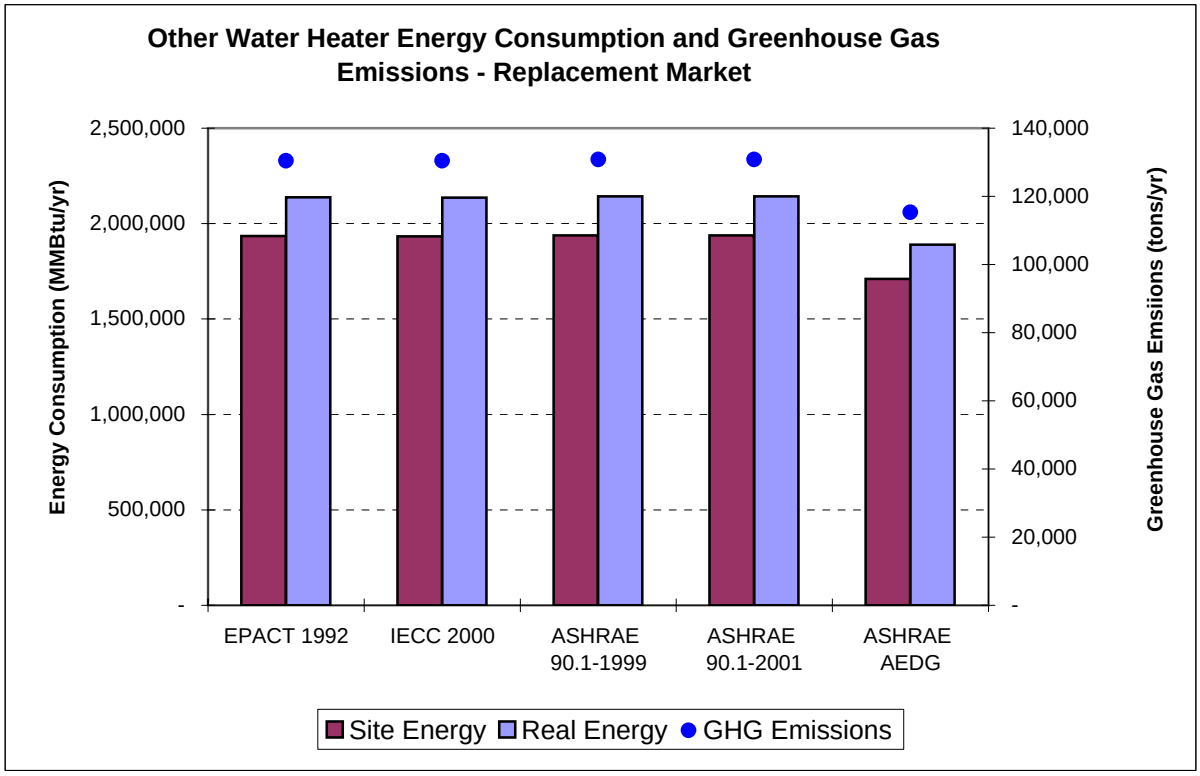
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	19,343,113	21,373,606	1,304,324
IECC 2000	19,338,621	21,368,642	1,304,021
ASHRAE 90.1-1999	19,390,975	21,426,492	1,307,552
ASHRAE 90.1-2001	19,390,975	21,426,492	1,307,552
ASHRAE AEDG	17,102,415	18,897,696	1,153,232



Other Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

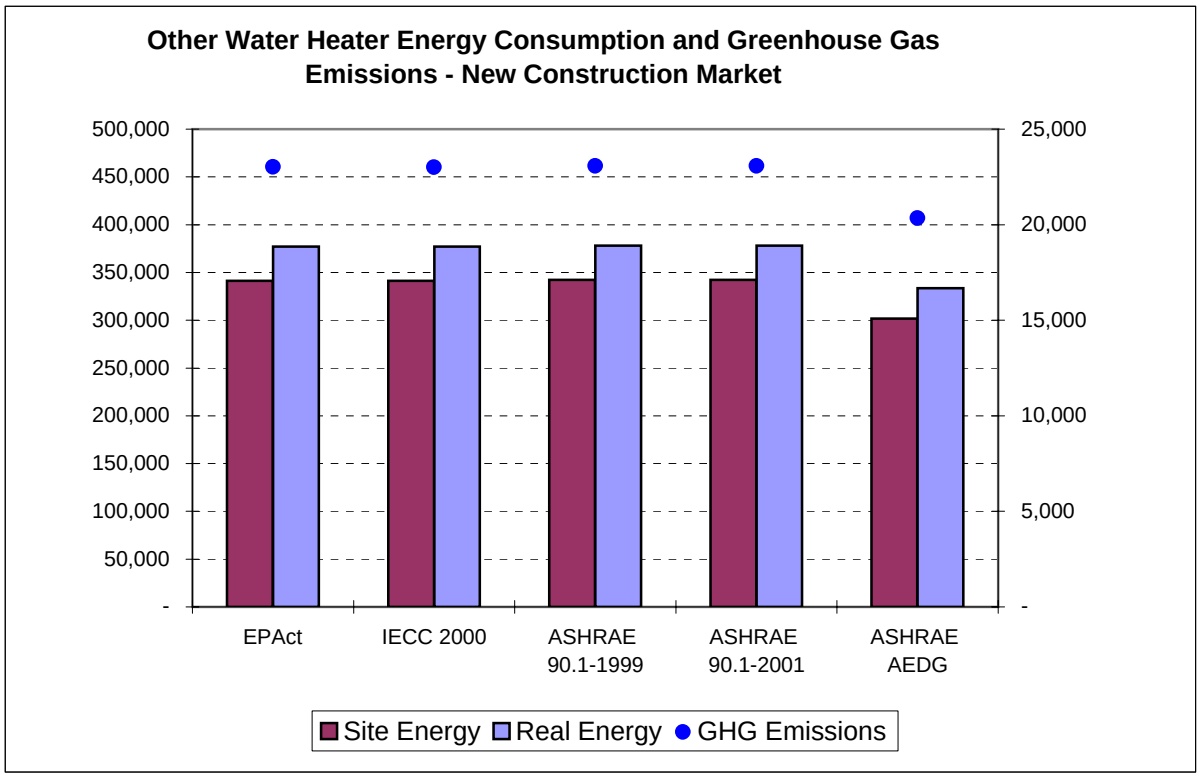
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,934,311	2,137,361	130,432
IECC 2000	1,933,862	2,136,864	130,402
ASHRAE 90.1-1999	1,939,098	2,142,649	130,755
ASHRAE 90.1-2001	1,939,098	2,142,649	130,755
ASHRAE AEDG	1,710,242	1,889,770	115,323



Other Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

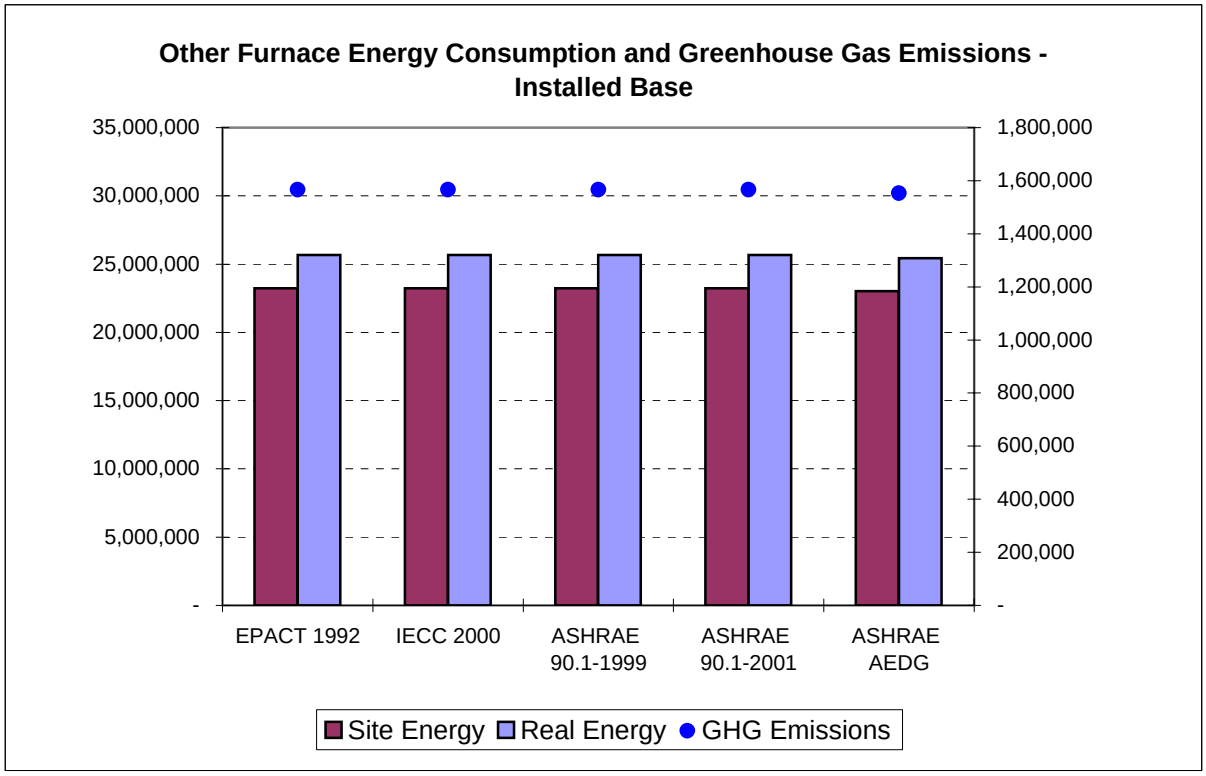
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	341,349	377,181	23,017
IECC 2000	341,270	377,094	23,012
ASHRAE 90.1-1999	342,194	378,115	23,074
ASHRAE 90.1-2001	342,194	378,115	23,074
ASHRAE AEDG	301,807	333,489	20,351



Other Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	23,229,621	25,668,089	1,566,395
IECC 2000	23,229,621	25,668,089	1,566,395
ASHRAE 90.1-1999	23,229,621	25,668,089	1,566,395
ASHRAE 90.1-2001	23,229,621	25,668,089	1,566,395
ASHRAE AEDG	23,020,500	25,437,017	1,552,294

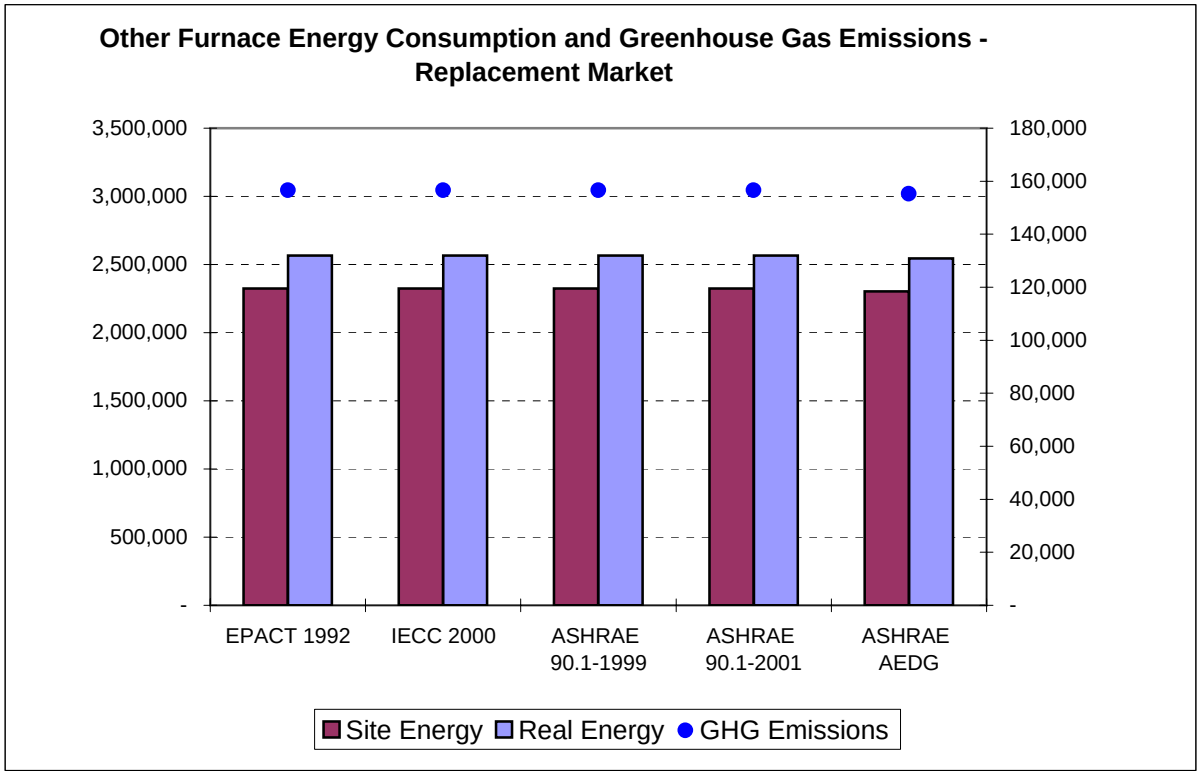


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Other Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	2,322,962	2,566,809	156,640
IECC 2000	2,322,962	2,566,809	156,640
ASHRAE 90.1-1999	2,322,962	2,566,809	156,640
ASHRAE 90.1-2001	2,322,962	2,566,809	156,640
ASHRAE AEDG	2,302,050	2,543,702	155,229

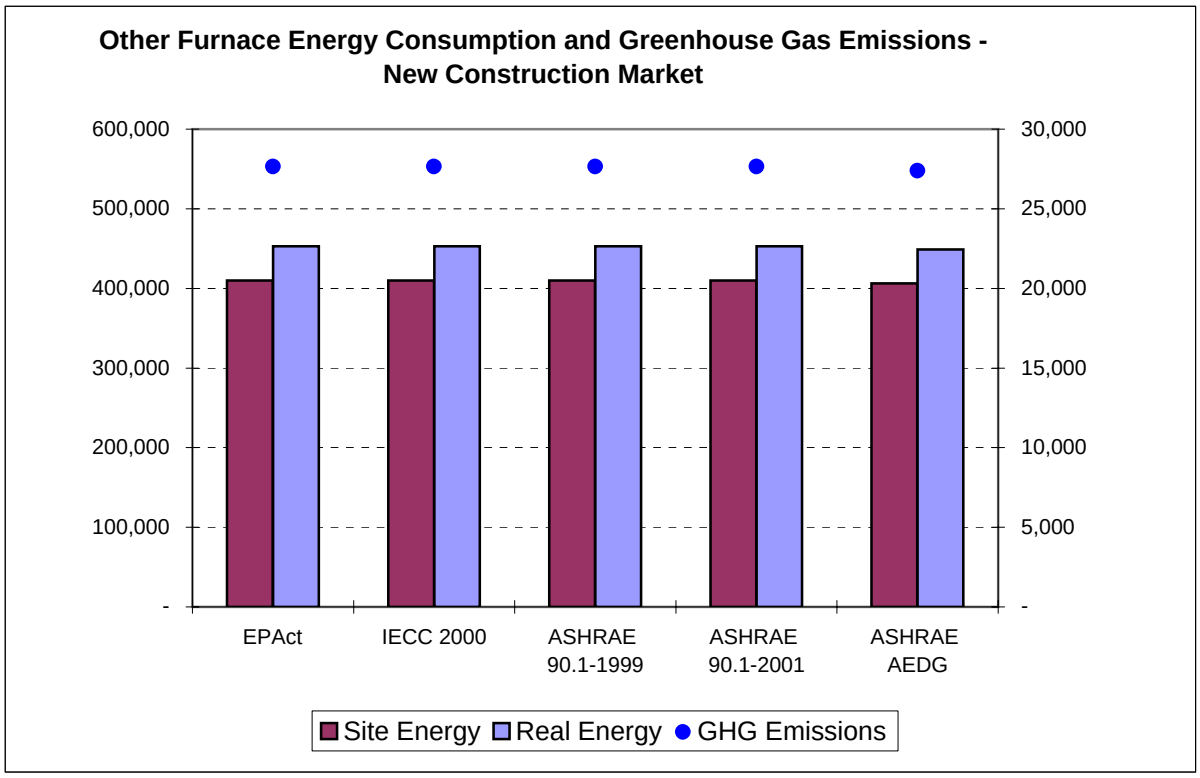


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Other Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	409,934	452,966	27,642
IECC 2000	409,934	452,966	27,642
ASHRAE 90.1-1999	409,934	452,966	27,642
ASHRAE 90.1-2001	409,934	452,966	27,642
ASHRAE AEDG	406,244	448,889	27,393

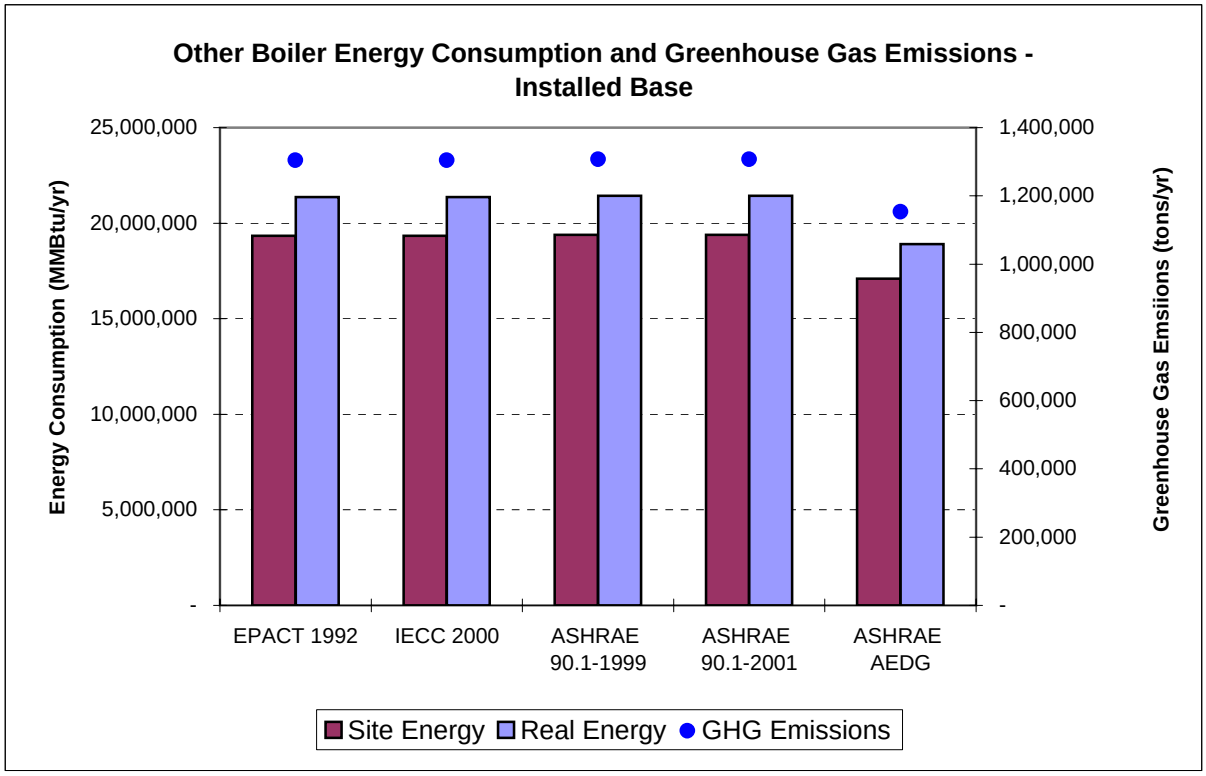


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Other Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

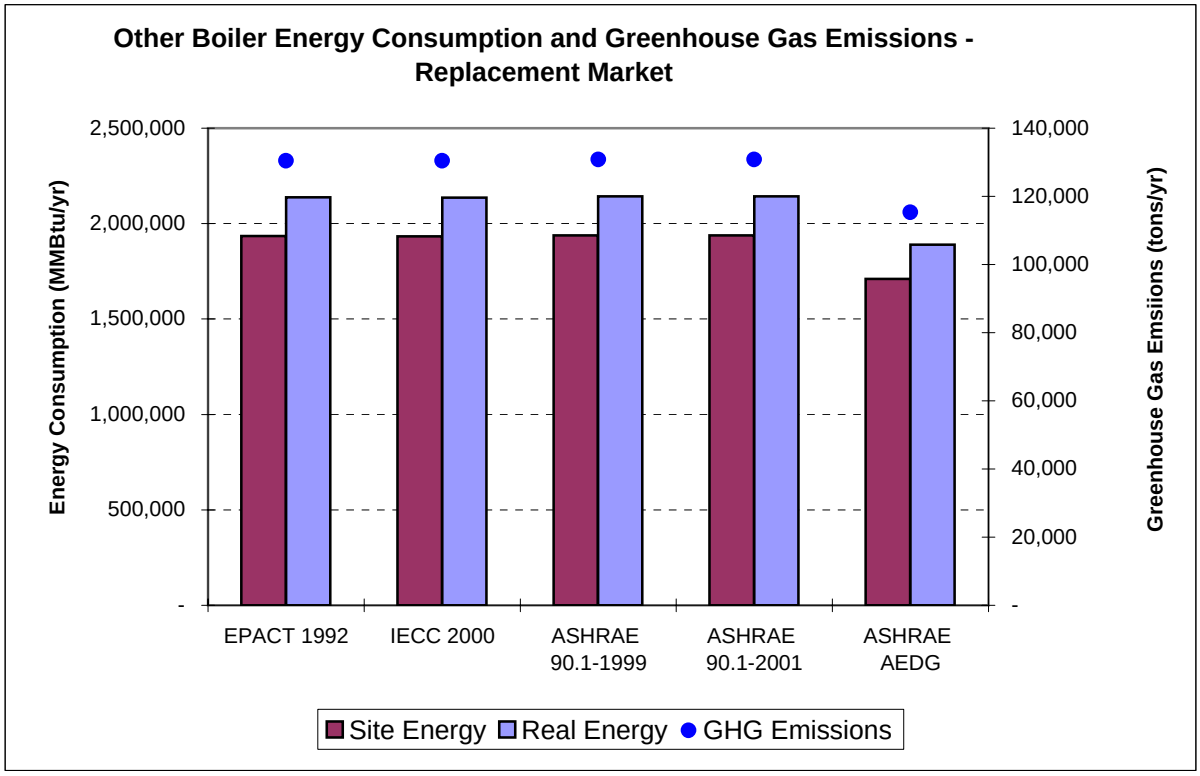
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	19,343,113	21,373,606	1,304,324
IECC 2000	19,338,621	21,368,642	1,304,021
ASHRAE 90.1-1999	19,390,975	21,426,492	1,307,552
ASHRAE 90.1-2001	19,390,975	21,426,492	1,307,552
ASHRAE AEDG	17,102,415	18,897,696	1,153,232



Other Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

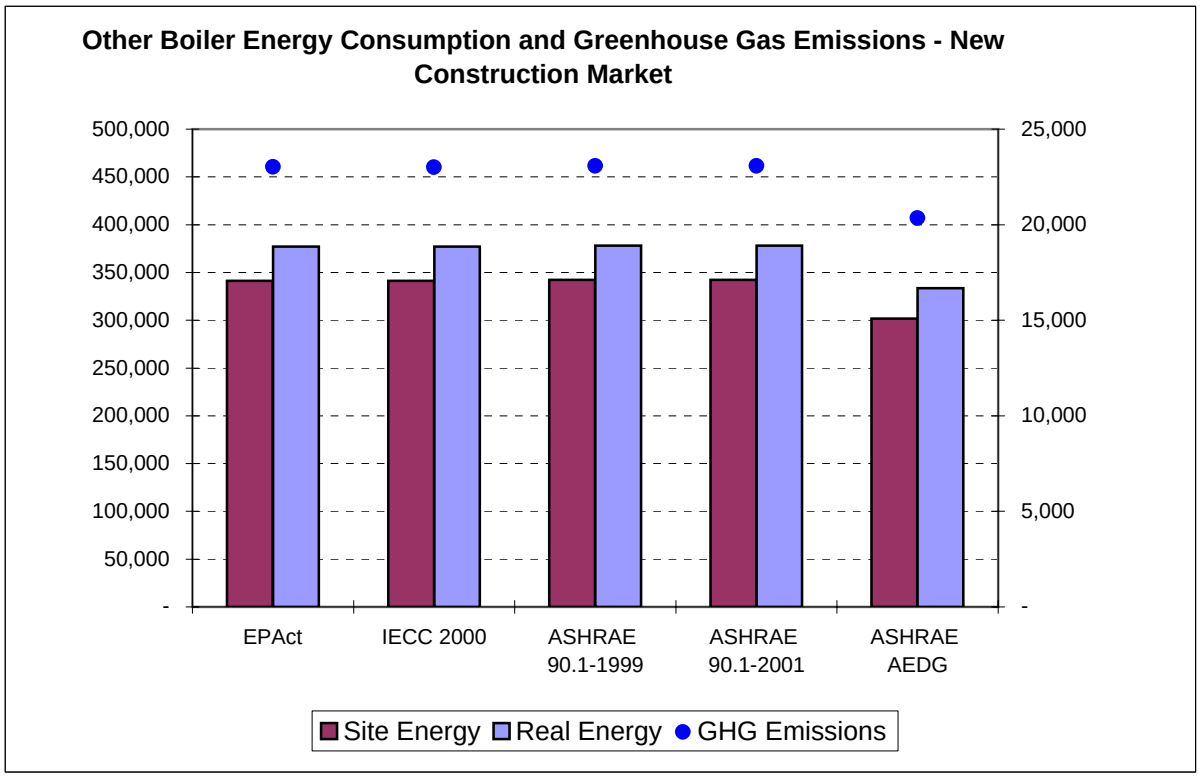
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,934,311	2,137,361	130,432
IECC 2000	1,933,862	2,136,864	130,402
ASHRAE 90.1-1999	1,939,098	2,142,649	130,755
ASHRAE 90.1-2001	1,939,098	2,142,649	130,755
ASHRAE AEDG	1,710,242	1,889,770	115,323



Other Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

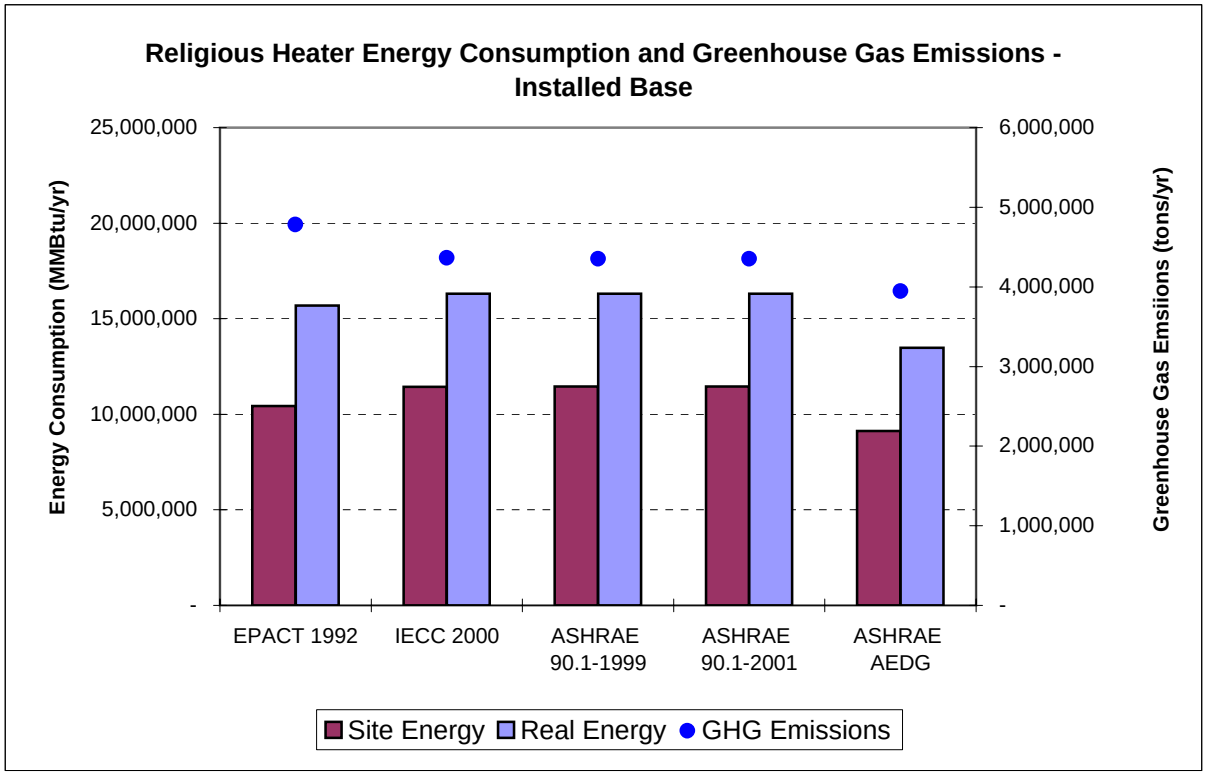
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	341,349	377,181	23,017
IECC 2000	341,270	377,094	23,012
ASHRAE 90.1-1999	342,194	378,115	23,074
ASHRAE 90.1-2001	342,194	378,115	23,074
ASHRAE AEDG	301,807	333,489	20,351



Religious Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

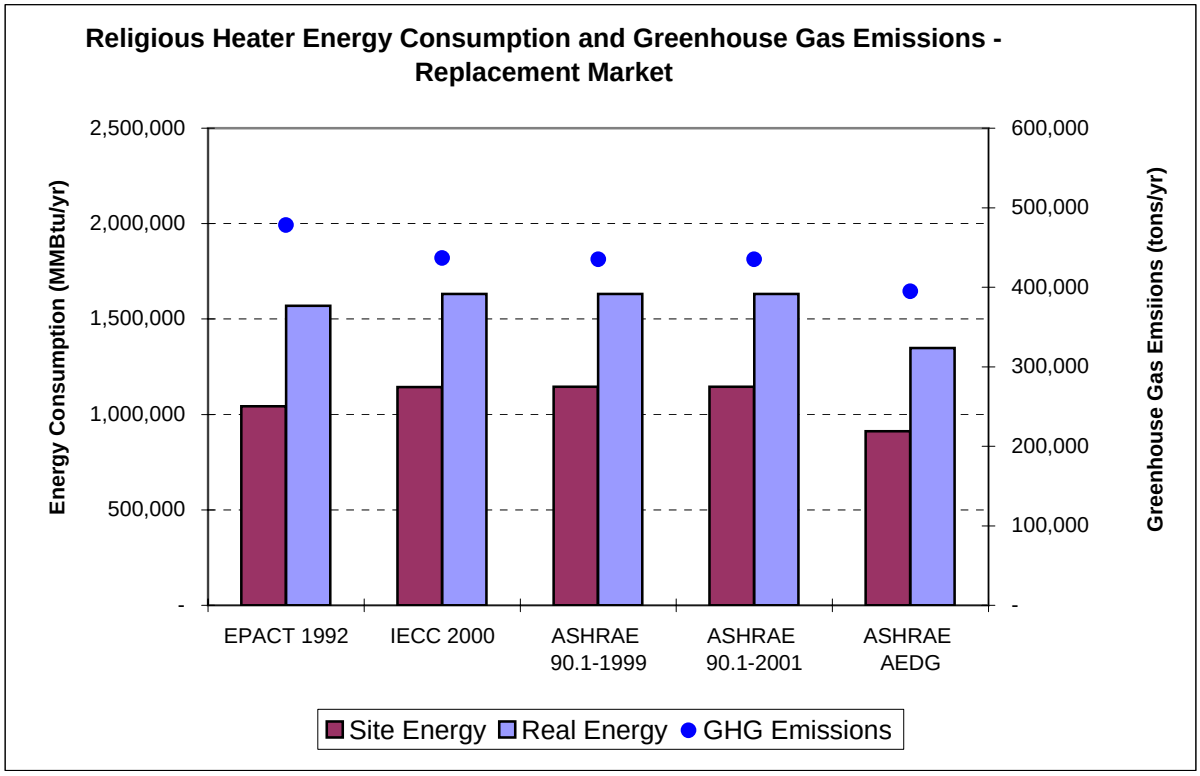
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	10,432,532	15,694,868	4,781,220
IECC 2000	11,435,241	16,309,386	4,365,979
ASHRAE 90.1-1999	11,451,390	16,311,415	4,351,593
ASHRAE 90.1-2001	11,451,390	16,311,415	4,351,593
ASHRAE AEDG	9,117,889	13,481,332	3,948,016



Religious Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

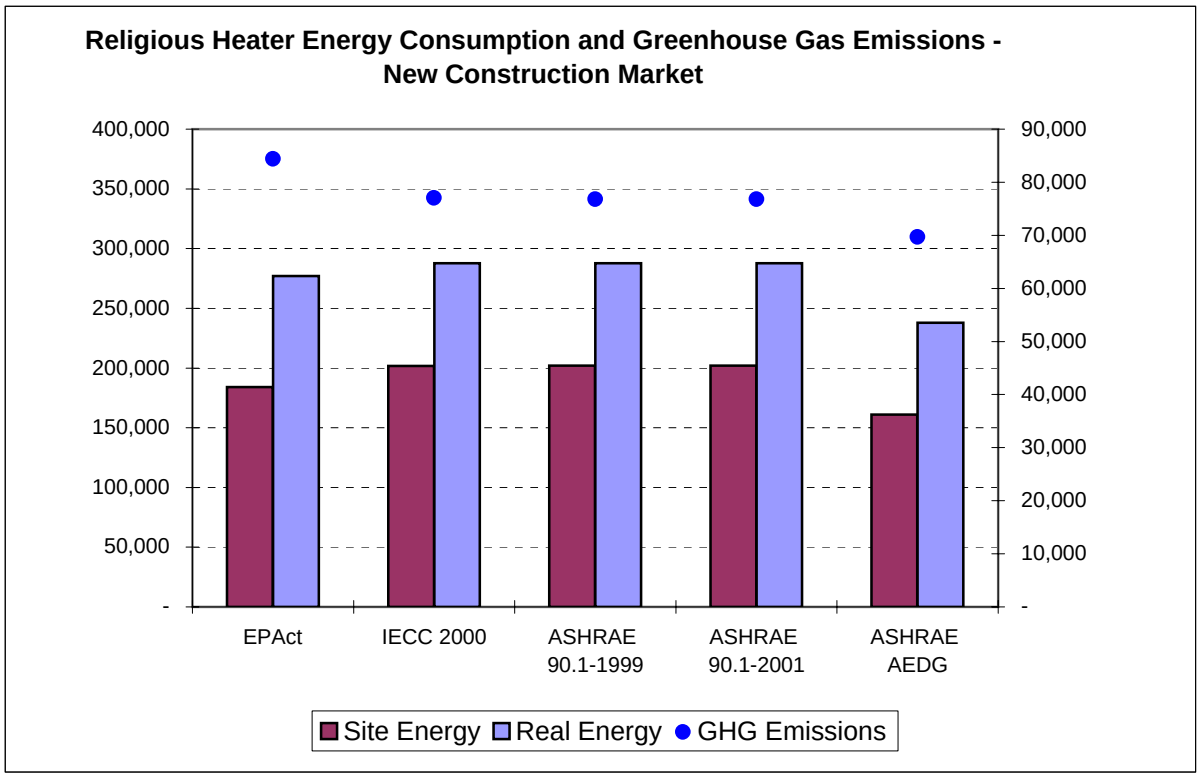
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,043,253	1,569,487	478,122
IECC 2000	1,143,524	1,630,939	436,598
ASHRAE 90.1-1999	1,145,139	1,631,142	435,159
ASHRAE 90.1-2001	1,145,139	1,631,142	435,159
ASHRAE AEDG	911,789	1,348,133	394,802



Religious Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

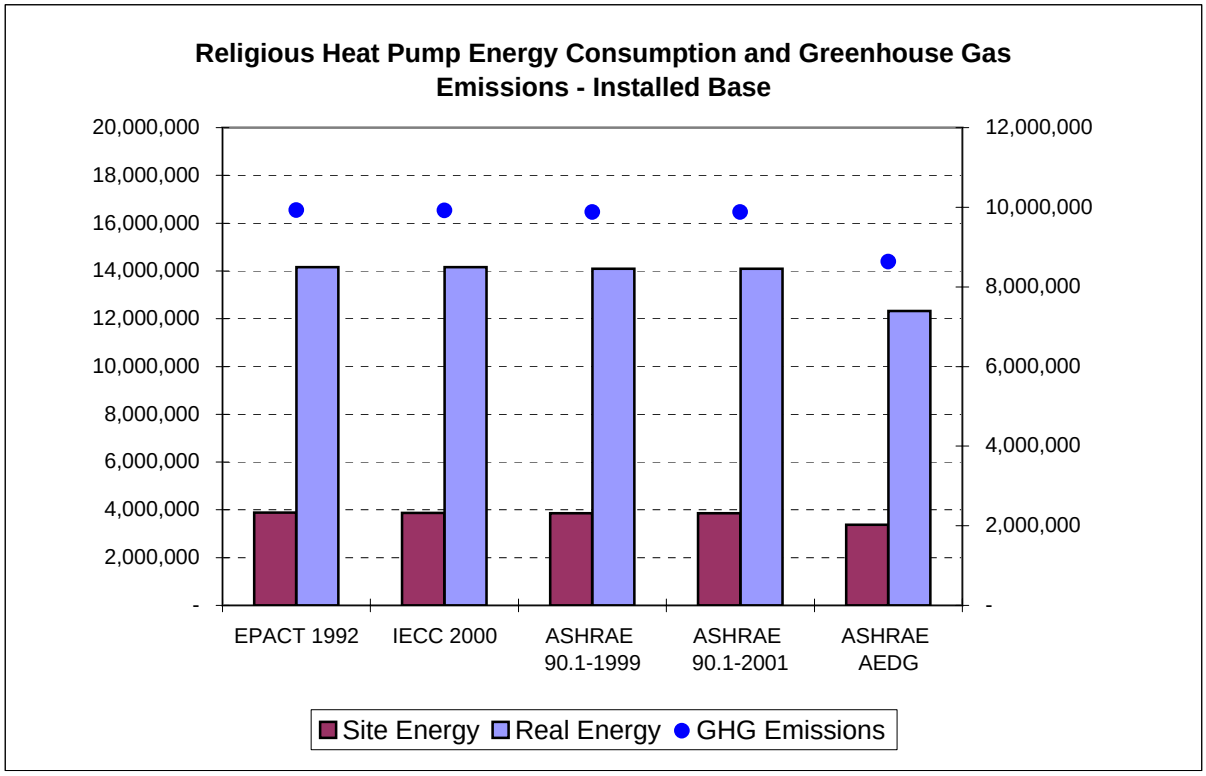
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	184,104	276,968	84,374
IECC 2000	201,798	287,813	77,047
ASHRAE 90.1-1999	202,083	287,849	76,793
ASHRAE 90.1-2001	202,083	287,849	76,793
ASHRAE AEDG	160,904	237,906	69,671



Religious Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

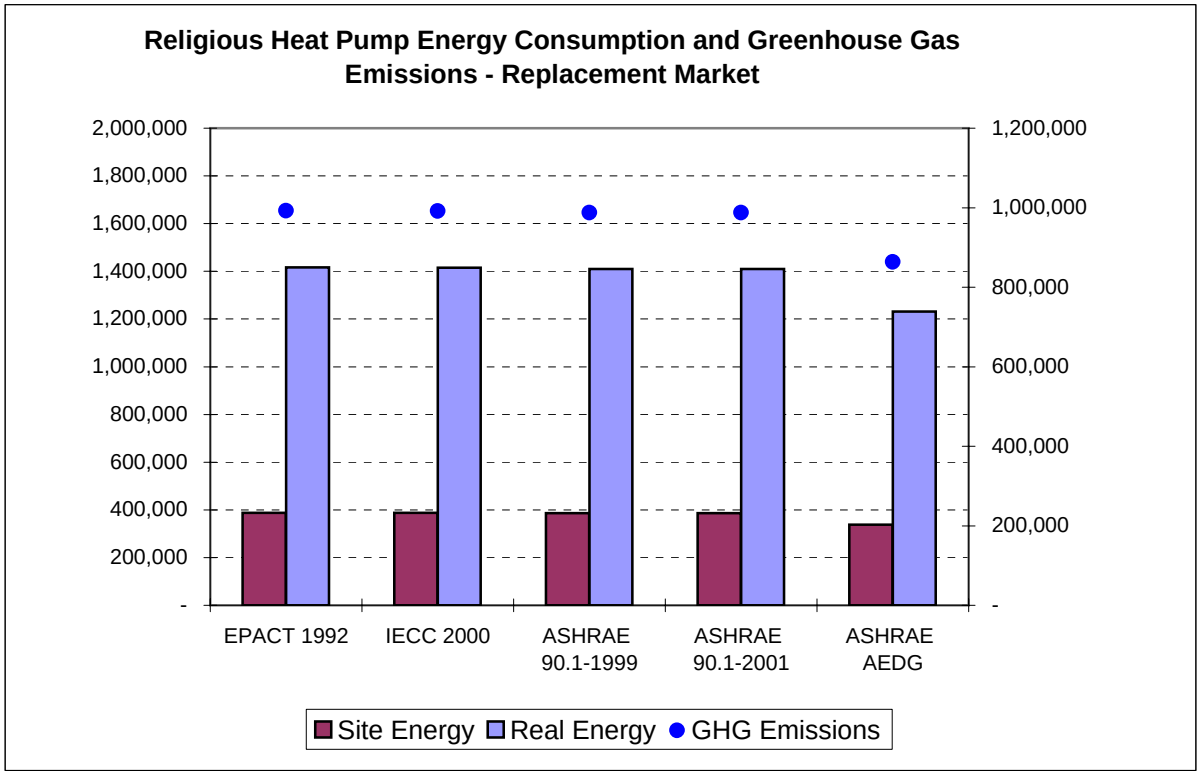
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	3,880,163	14,161,179	9,923,376
IECC 2000	3,877,933	14,153,040	9,917,672
ASHRAE 90.1-1999	3,862,652	14,097,271	9,878,592
ASHRAE 90.1-2001	3,862,652	14,097,271	9,878,592
ASHRAE AEDG	3,375,419	12,319,049	8,632,512



Religious Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

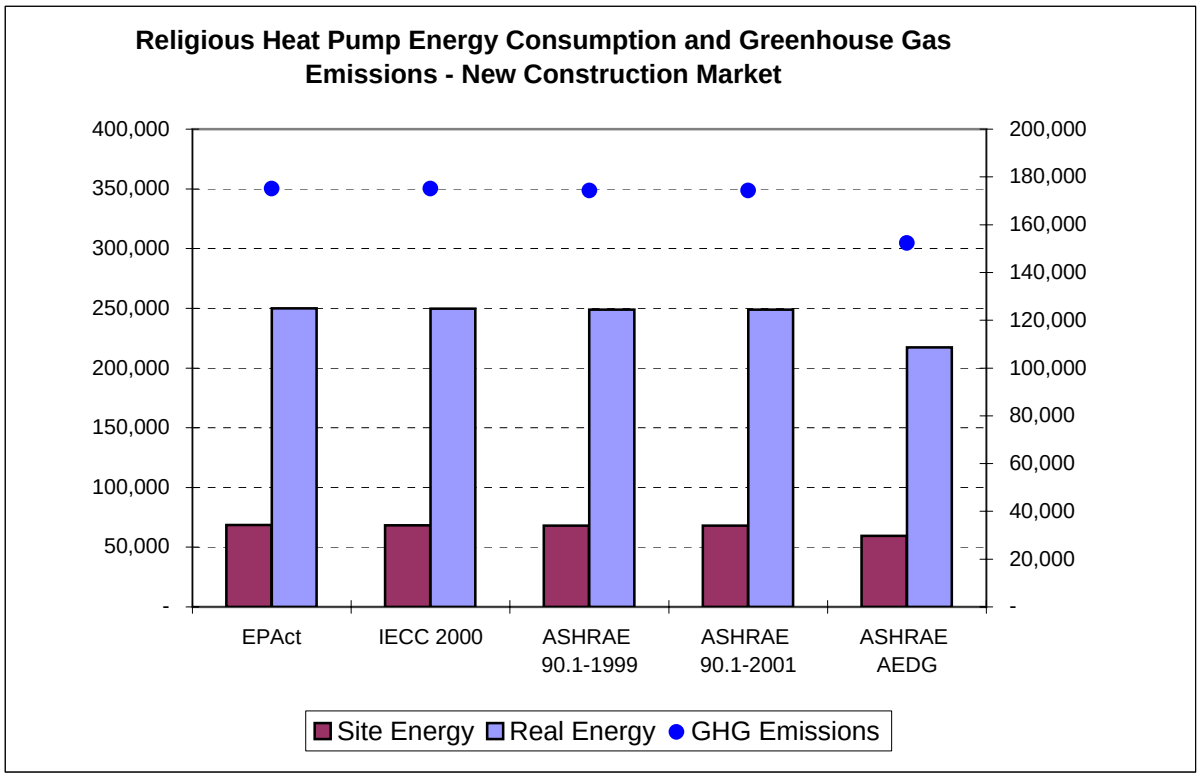
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	388,016	1,416,118	992,338
IECC 2000	387,793	1,415,304	991,767
ASHRAE 90.1-1999	386,265	1,409,727	987,859
ASHRAE 90.1-2001	386,265	1,409,727	987,859
ASHRAE AEDG	337,542	1,231,905	863,251



Religious Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

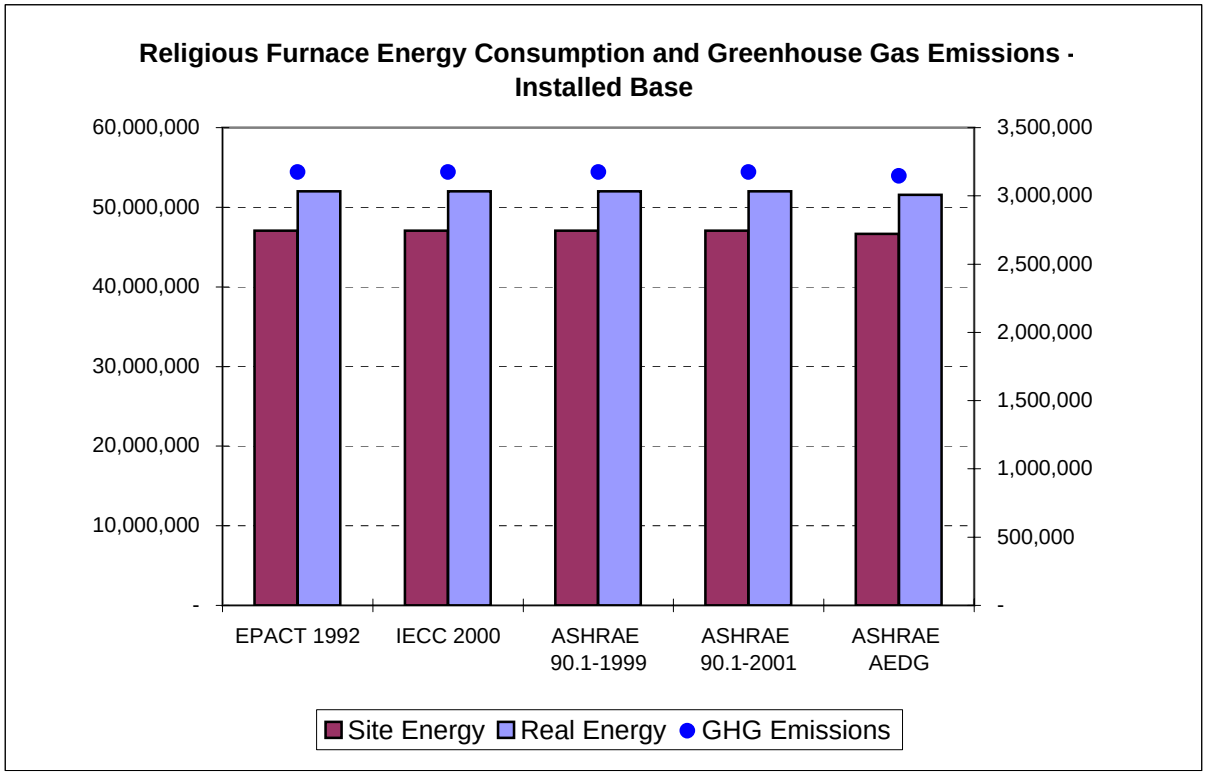
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	68,473	249,903	175,118
IECC 2000	68,434	249,760	175,018
ASHRAE 90.1-1999	68,164	248,775	174,328
ASHRAE 90.1-2001	68,164	248,775	174,328
ASHRAE AEDG	59,566	217,395	152,338



Religious Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	47,075,553	52,017,186	3,174,349
IECC 2000	47,075,553	52,017,186	3,174,349
ASHRAE 90.1-1999	47,075,553	52,017,186	3,174,349
ASHRAE 90.1-2001	47,075,553	52,017,186	3,174,349
ASHRAE AEDG	46,651,763	51,548,910	3,145,772

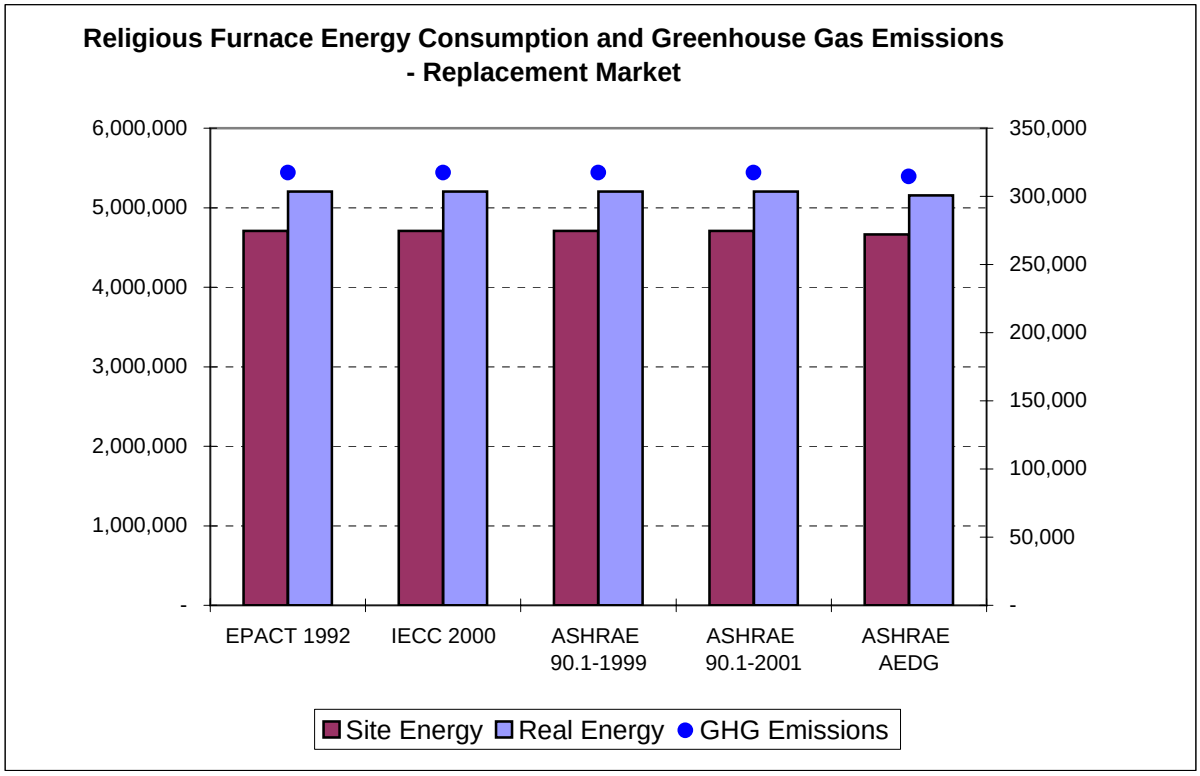


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Religious Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	4,707,555	5,201,719	317,435
IECC 2000	4,707,555	5,201,719	317,435
ASHRAE 90.1-1999	4,707,555	5,201,719	317,435
ASHRAE 90.1-2001	4,707,555	5,201,719	317,435
ASHRAE AEDG	4,665,176	5,154,891	314,577

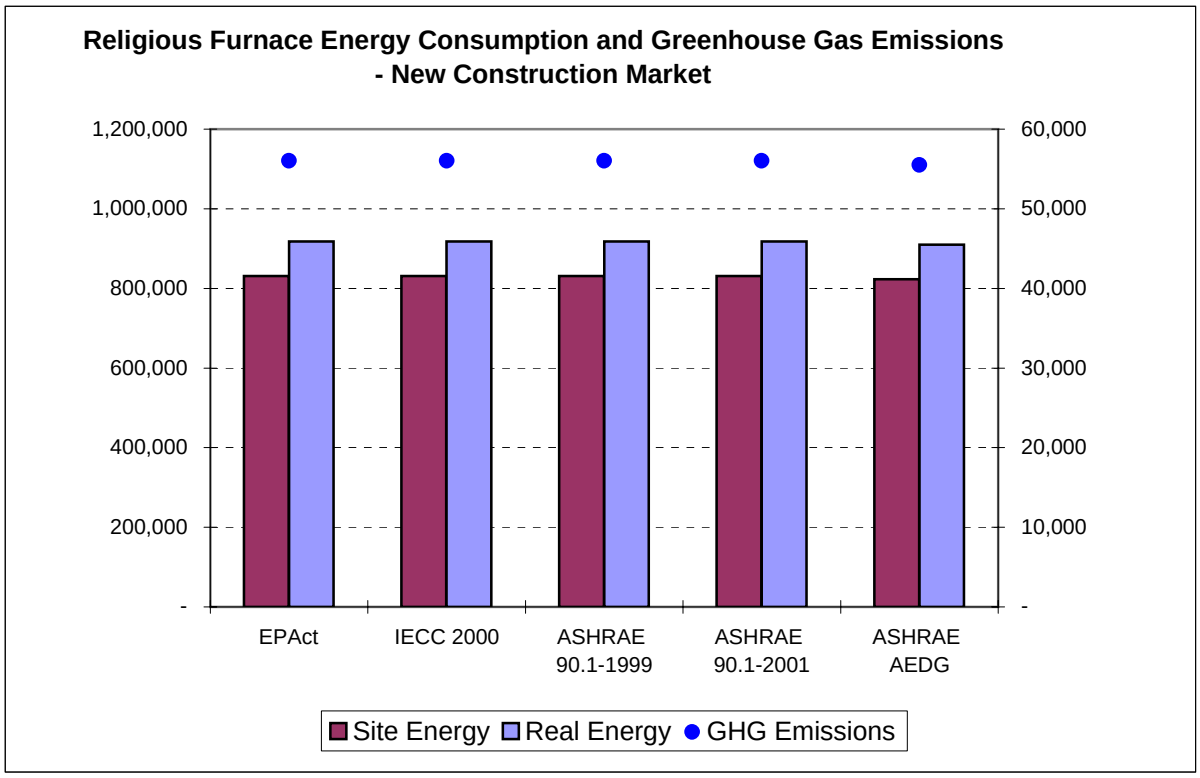


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Religious Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	830,745	917,950	56,018
IECC 2000	830,745	917,950	56,018
ASHRAE 90.1-1999	830,745	917,950	56,018
ASHRAE 90.1-2001	830,745	917,950	56,018
ASHRAE AEDG	823,266	909,687	55,514

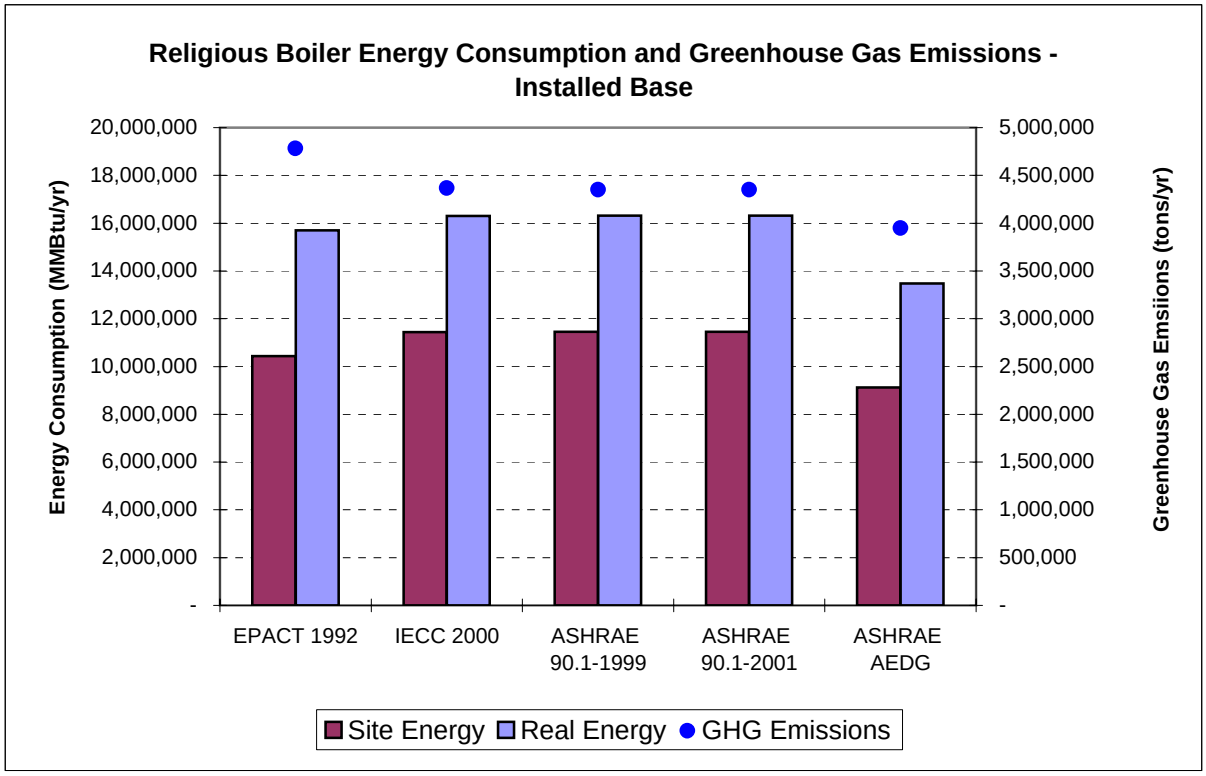


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Religious Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	10,432,532	15,694,868	4,781,220
IECC 2000	11,435,241	16,309,386	4,365,979
ASHRAE 90.1-1999	11,451,390	16,311,415	4,351,593
ASHRAE 90.1-2001	11,451,390	16,311,415	4,351,593
ASHRAE AEDG	9,117,889	13,481,332	3,948,016



Religious Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,043,253	1,569,487	478,122
IECC 2000	1,143,524	1,630,939	436,598
ASHRAE 90.1-1999	1,145,139	1,631,142	435,159
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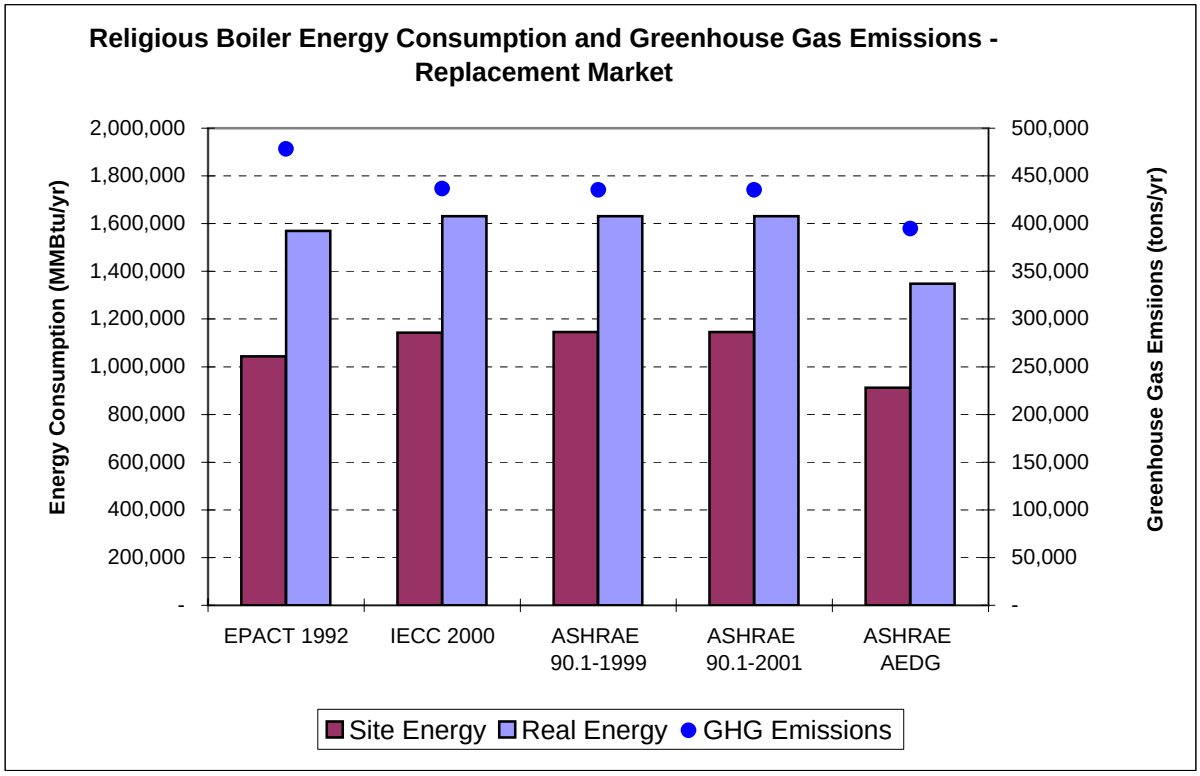
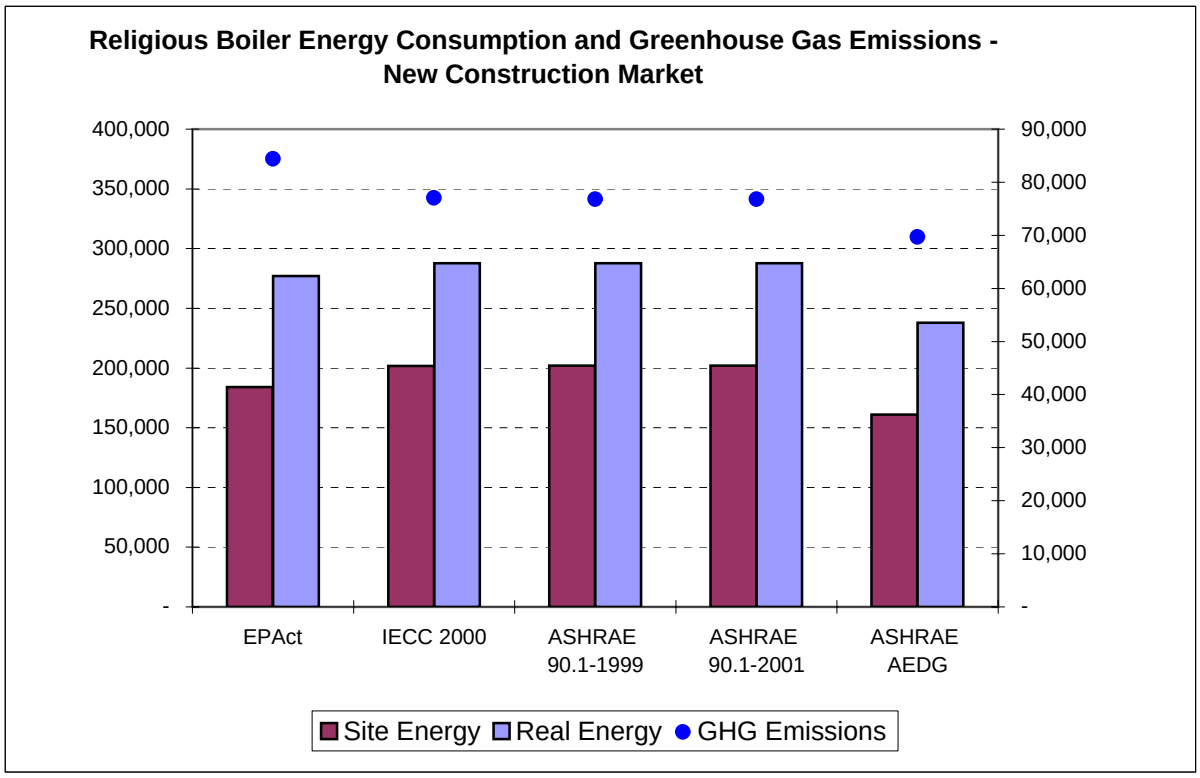
ASHRAE AEDG	911,789	1,348,133	394,802



Religious Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

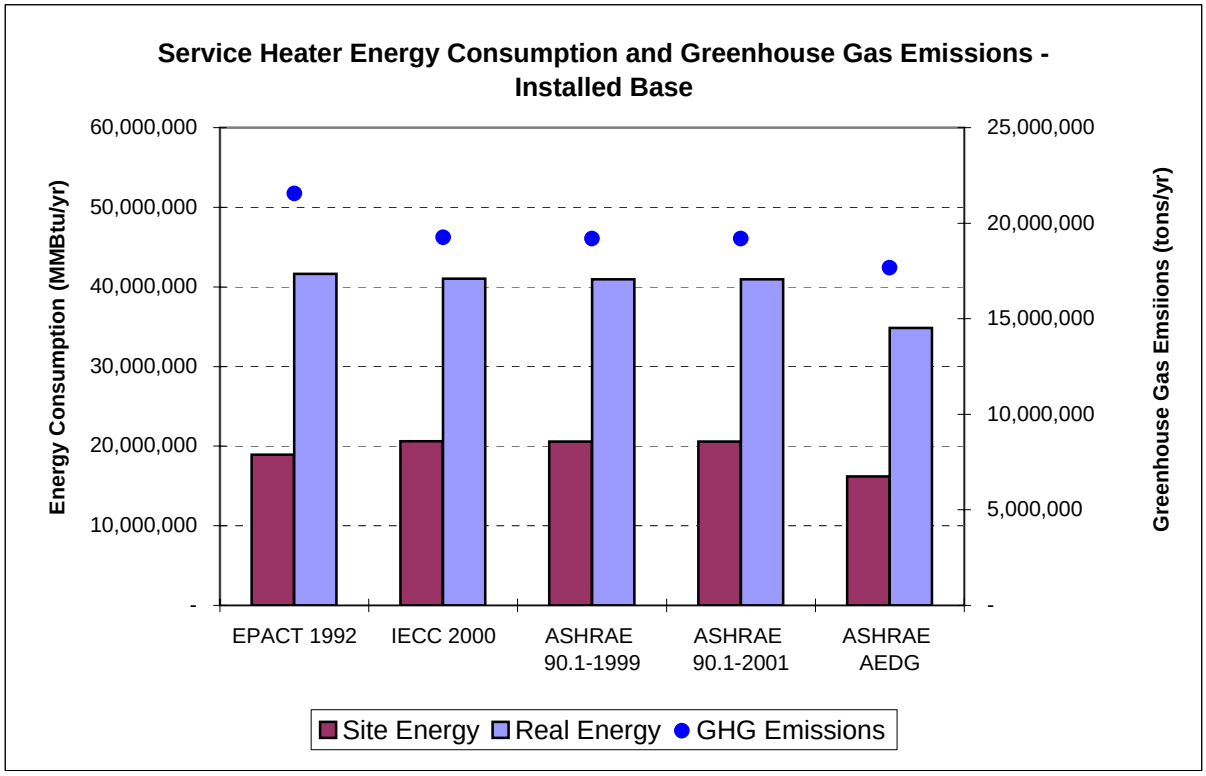
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	184,104	276,968	84,374
IECC 2000	201,798	287,813	77,047
ASHRAE 90.1-1999	202,083	287,849	76,793
ASHRAE 90.1-2001	202,083	287,849	76,793
ASHRAE AEDG	160,904	237,906	69,671



Service Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

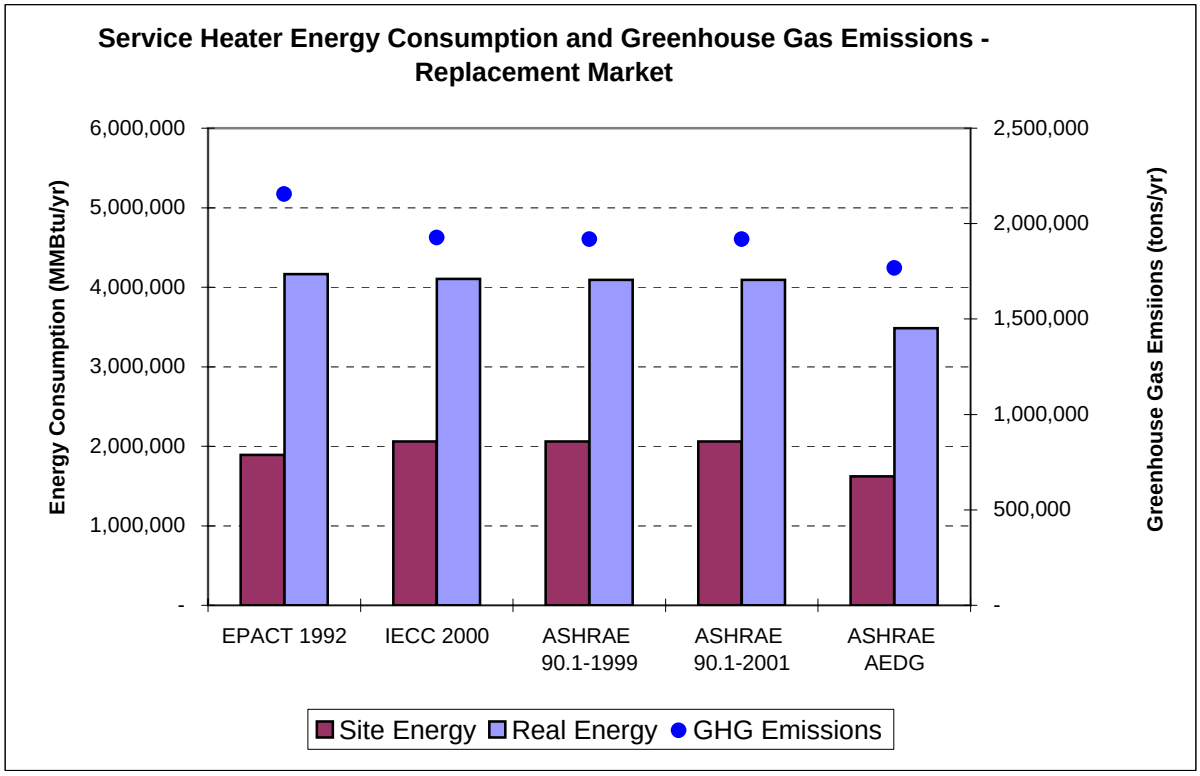
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	18,932,535	41,639,988	21,551,870
IECC 2000	20,609,066	41,039,005	19,264,089
ASHRAE 90.1-1999	20,594,376	40,944,140	19,186,154
ASHRAE 90.1-2001	20,594,376	40,944,140	19,186,154
ASHRAE AEDG	16,202,849	34,840,480	17,665,745



Service Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

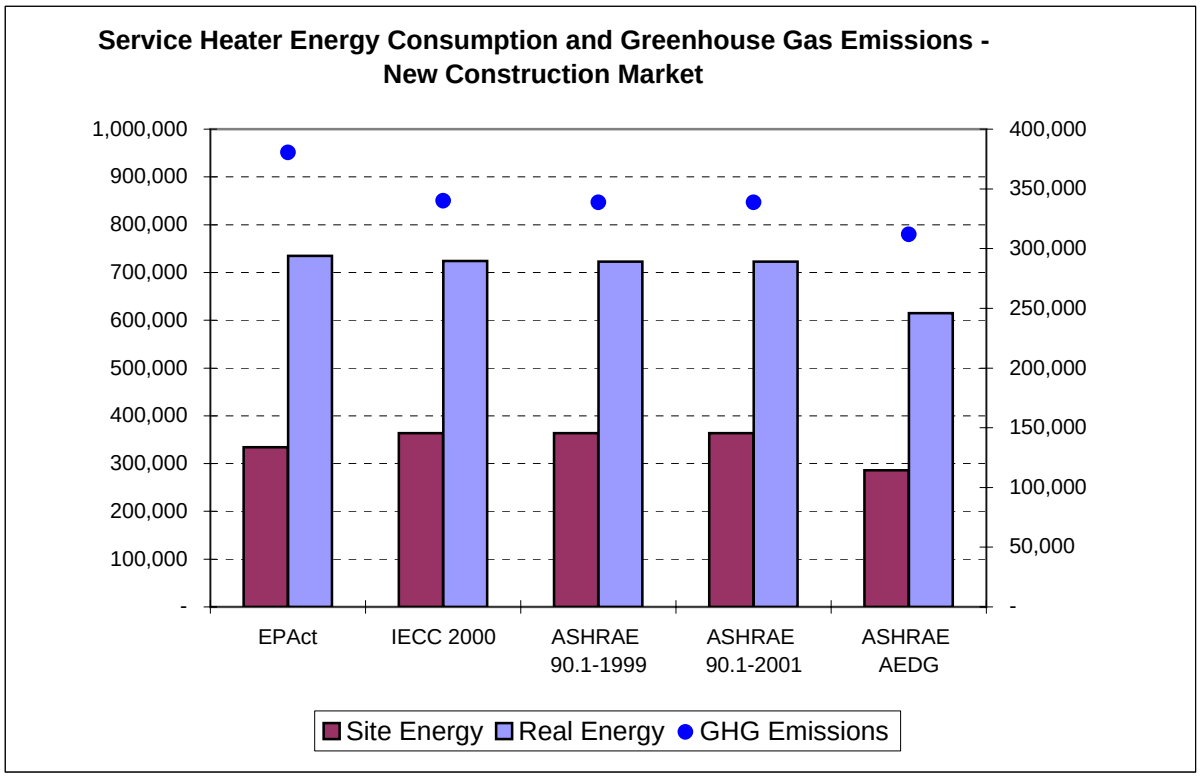
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,893,254	4,163,999	2,155,187
IECC 2000	2,060,907	4,103,900	1,926,409
ASHRAE 90.1-1999	2,059,438	4,094,414	1,918,615
ASHRAE 90.1-2001	2,059,438	4,094,414	1,918,615
ASHRAE AEDG	1,620,285	3,484,048	1,766,575



Service Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

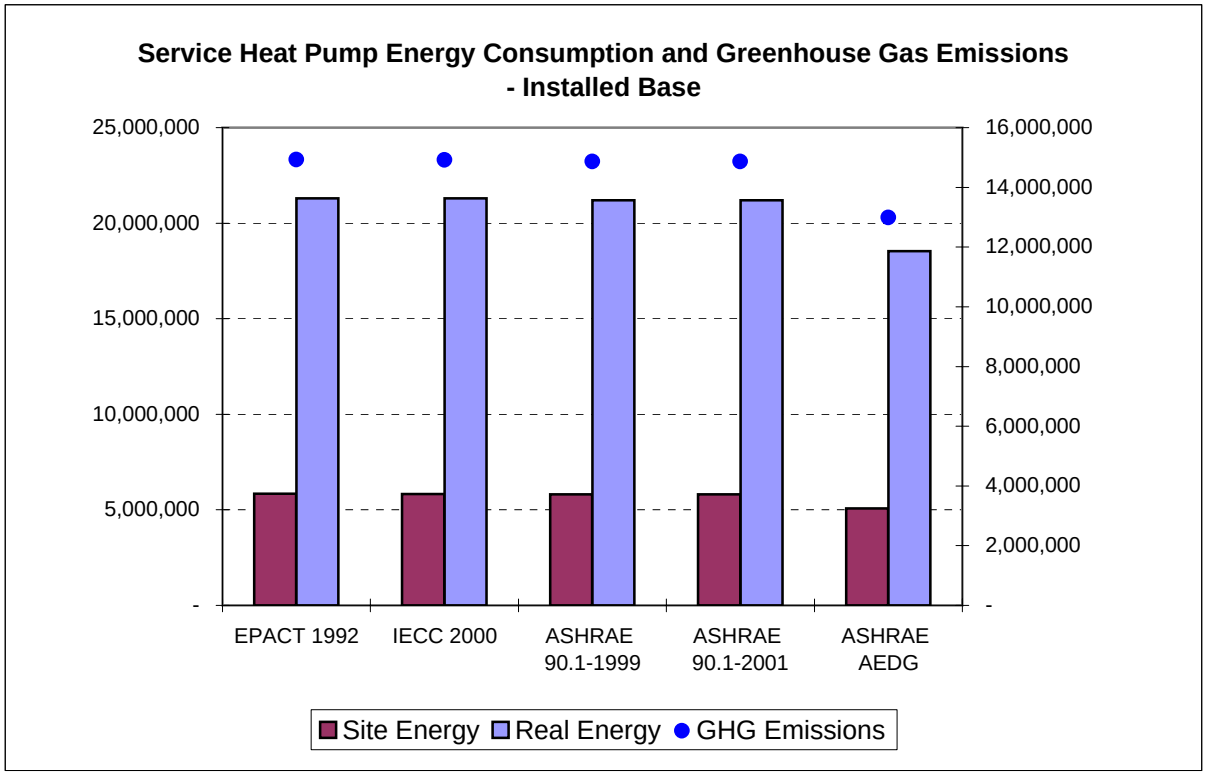
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	334,104	734,823	380,327
IECC 2000	363,689	724,218	339,955
ASHRAE 90.1-1999	363,430	722,544	338,579
ASHRAE 90.1-2001	363,430	722,544	338,579
ASHRAE AEDG	285,933	614,832	311,748



Service Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

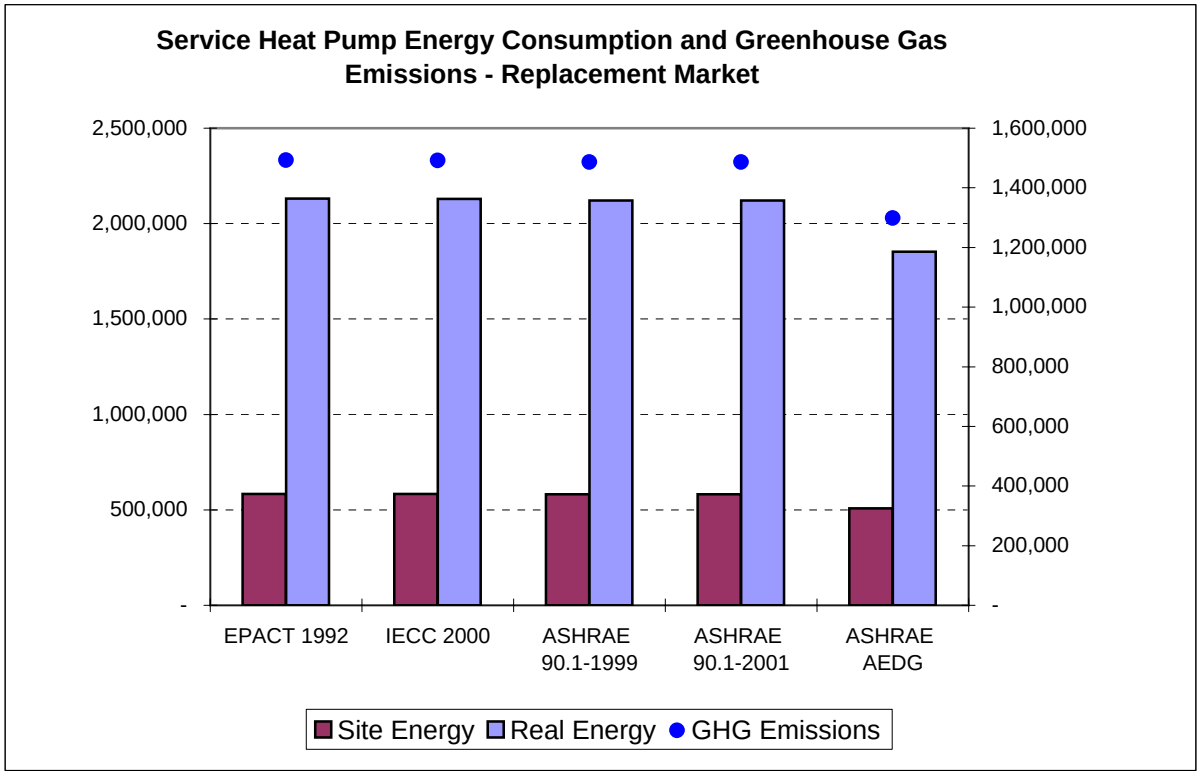
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,837,142	21,303,440	14,928,279
IECC 2000	5,833,788	21,291,196	14,919,699
ASHRAE 90.1-1999	5,810,800	21,207,299	14,860,909
ASHRAE 90.1-2001	5,810,800	21,207,299	14,860,909
ASHRAE AEDG	5,077,829	18,532,221	12,986,361



Service Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

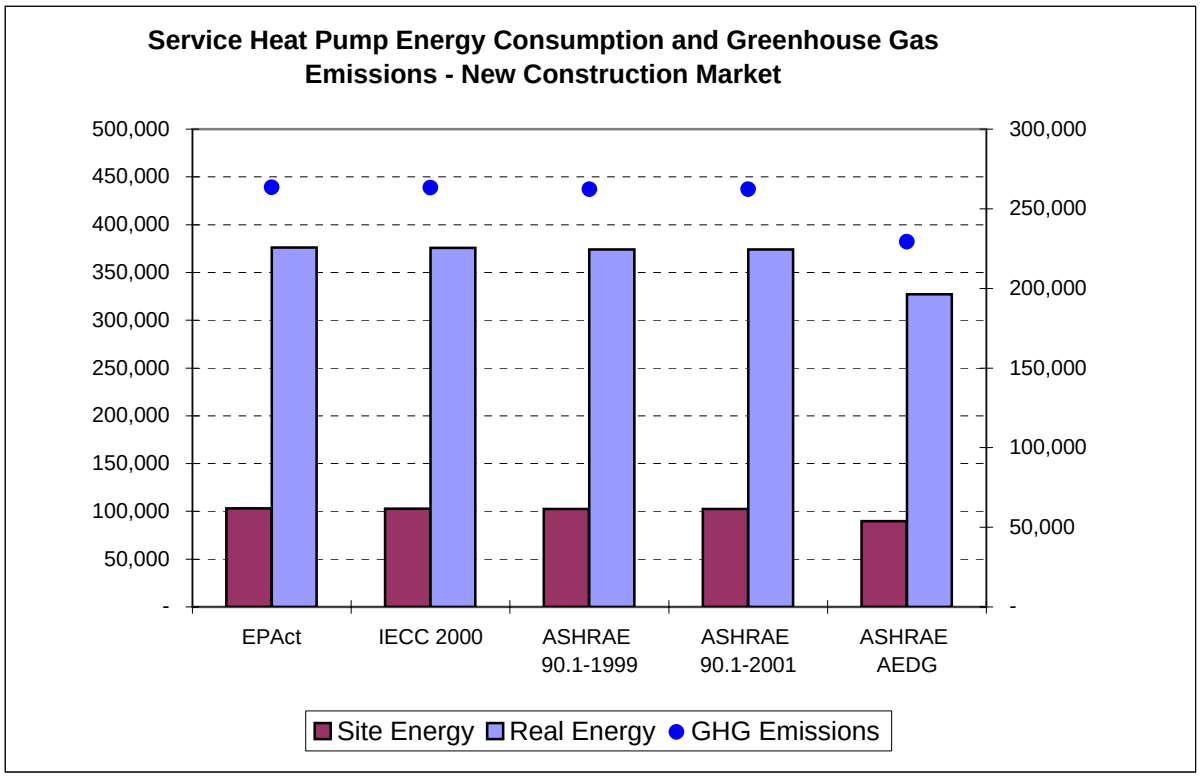
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	583,714	2,130,344	1,492,828
IECC 2000	583,379	2,129,120	1,491,970
ASHRAE 90.1-1999	581,080	2,120,730	1,486,091
ASHRAE 90.1-2001	581,080	2,120,730	1,486,091
ASHRAE AEDG	507,783	1,853,222	1,298,636



Service Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

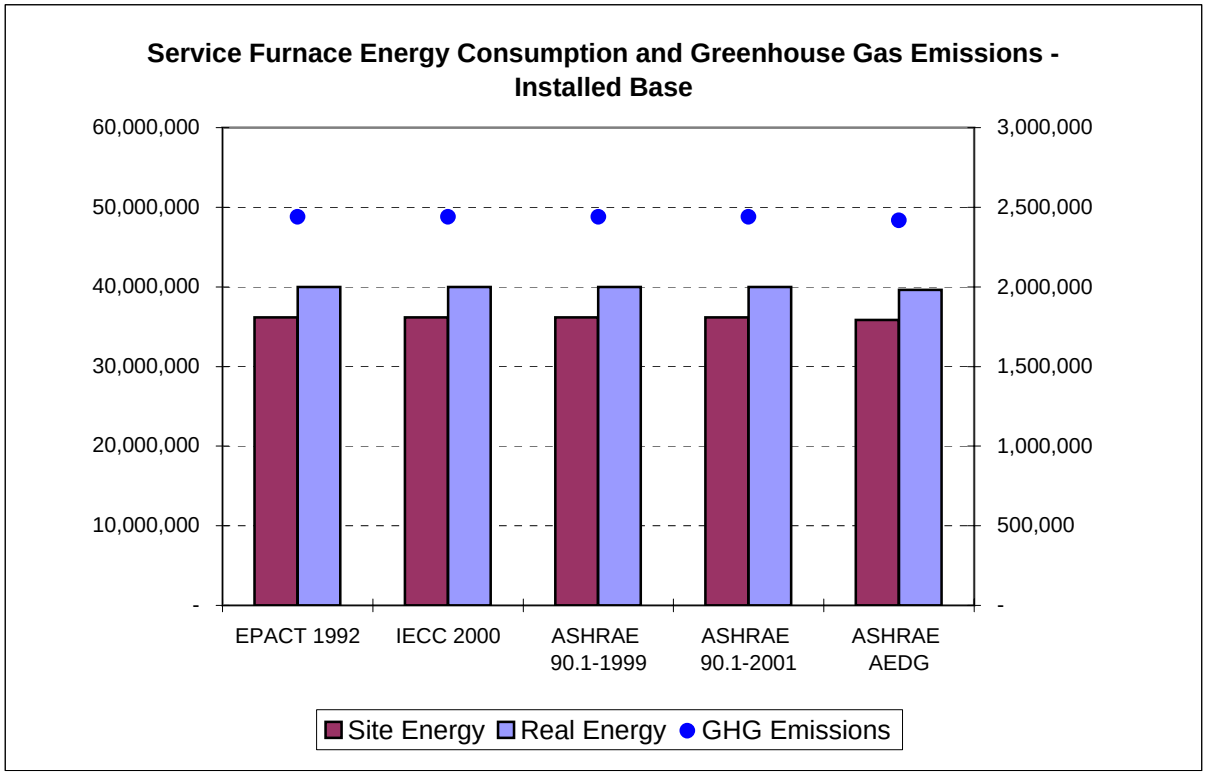
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	103,008	375,943	263,440
IECC 2000	102,949	375,727	263,289
ASHRAE 90.1-1999	102,544	374,246	262,251
ASHRAE 90.1-2001	102,544	374,246	262,251
ASHRAE AEDG	89,609	327,039	229,171



Service Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	36,179,852	39,977,737	2,439,641
IECC 2000	36,179,852	39,977,737	2,439,641
ASHRAE 90.1-1999	36,179,852	39,977,737	2,439,641
ASHRAE 90.1-2001	36,179,852	39,977,737	2,439,641
ASHRAE AEDG	35,854,149	39,617,844	2,417,679

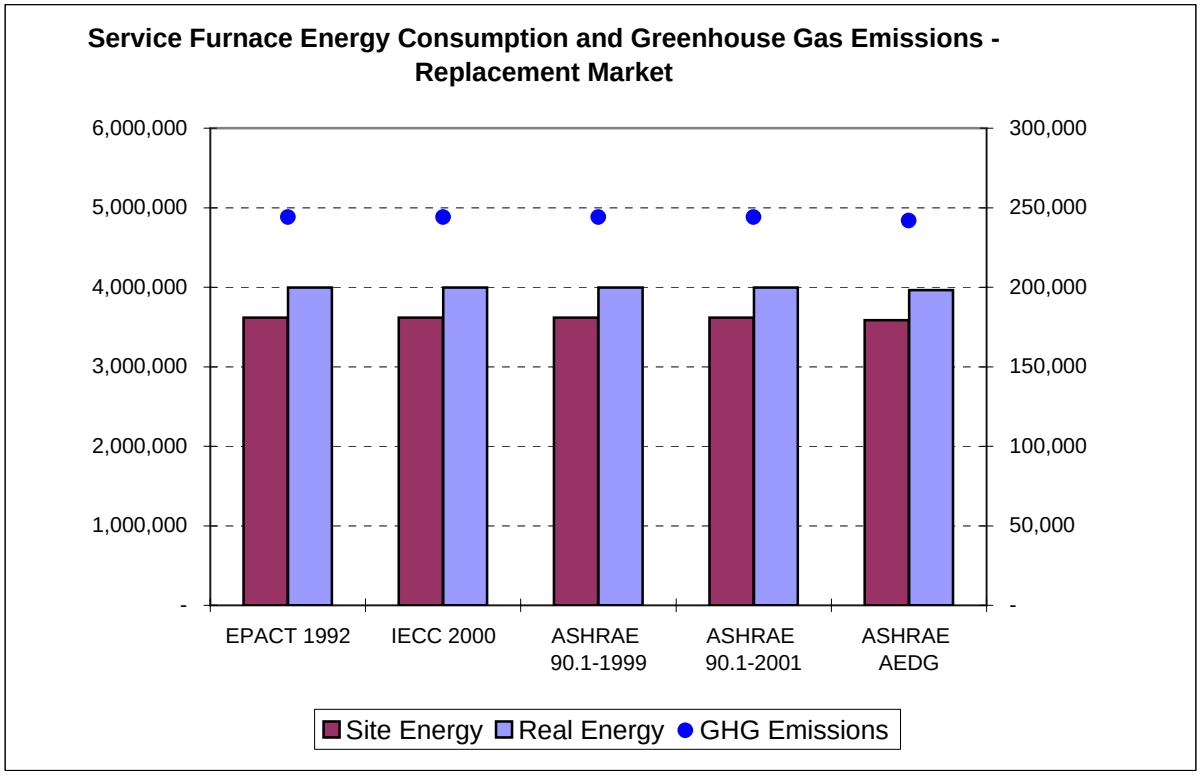


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Service Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	3,617,985	3,997,774	243,964
IECC 2000	3,617,985	3,997,774	243,964
ASHRAE 90.1-1999	3,617,985	3,997,774	243,964
ASHRAE 90.1-2001	3,617,985	3,997,774	243,964
ASHRAE AEDG	3,585,415	3,961,784	241,768

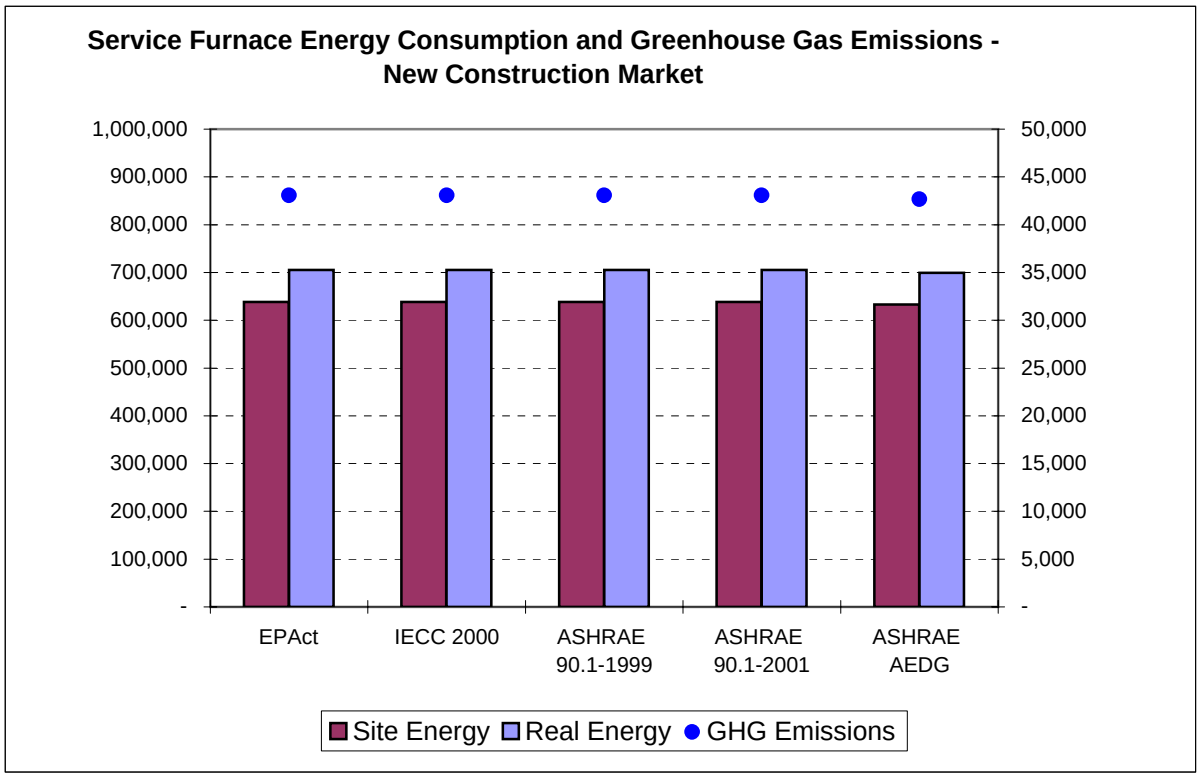


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Service Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	638,468	705,489	43,052
IECC 2000	638,468	705,489	43,052
ASHRAE 90.1-1999	638,468	705,489	43,052
ASHRAE 90.1-2001	638,468	705,489	43,052
ASHRAE AEDG	632,720	699,138	42,665

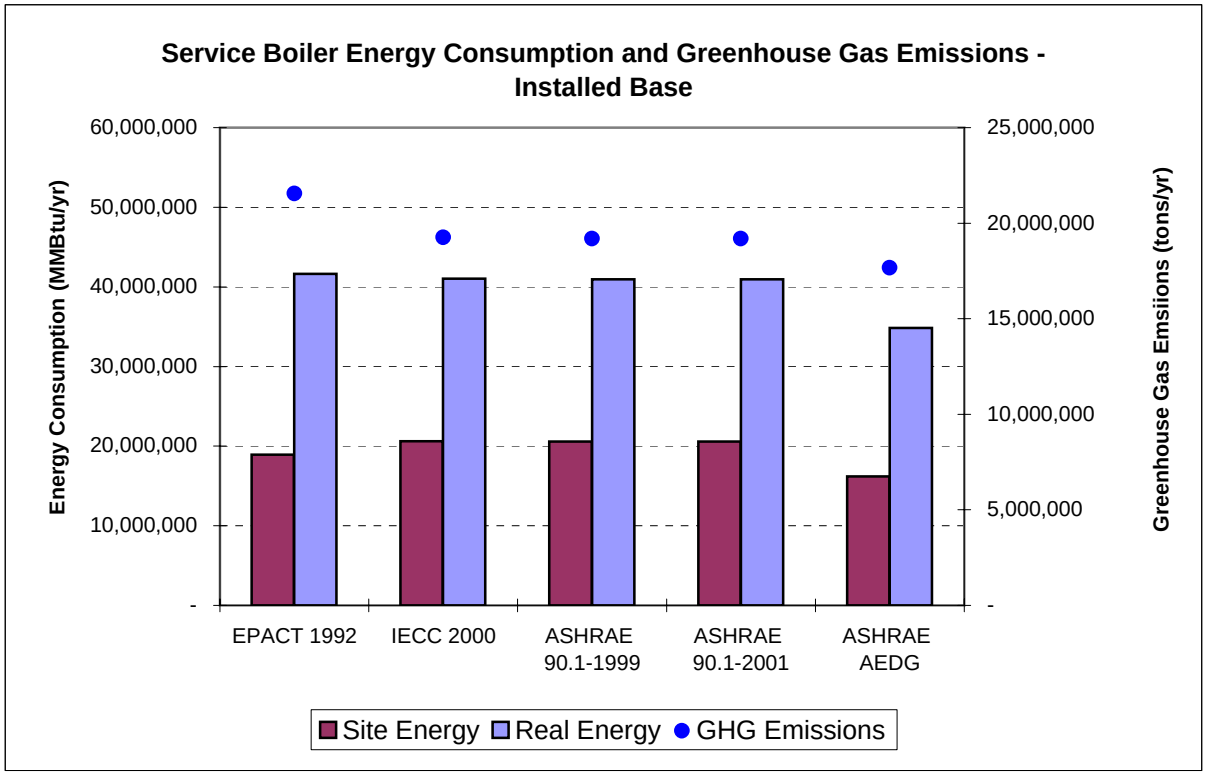


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Service Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

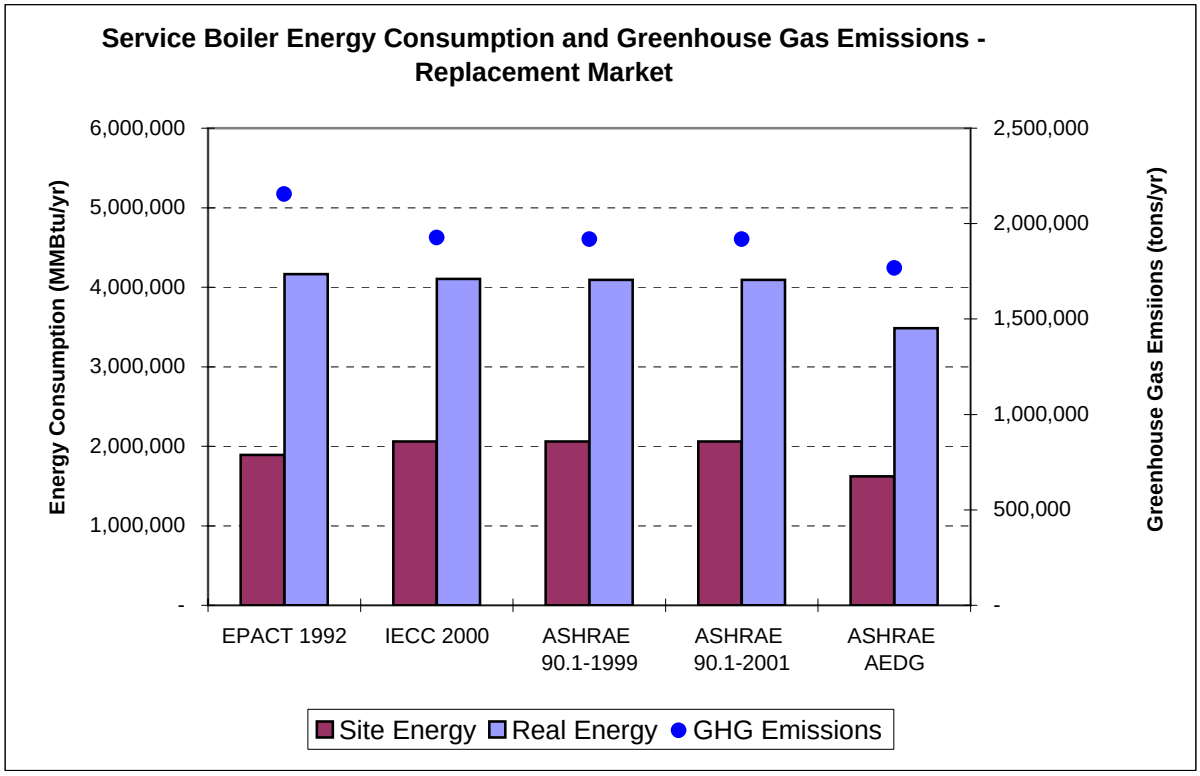
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	18,932,535	41,639,988	21,551,870
IECC 2000	20,609,066	41,039,005	19,264,089
ASHRAE 90.1-1999	20,594,376	40,944,140	19,186,154
ASHRAE 90.1-2001	20,594,376	40,944,140	19,186,154
ASHRAE AEDG	16,202,849	34,840,480	17,665,745



Service Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

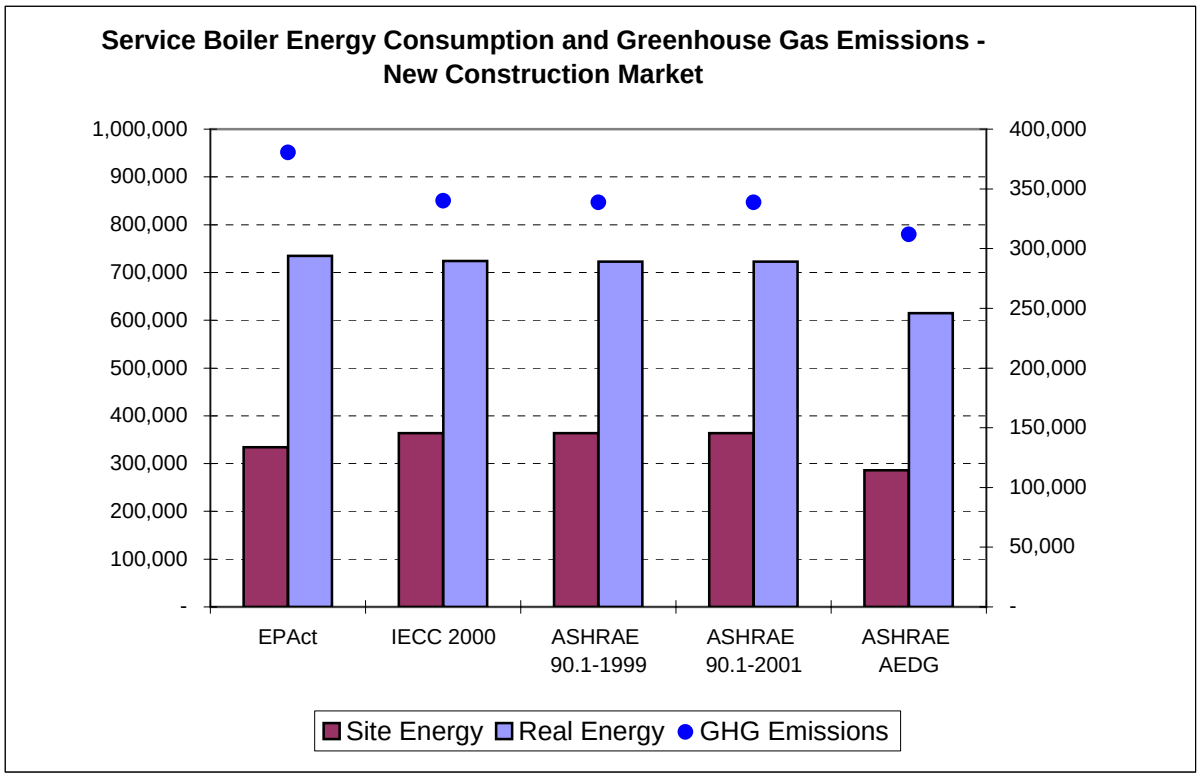
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,893,254	4,163,999	2,155,187
IECC 2000	2,060,907	4,103,900	1,926,409
ASHRAE 90.1-1999	2,059,438	4,094,414	1,918,615
ASHRAE 90.1-2001	2,059,438	4,094,414	1,918,615
ASHRAE AEDG	1,620,285	3,484,048	1,766,575



Service Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

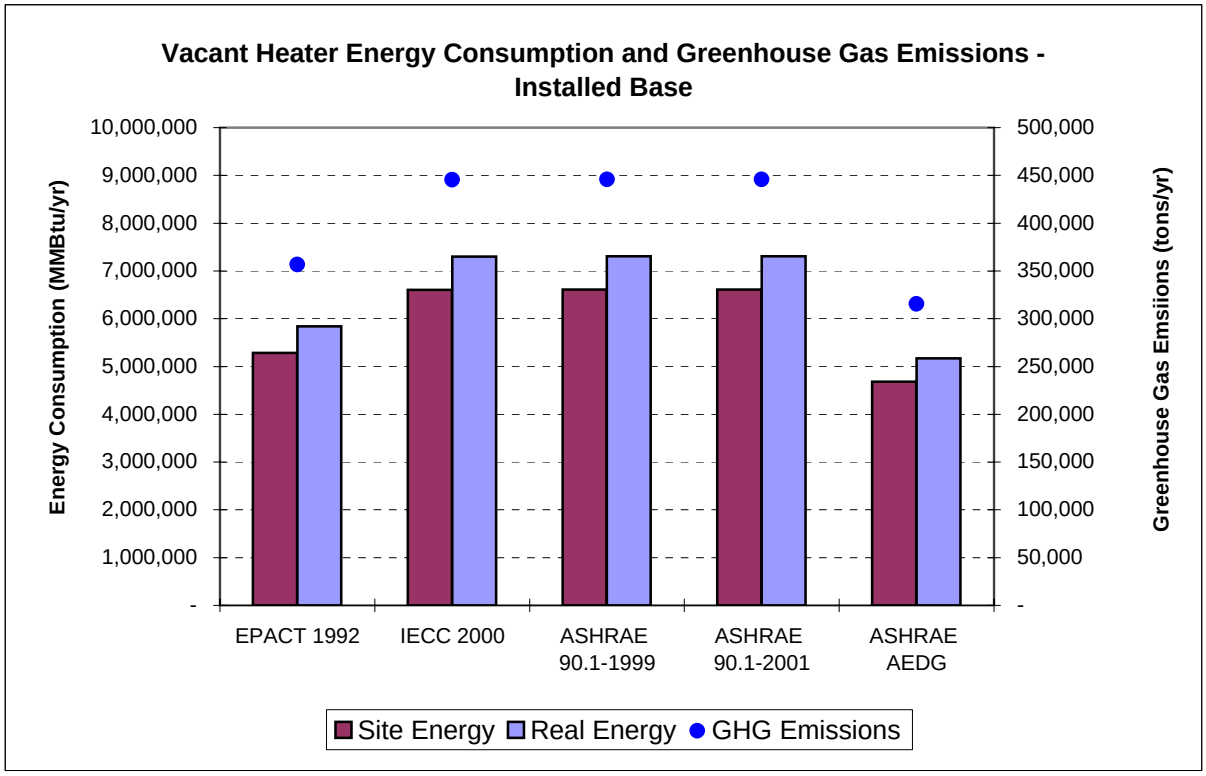
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	334,104	734,823	380,327
IECC 2000	363,689	724,218	339,955
ASHRAE 90.1-1999	363,430	722,544	338,579
ASHRAE 90.1-2001	363,430	722,544	338,579
ASHRAE AEDG	285,933	614,832	311,748



Vacant Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

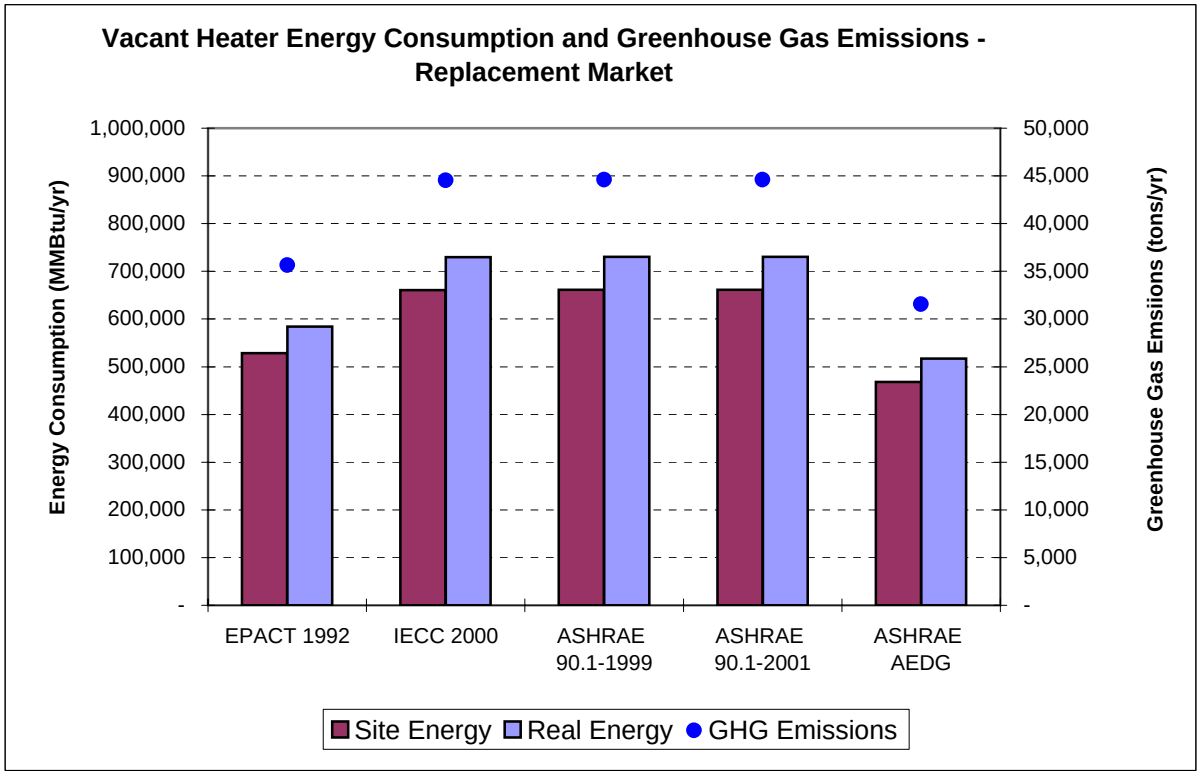
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,287,745	5,842,812	356,558
IECC 2000	6,604,853	7,298,180	445,371
ASHRAE 90.1-1999	6,612,238	7,306,340	445,869
ASHRAE 90.1-2001	6,612,238	7,306,340	445,869
ASHRAE AEDG	4,678,691	5,169,824	315,489



Vacant Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

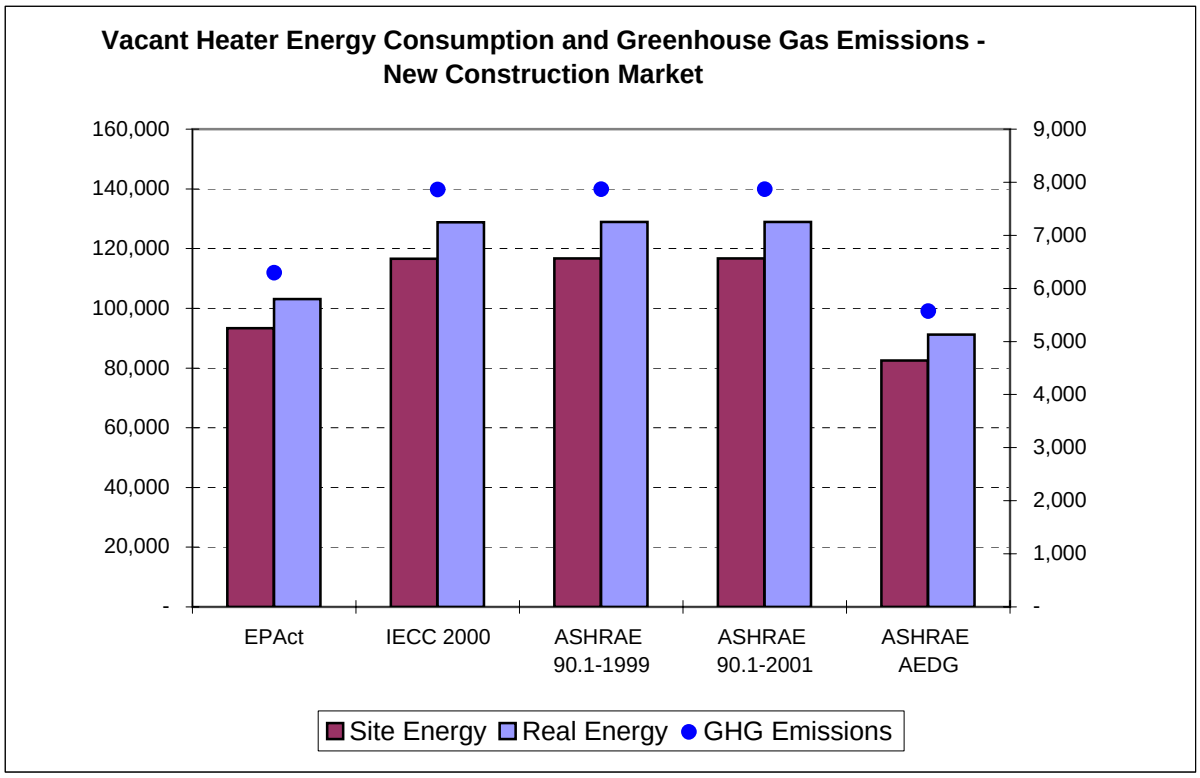
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	528,774	584,281	35,656
IECC 2000	660,485	729,818	44,537
ASHRAE 90.1-1999	661,224	730,634	44,587
ASHRAE 90.1-2001	661,224	730,634	44,587
ASHRAE AEDG	467,869	516,982	31,549



Vacant Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

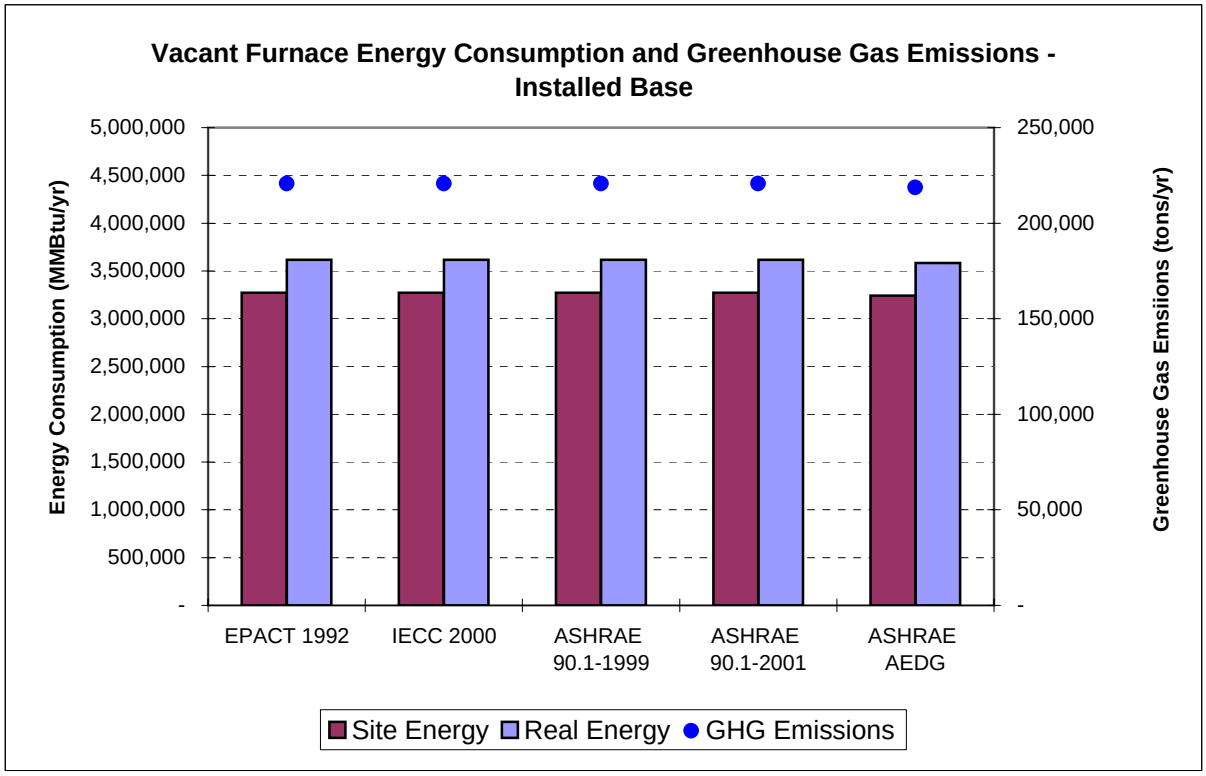
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	93,313	103,108	6,292
IECC 2000	116,556	128,791	7,859
ASHRAE 90.1-1999	116,687	128,935	7,868
ASHRAE 90.1-2001	116,687	128,935	7,868
ASHRAE AEDG	82,565	91,232	5,567



Vacant Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	3,272,208	3,615,699	220,648
IECC 2000	3,272,208	3,615,699	220,648
ASHRAE 90.1-1999	3,272,208	3,615,699	220,648
ASHRAE 90.1-2001	3,272,208	3,615,699	220,648
ASHRAE AEDG	3,242,750	3,583,149	218,662

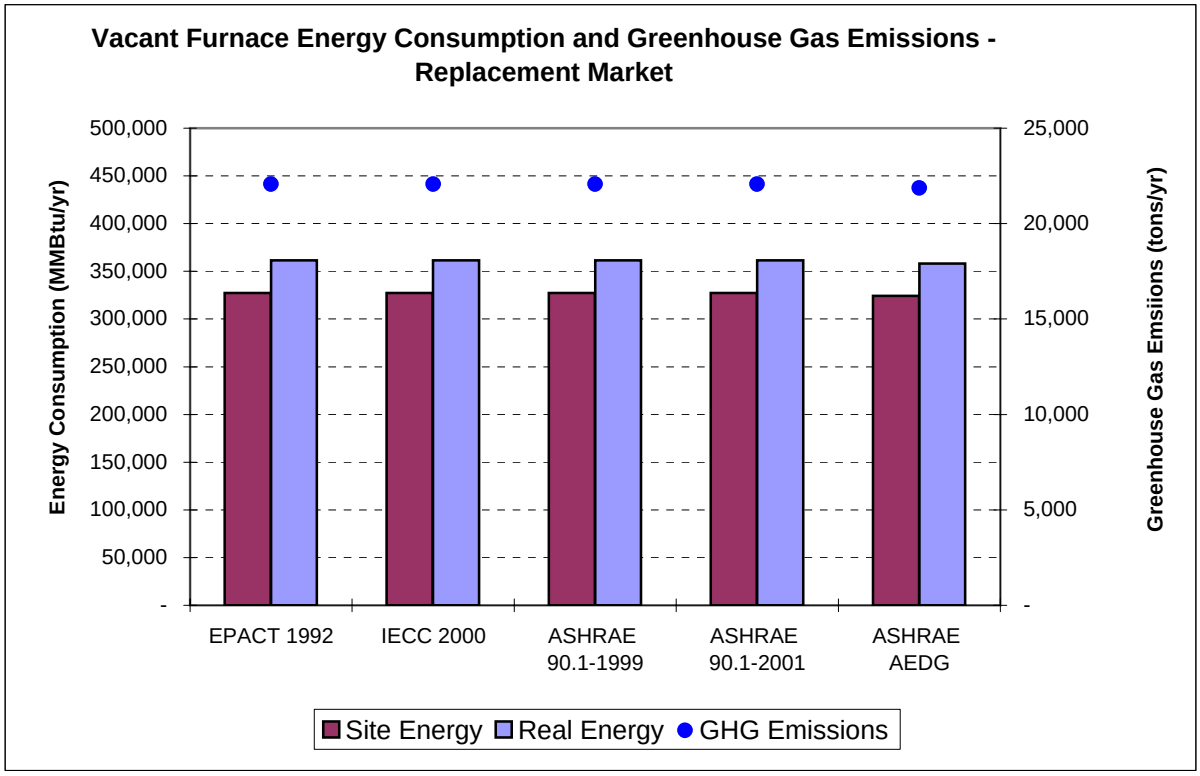


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Vacant Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	327,221	361,570	22,065
IECC 2000	327,221	361,570	22,065
ASHRAE 90.1-1999	327,221	361,570	22,065
ASHRAE 90.1-2001	327,221	361,570	22,065
ASHRAE AEDG	324,275	358,315	21,866

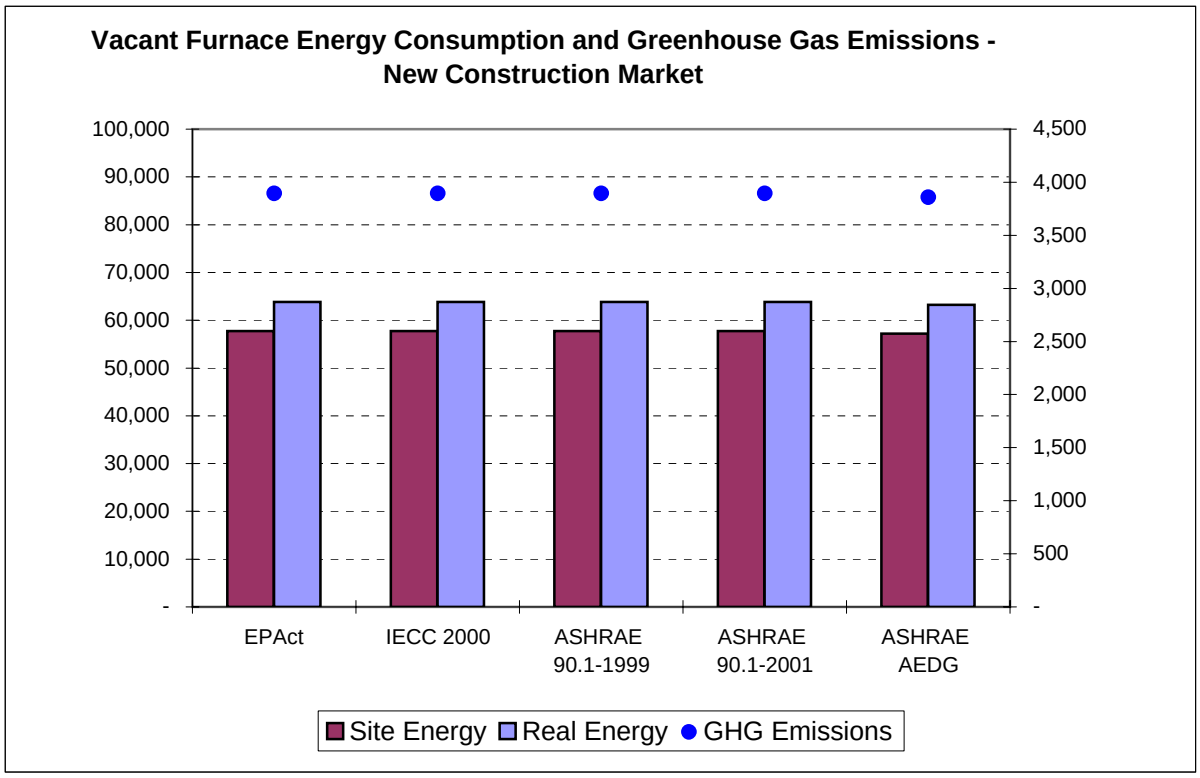


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Vacant Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	57,745	63,806	3,894
IECC 2000	57,745	63,806	3,894
ASHRAE 90.1-1999	57,745	63,806	3,894
ASHRAE 90.1-2001	57,745	63,806	3,894
ASHRAE AEDG	57,225	63,232	3,859

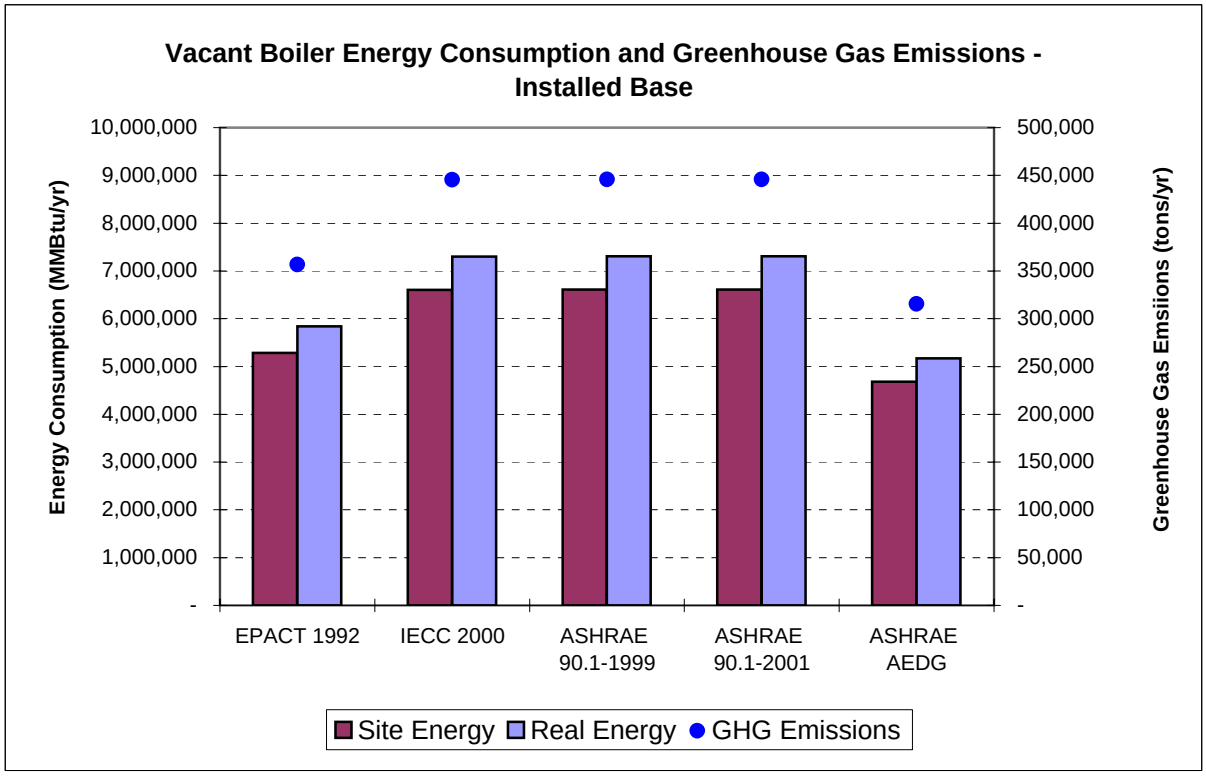


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Vacant Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

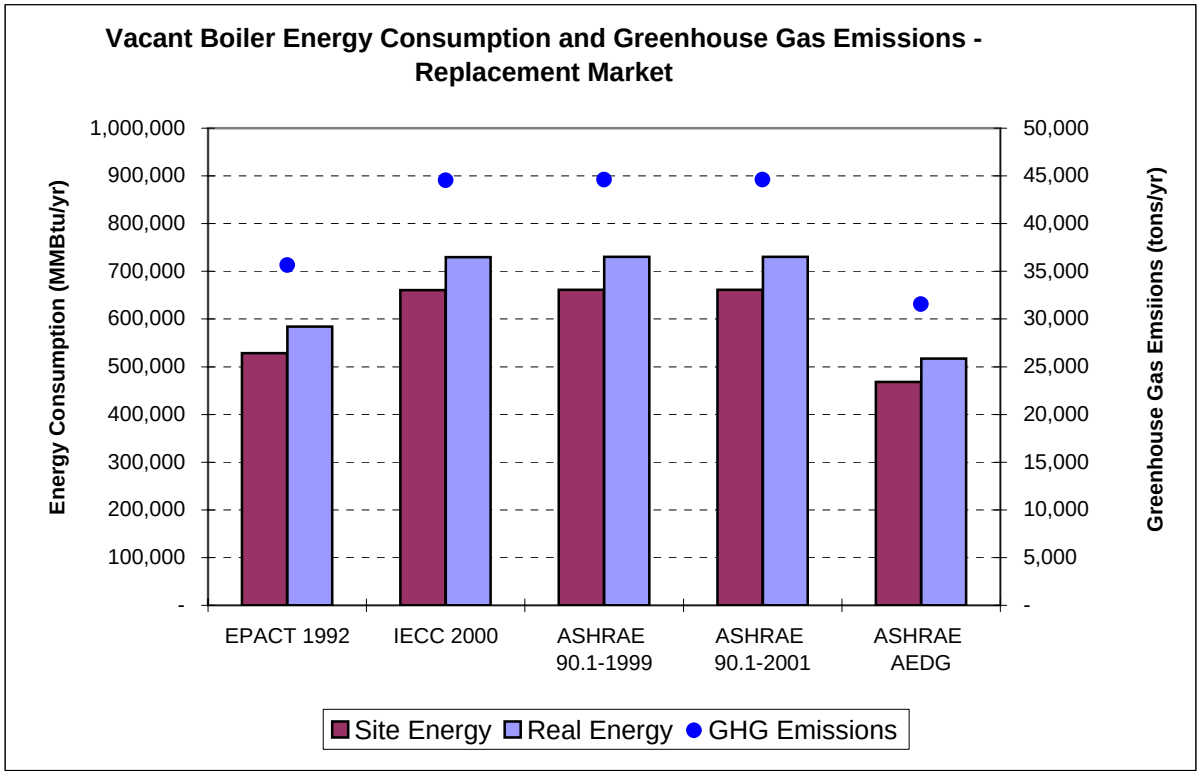
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,287,745	5,842,812	356,558
IECC 2000	6,604,853	7,298,180	445,371
ASHRAE 90.1-1999	6,612,238	7,306,340	445,869
ASHRAE 90.1-2001	6,612,238	7,306,340	445,869
ASHRAE AEDG	4,678,691	5,169,824	315,489



Vacant Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

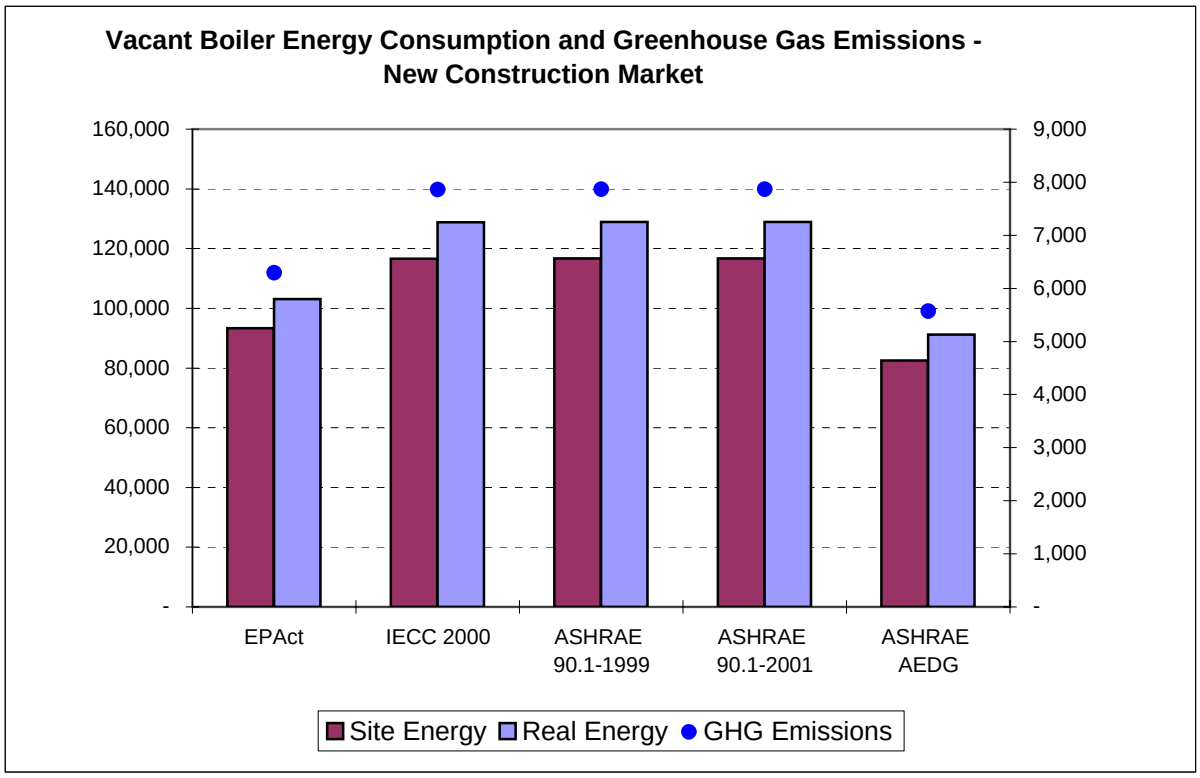
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	528,774	584,281	35,656
IECC 2000	660,485	729,818	44,537
ASHRAE 90.1-1999	661,224	730,634	44,587
ASHRAE 90.1-2001	661,224	730,634	44,587
ASHRAE AEDG	467,869	516,982	31,549



Vacant Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

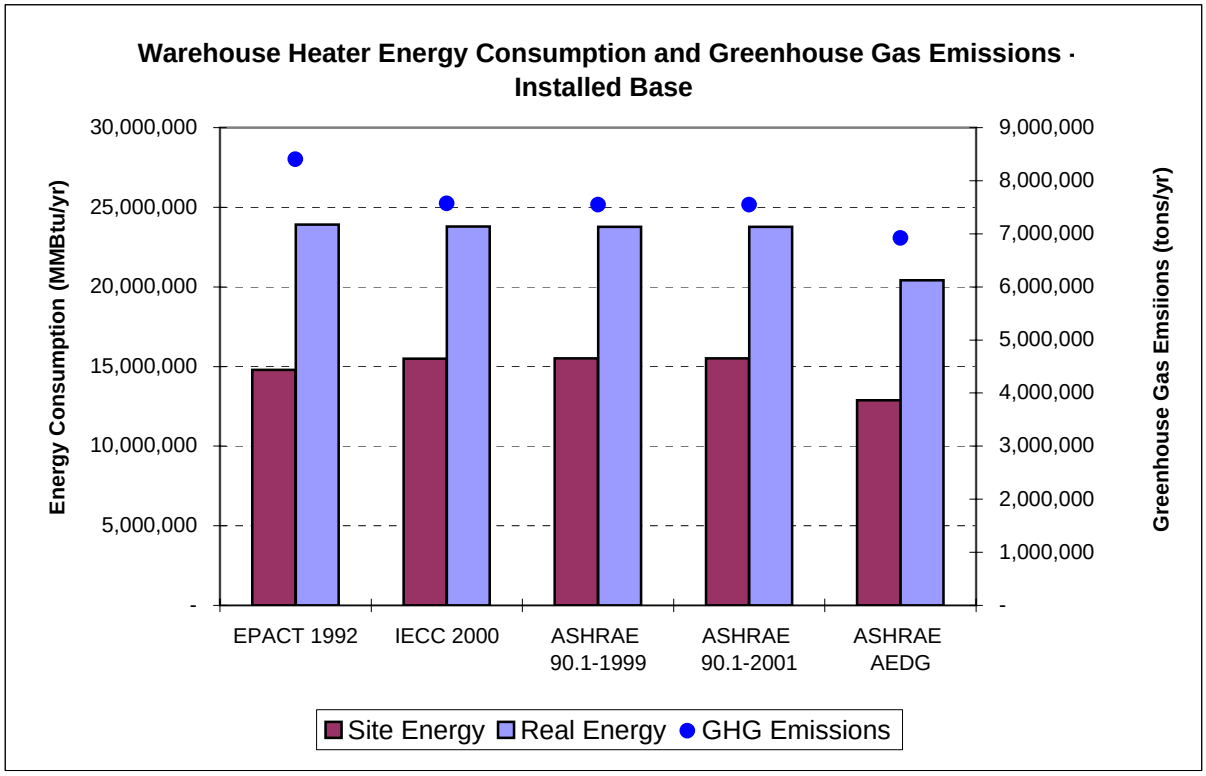
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	93,313	103,108	6,292
IECC 2000	116,556	128,791	7,859
ASHRAE 90.1-1999	116,687	128,935	7,868
ASHRAE 90.1-2001	116,687	128,935	7,868
ASHRAE AEDG	82,565	91,232	5,567



Warehouse Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

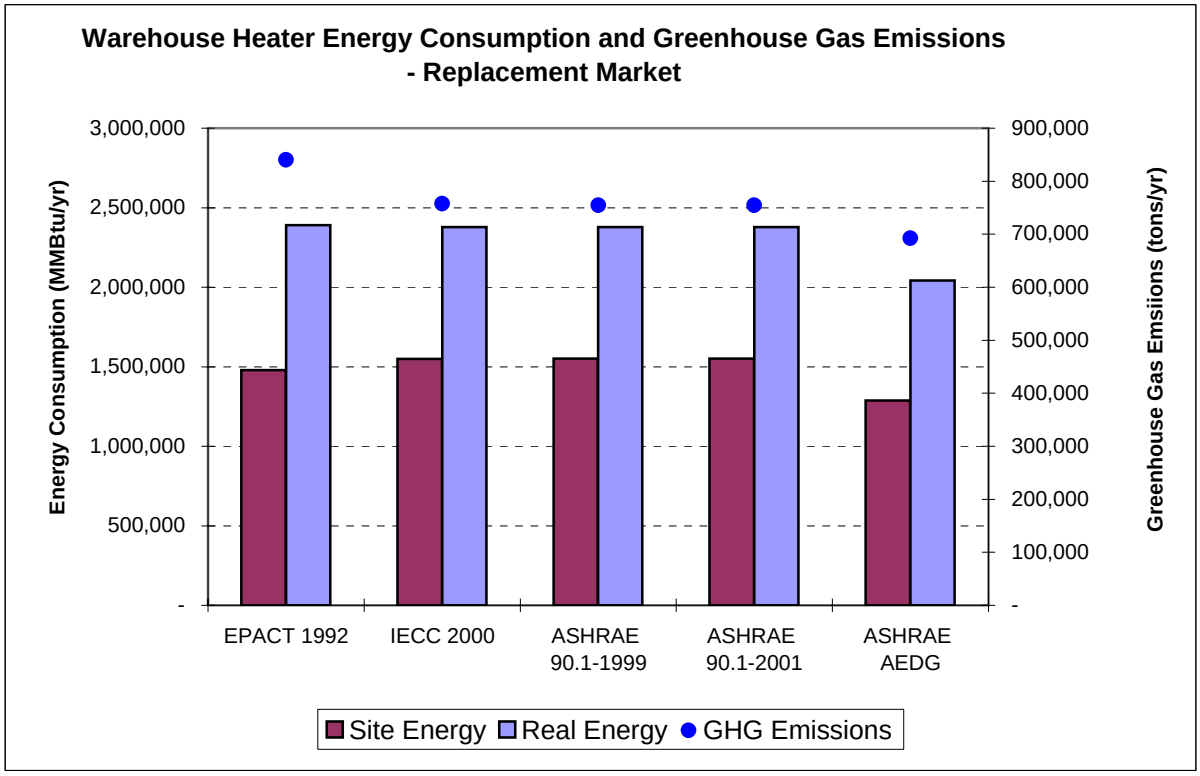
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	14,784,886	23,904,776	8,402,373
IECC 2000	15,493,669	23,791,833	7,573,277
ASHRAE 90.1-1999	15,508,698	23,779,719	7,546,187
ASHRAE 90.1-2001	15,508,698	23,779,719	7,546,187
ASHRAE AEDG	12,876,498	20,414,238	6,921,532



Warehouse Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

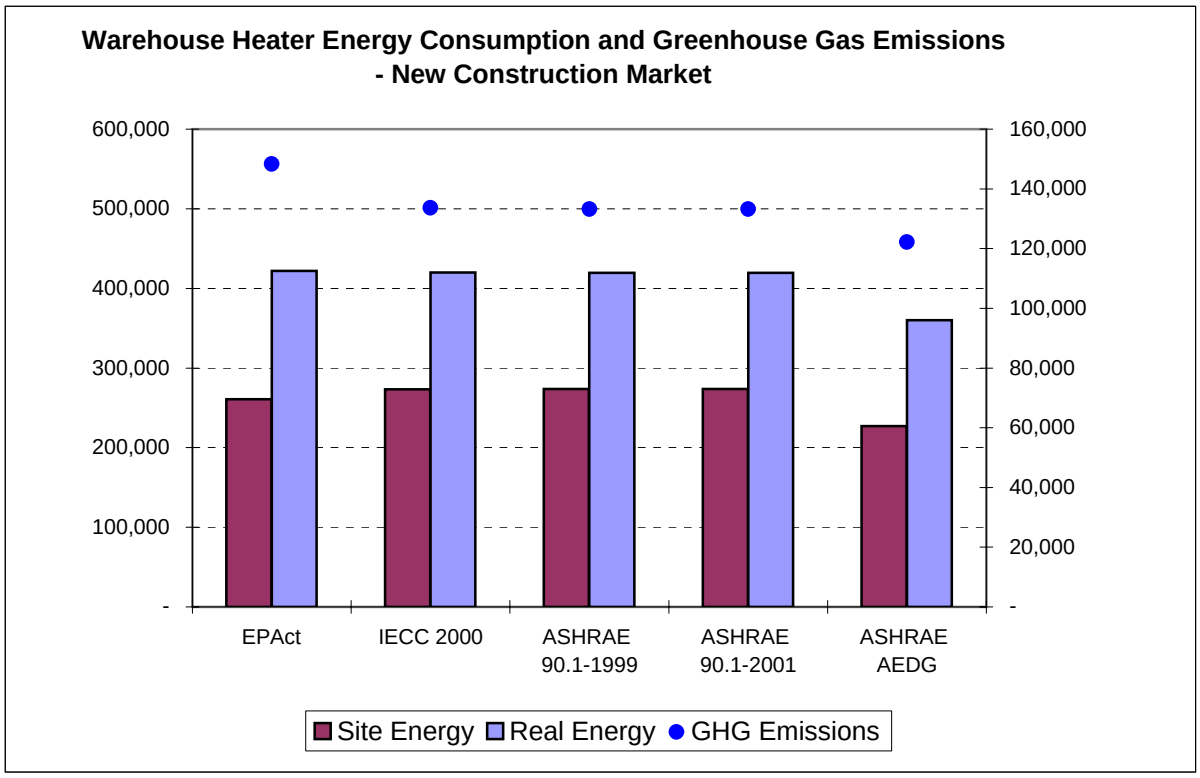
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,478,489	2,390,478	840,237
IECC 2000	1,549,367	2,379,183	757,328
ASHRAE 90.1-1999	1,550,870	2,377,972	754,619
ASHRAE 90.1-2001	1,550,870	2,377,972	754,619
ASHRAE AEDG	1,287,650	2,041,424	692,153



Warehouse Water Heater Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

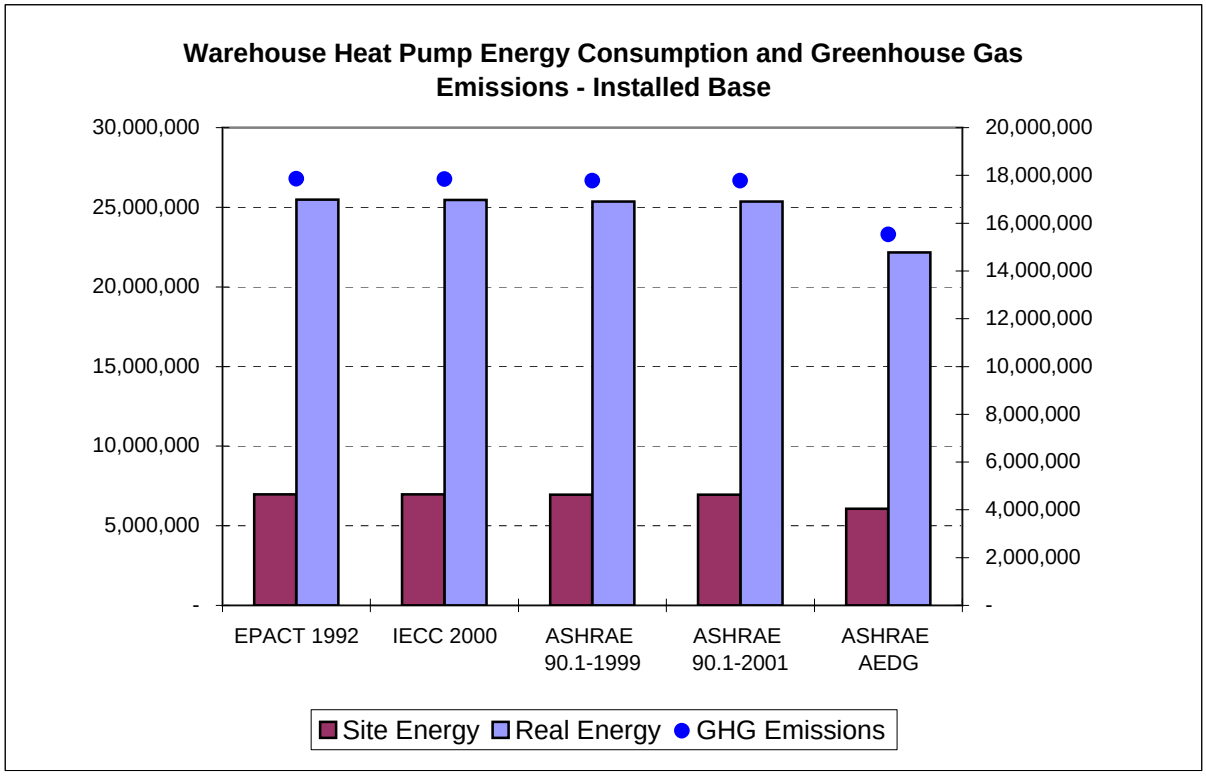
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	260,910	421,849	148,277
IECC 2000	273,418	419,856	133,646
ASHRAE 90.1-1999	273,683	419,642	133,168
ASHRAE 90.1-2001	273,683	419,642	133,168
ASHRAE AEDG	227,232	360,251	122,145



Warehouse Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

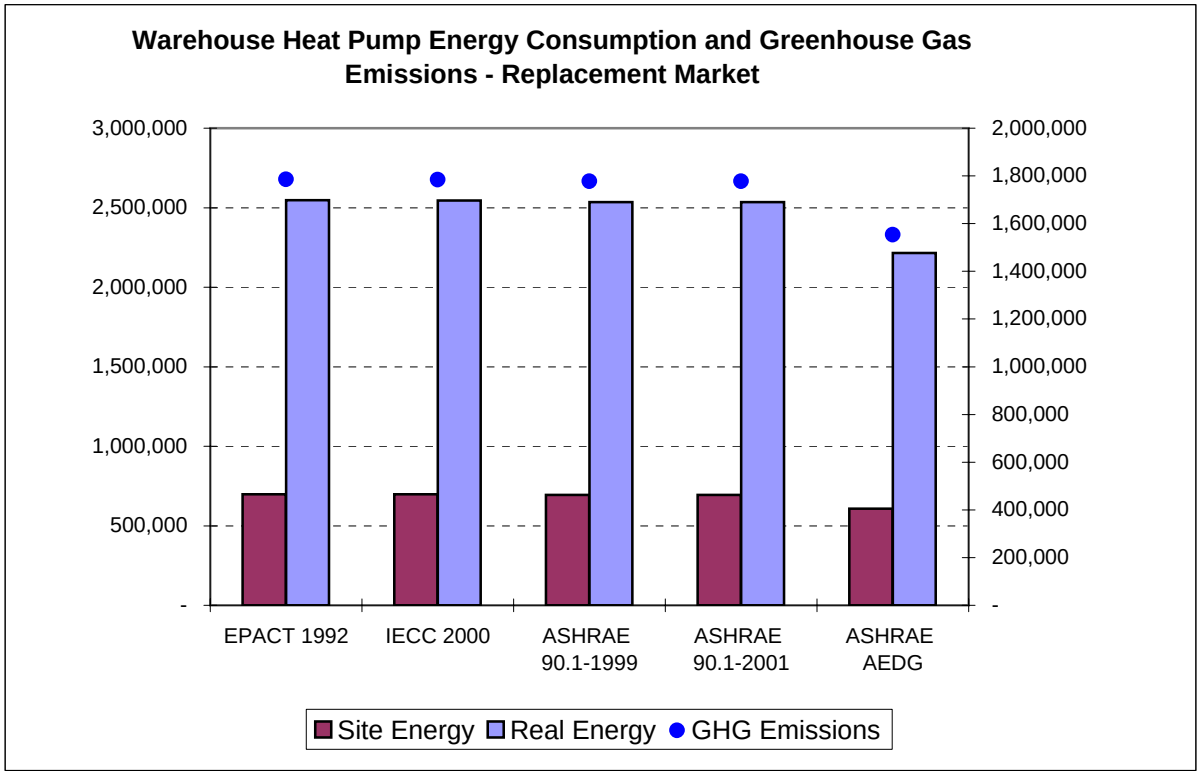
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	6,980,178	25,475,103	17,851,551
IECC 2000	6,976,166	25,460,461	17,841,291
ASHRAE 90.1-1999	6,948,677	25,360,136	17,770,989
ASHRAE 90.1-2001	6,948,677	25,360,136	17,770,989
ASHRAE AEDG	6,072,175	22,161,222	15,529,365



Warehouse Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

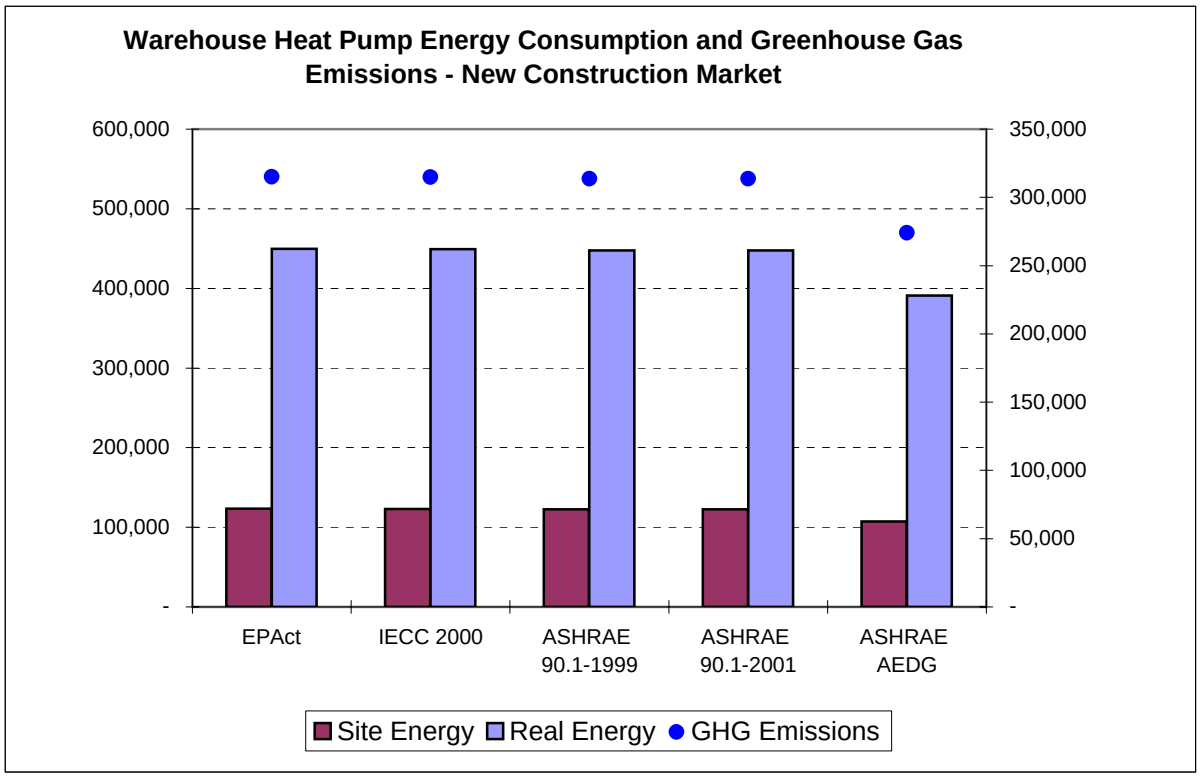
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	698,018	2,547,510	1,785,155
IECC 2000	697,617	2,546,046	1,784,129
ASHRAE 90.1-1999	694,868	2,536,014	1,777,099
ASHRAE 90.1-2001	694,868	2,536,014	1,777,099
ASHRAE AEDG	607,217	2,216,122	1,552,937



Warehouse Heat Pump Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

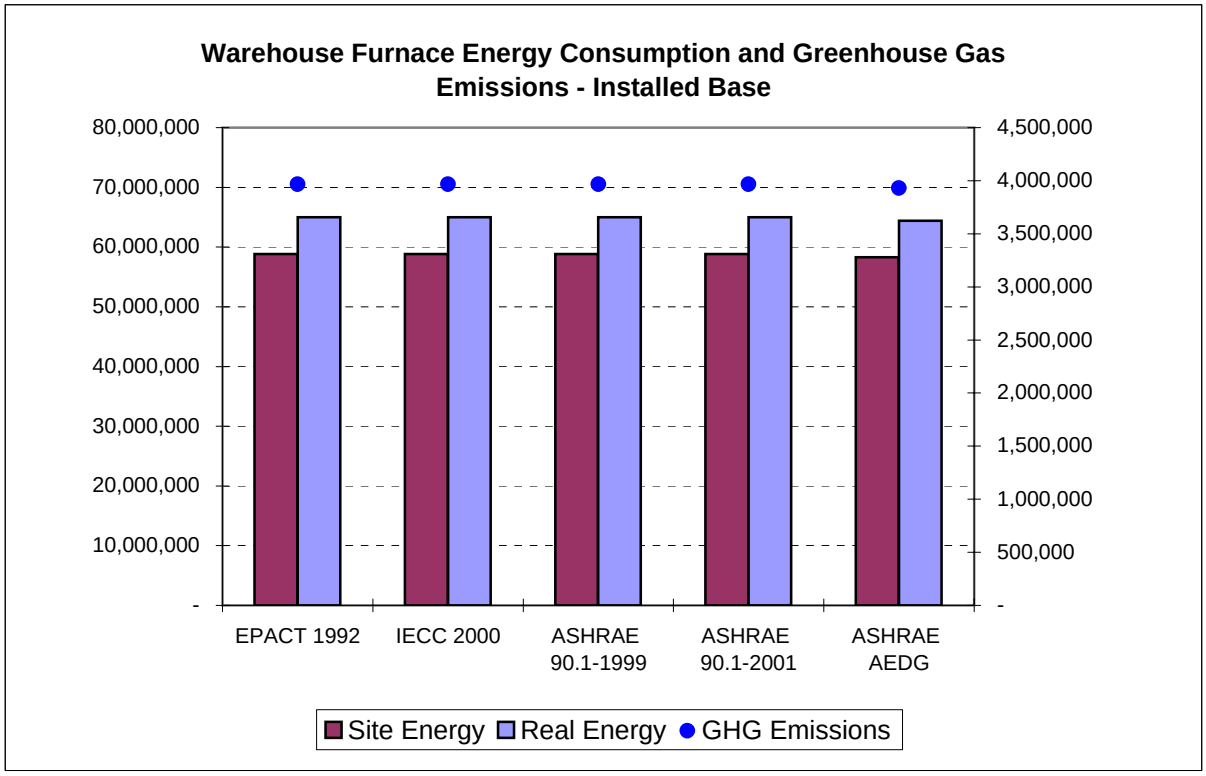
	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	123,180	449,561	315,027
IECC 2000	123,109	449,302	314,846
ASHRAE 90.1-1999	122,624	447,532	313,606
ASHRAE 90.1-2001	122,624	447,532	313,606
ASHRAE AEDG	107,156	391,080	274,048



Warehouse Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	58,831,396	65,007,067	3,967,056
IECC 2000	58,831,396	65,007,067	3,967,056
ASHRAE 90.1-1999	58,831,396	65,007,067	3,967,056
ASHRAE 90.1-2001	58,831,396	65,007,067	3,967,056
ASHRAE AEDG	58,301,775	64,421,851	3,931,343

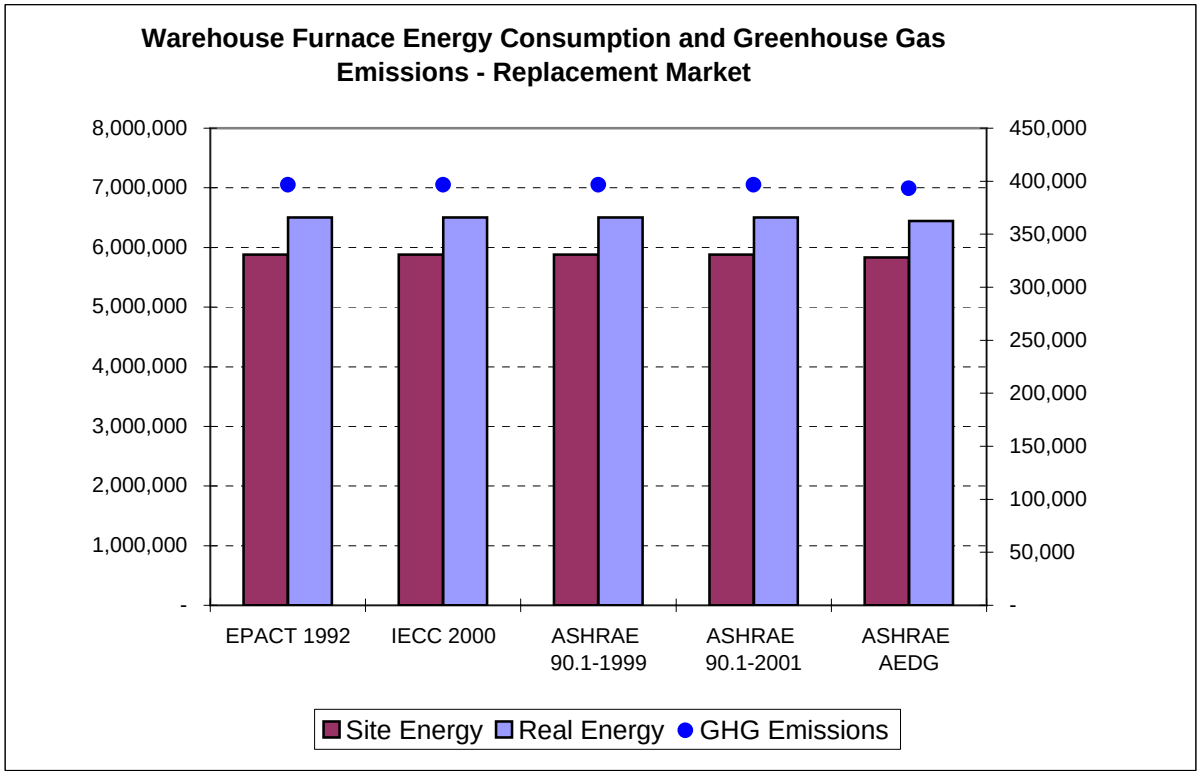


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Warehouse Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	5,883,140	6,500,707	396,706
IECC 2000	5,883,140	6,500,707	396,706
ASHRAE 90.1-1999	5,883,140	6,500,707	396,706
ASHRAE 90.1-2001	5,883,140	6,500,707	396,706
ASHRAE AEDG	5,830,178	6,442,185	393,134

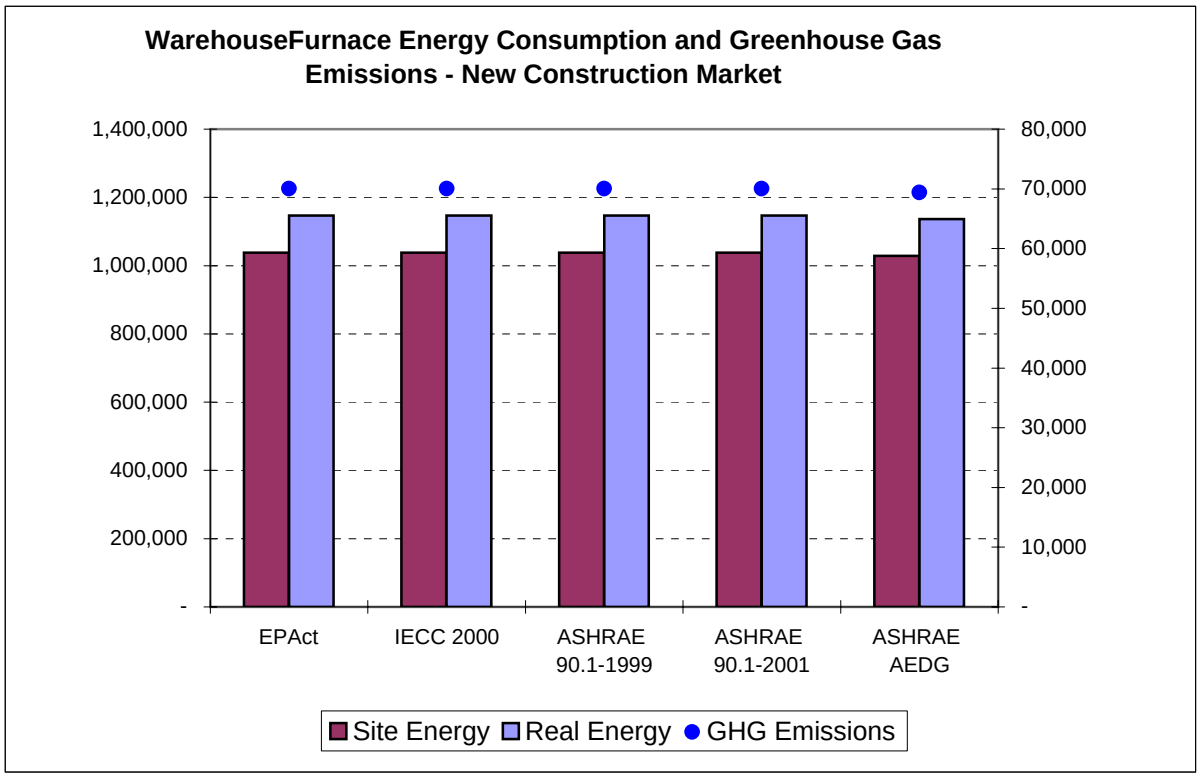


Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Warehouse Furnace Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	1,038,201	1,147,184	70,007
IECC 2000	1,038,201	1,147,184	70,007
ASHRAE 90.1-1999	1,038,201	1,147,184	70,007
ASHRAE 90.1-2001	1,038,201	1,147,184	70,007
ASHRAE AEDG	1,028,855	1,136,856	69,377



Note: Comparison is of natural gas-fired furnaces only, which is the only equipment type covered by all five programs evaluated.

Warehouse Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	14,784,886	23,904,776	8,402,373
IECC 2000	15,493,669	23,791,833	7,573,277
ASHRAE 90.1-1999	15,508,698	23,779,719	7,546,187
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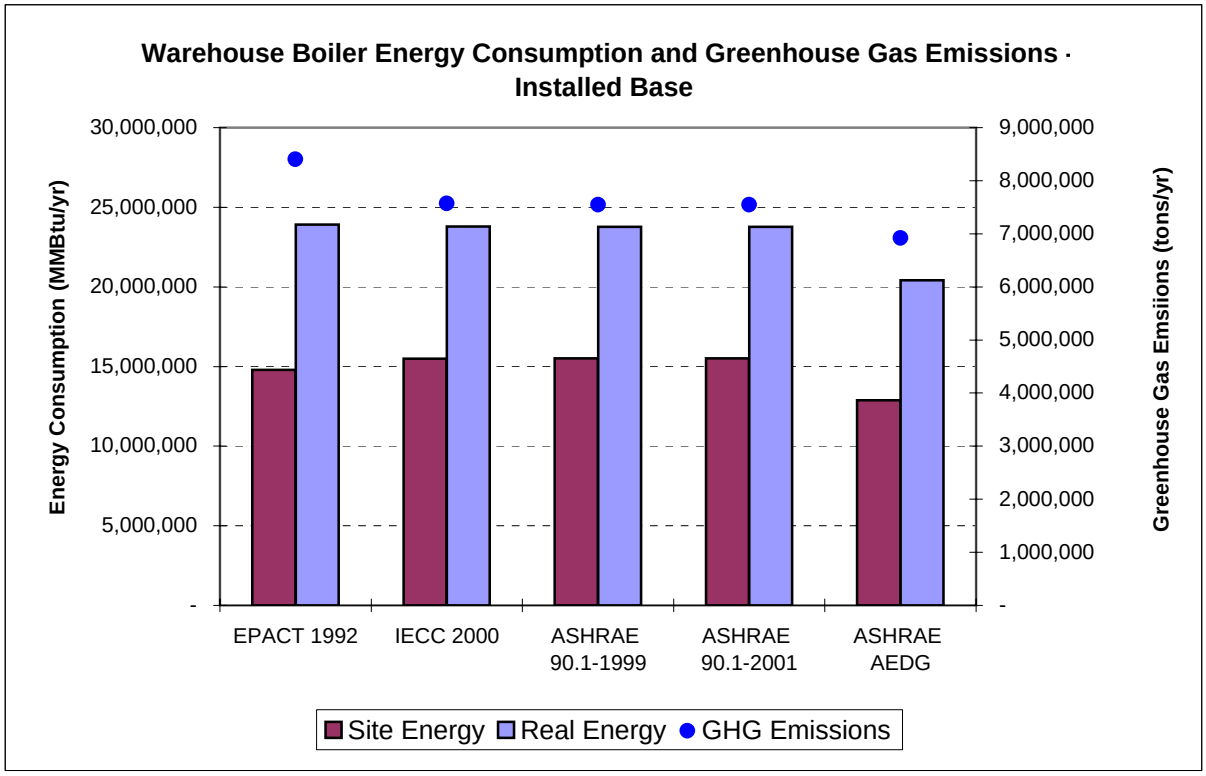
ASHRAE AEDG	12,876,498	20,414,238	6,921,532



Warehouse Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Replacement Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPACT 1992	1,478,489	2,390,478	840,237
IECC 2000	1,549,367	2,379,183	757,328
ASHRAE 90.1-1999	1,550,870	2,377,972	754,619
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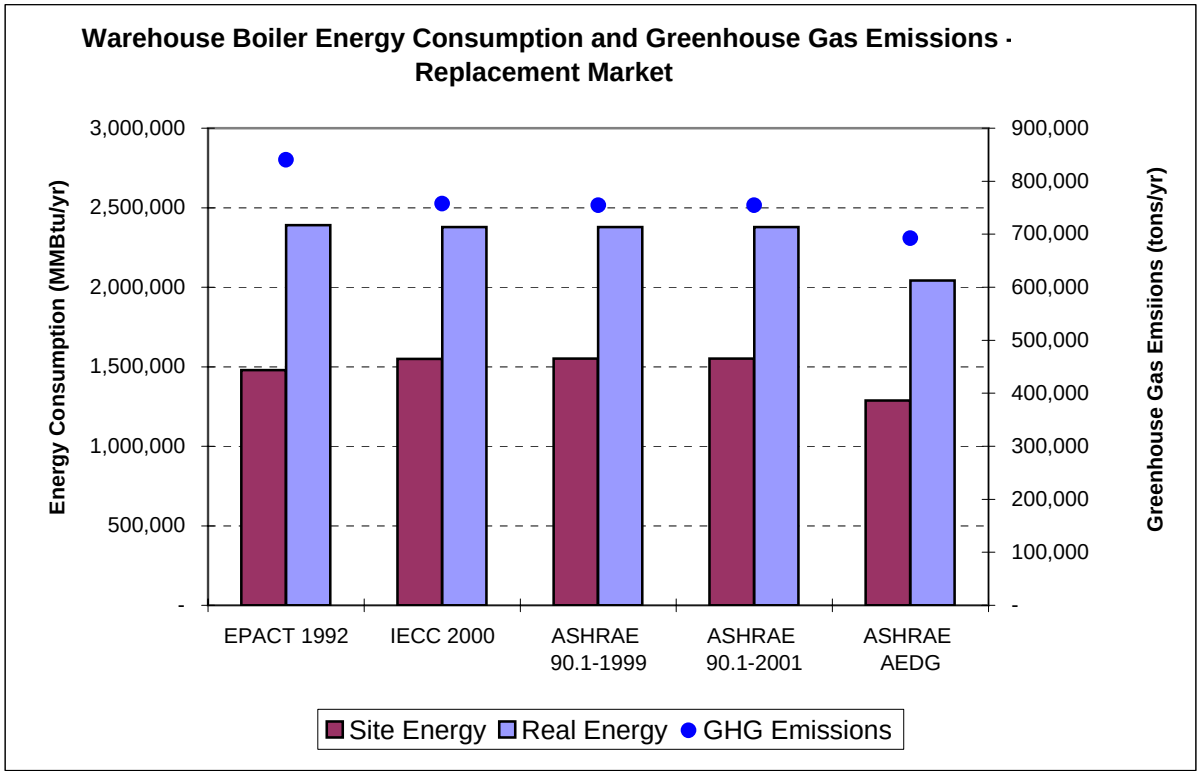
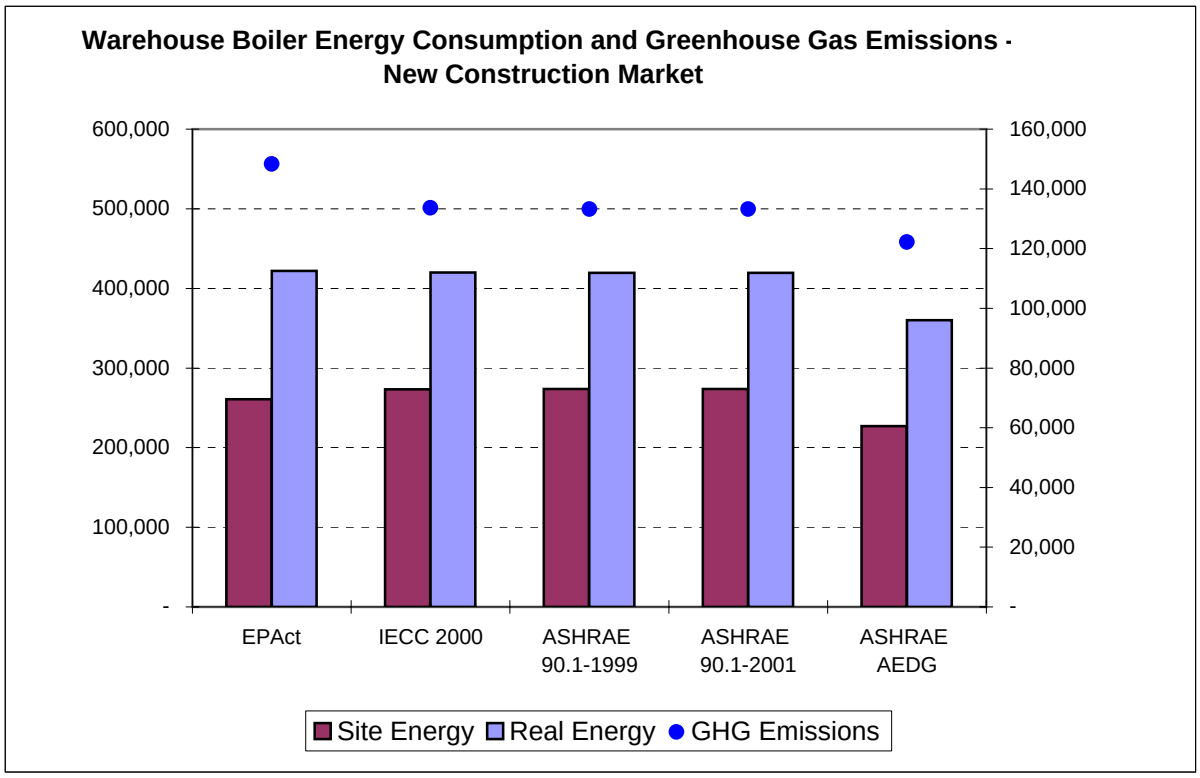
ASHRAE AEDG	1,287,650	2,041,424	692,153



Warehouse Boiler Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Construction Market

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPAct	260,910	421,849	148,277
IECC 2000	273,418	419,856	133,646
ASHRAE 90.1-1999	273,683	419,642	133,168
ASHRAE 90.1-2001	273,683	419,642	133,168
ASHRAE AEDG	227,232	360,251	122,145



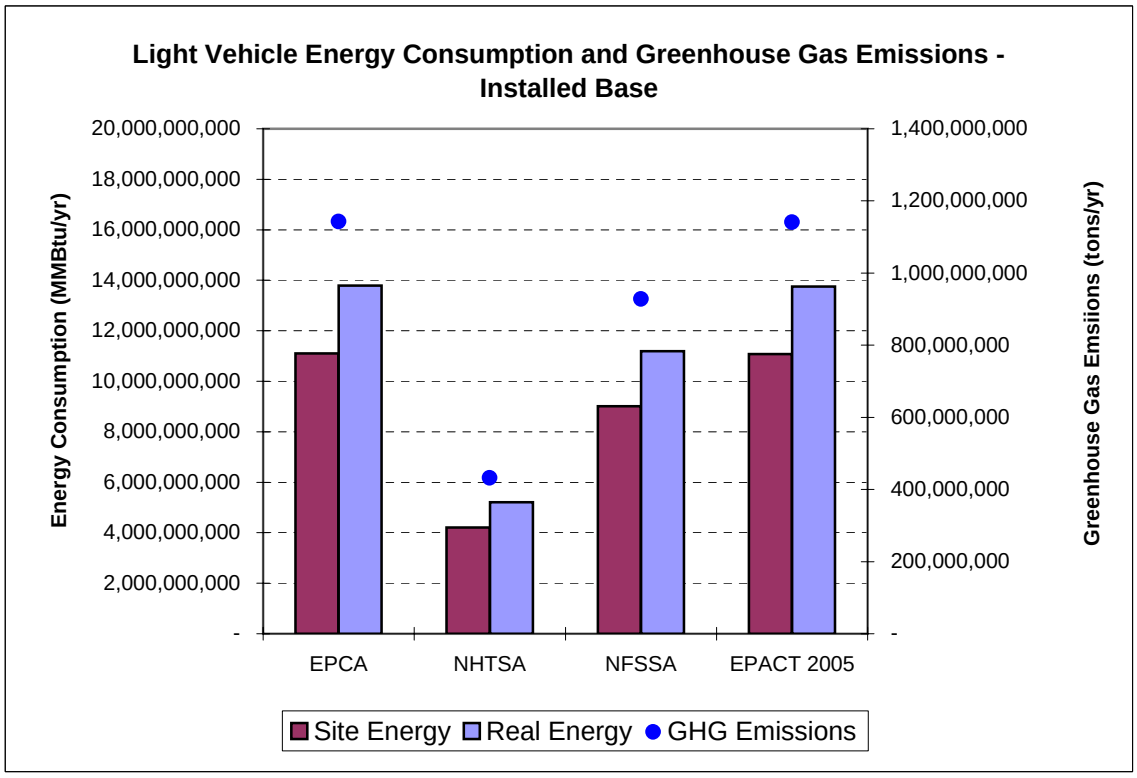
Appendix F

Vehicle Energy Consumption and Greenhouse Gas Emissions

Light Vehicle Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	11,103,408,737	13,789,056,829	1,143,149,709
NHTSA	4,208,722,977	5,212,218,319	432,362,201
NFSSA	9,009,997,848	11,189,731,903	927,698,746
EPACT 2005	11,071,266,165	13,746,703,389	1,141,212,962

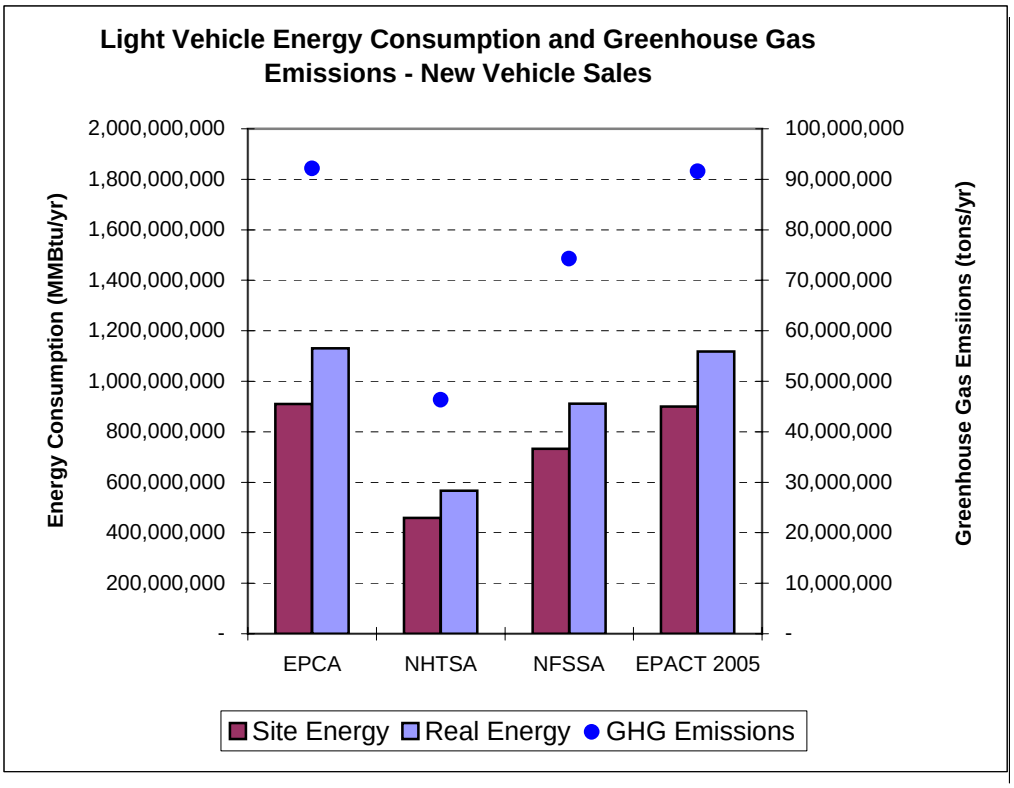


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Light Vehicle Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Vehicle Sales

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	909,414,241	1,130,651,743	92,167,294
NHTSA	458,718,347	566,455,608	46,310,700
NFSSA	732,707,977	911,075,060	74,276,092
EPACT 2005	899,588,924	1,118,058,242	91,585,474

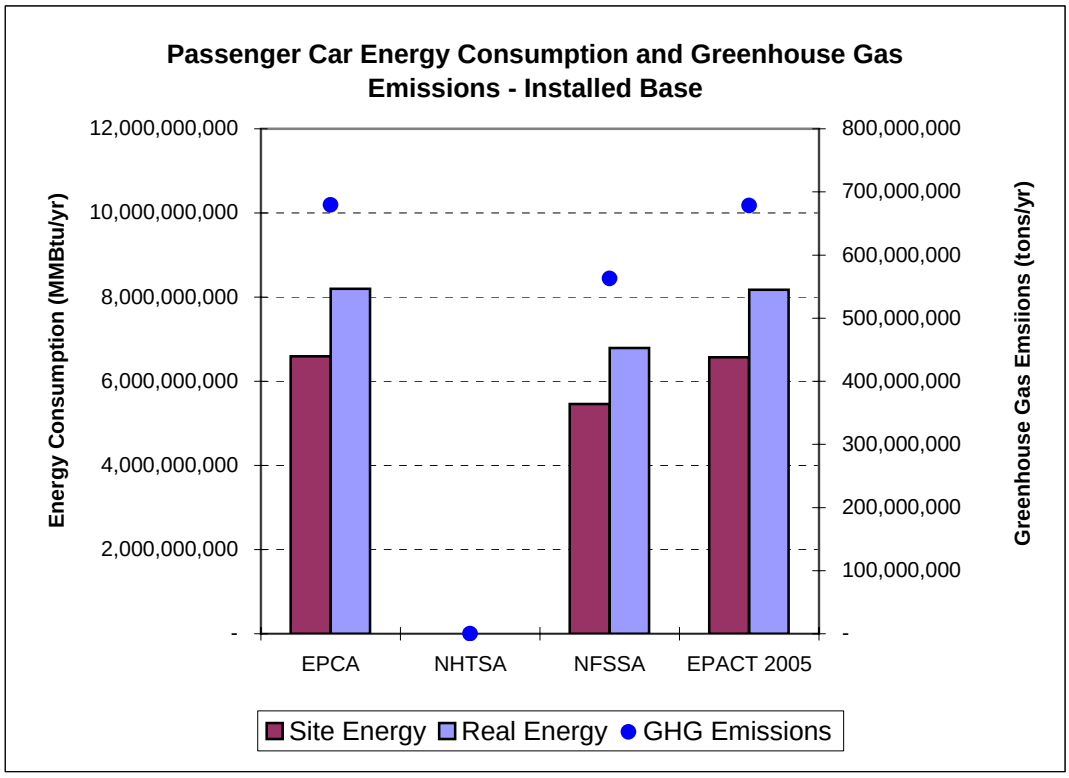


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Passenger Car Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	6,589,705,834	8,199,141,531	679,456,914
NHTSA	-	-	-
NFSSA	5,457,387,579	6,790,064,729	562,739,018
EPACT 2005	6,573,795,161	8,175,889,545	678,386,039

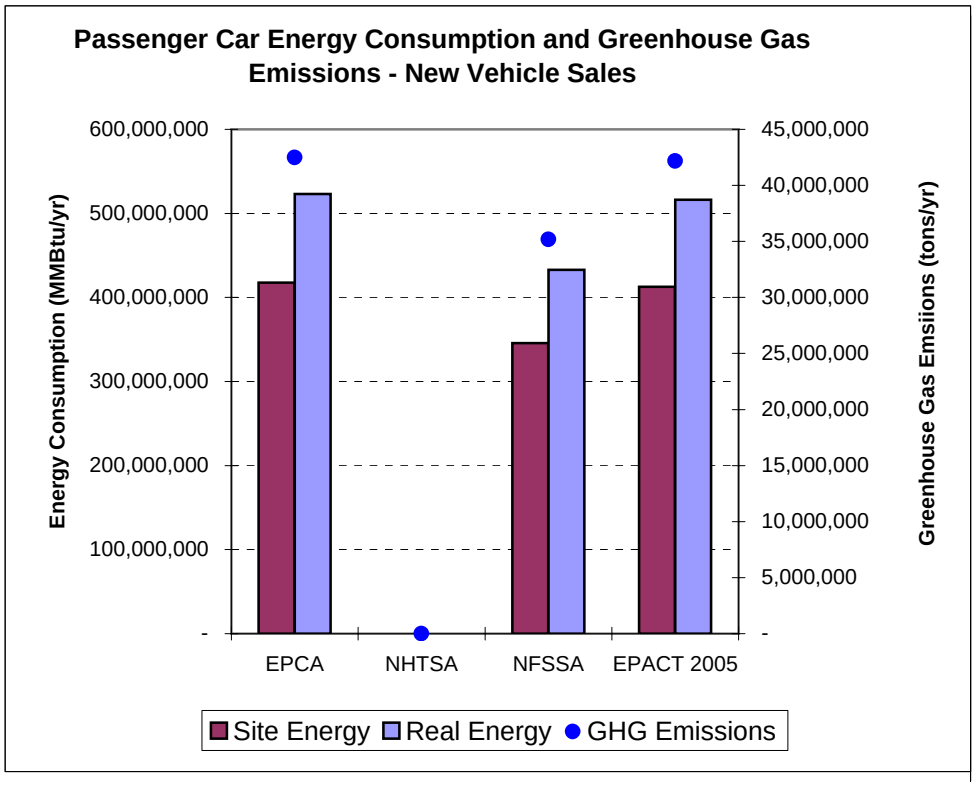


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Passenger Car Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Vehicle Sales

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	417,455,434	523,148,627	42,500,746
NHTSA	-	-	-
NFSSA	345,500,855	432,926,220	35,184,931
EPACT 2005	412,730,900	516,392,358	42,183,558

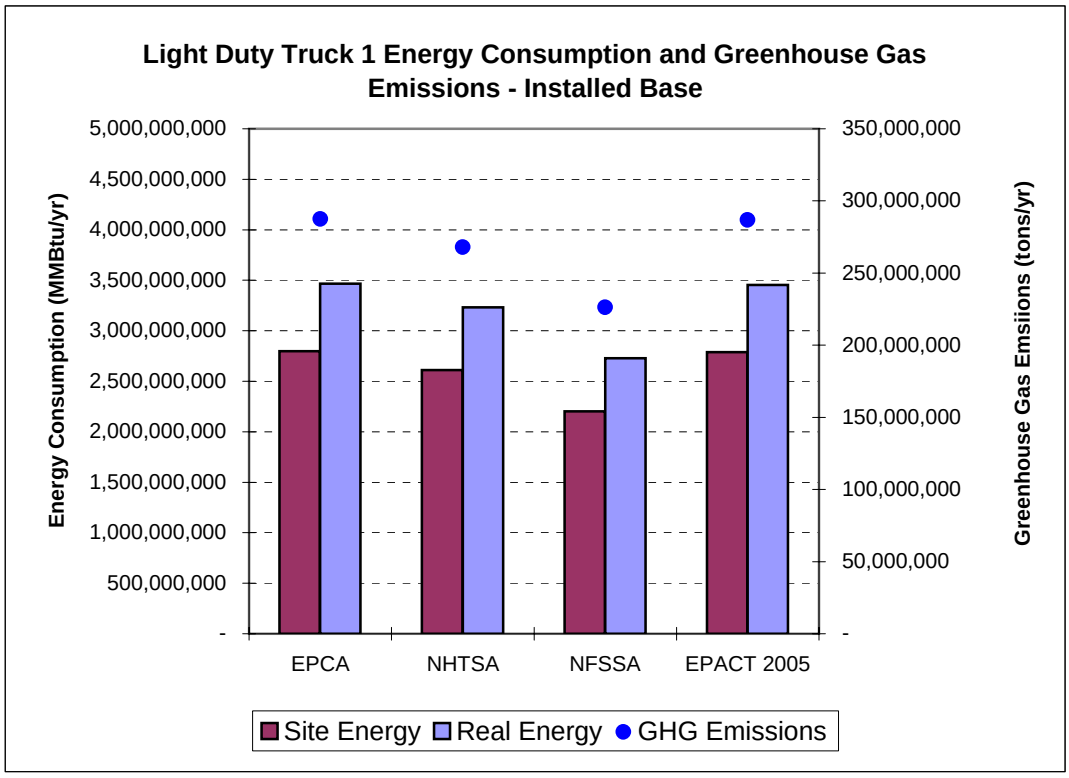


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Light Duty Truck 1 Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	2,798,495,800	3,465,747,485	287,375,621
NHTSA	2,609,408,246	3,231,575,358	267,958,349
NFSSA	2,202,618,367	2,727,793,648	226,185,375
EPACT 2005	2,788,432,022	3,453,904,583	286,841,173

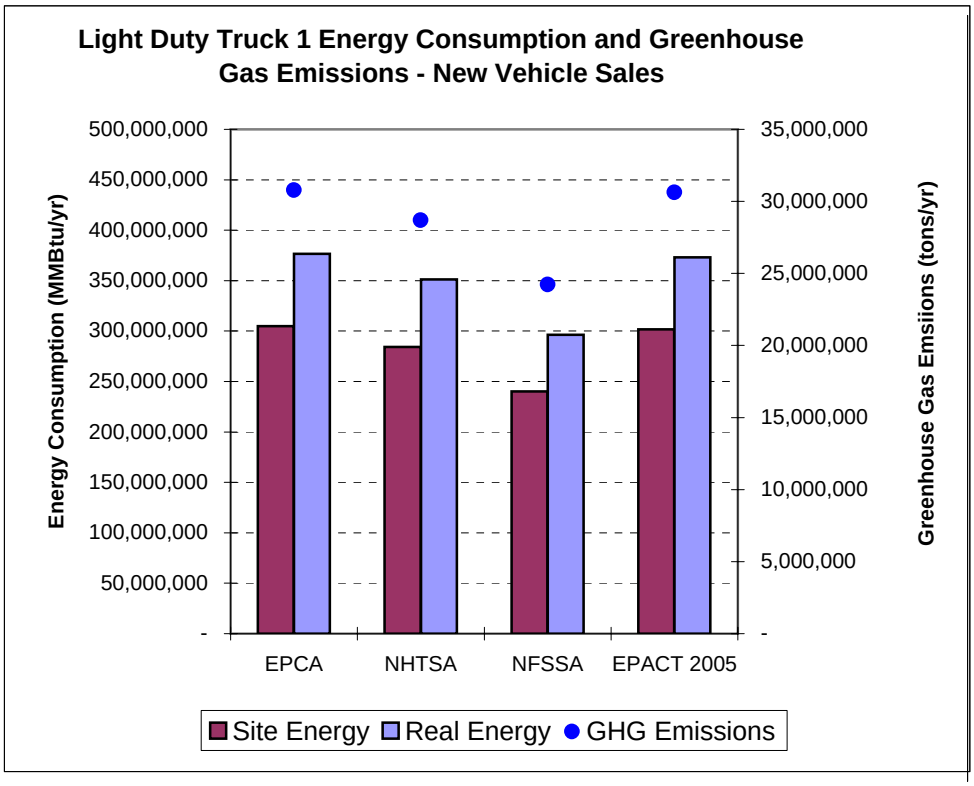


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Light Duty Truck 1 Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Vehicle Sales

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	305,014,460	376,651,932	30,778,976
NHTSA	284,405,375	351,202,477	28,699,315
NFSSA	240,068,416	296,452,281	24,225,278
EPACT 2005	301,851,974	373,032,848	30,615,636

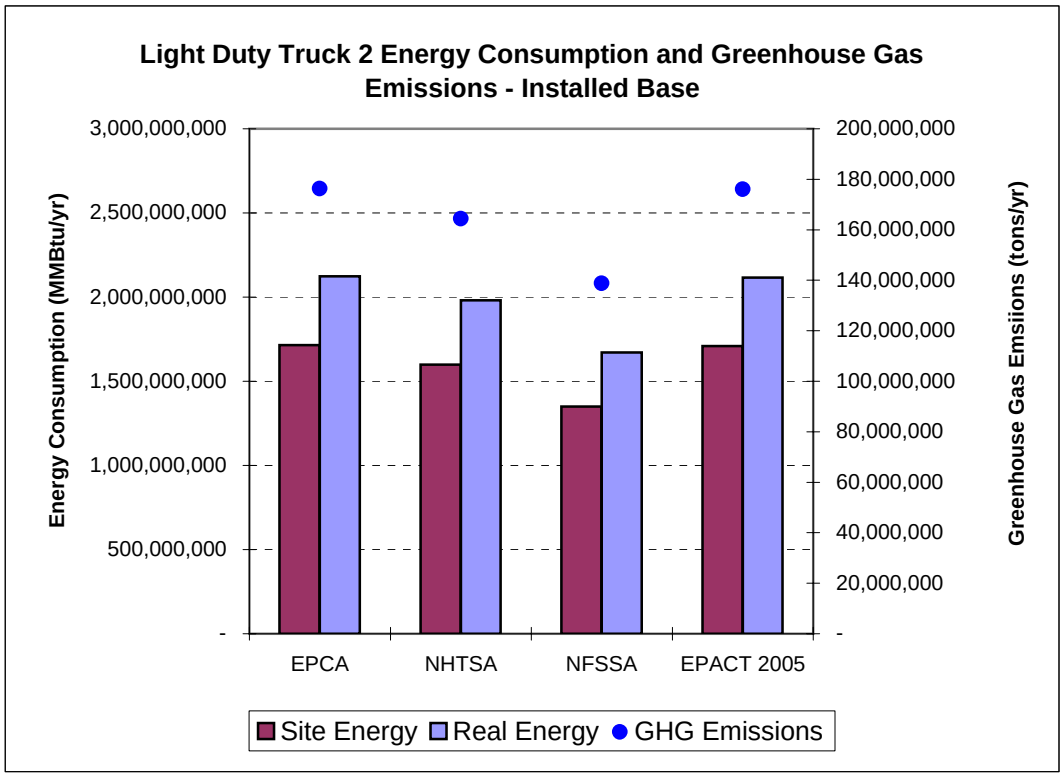


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Light Duty Truck 2 Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - Installed Base

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	1,715,207,103	2,124,167,813	176,317,175
NHTSA	1,599,314,731	1,980,642,961	164,403,852
NFSSA	1,349,991,902	1,671,873,526	138,774,354
EPACT 2005	1,709,038,981	2,116,909,261	175,985,750

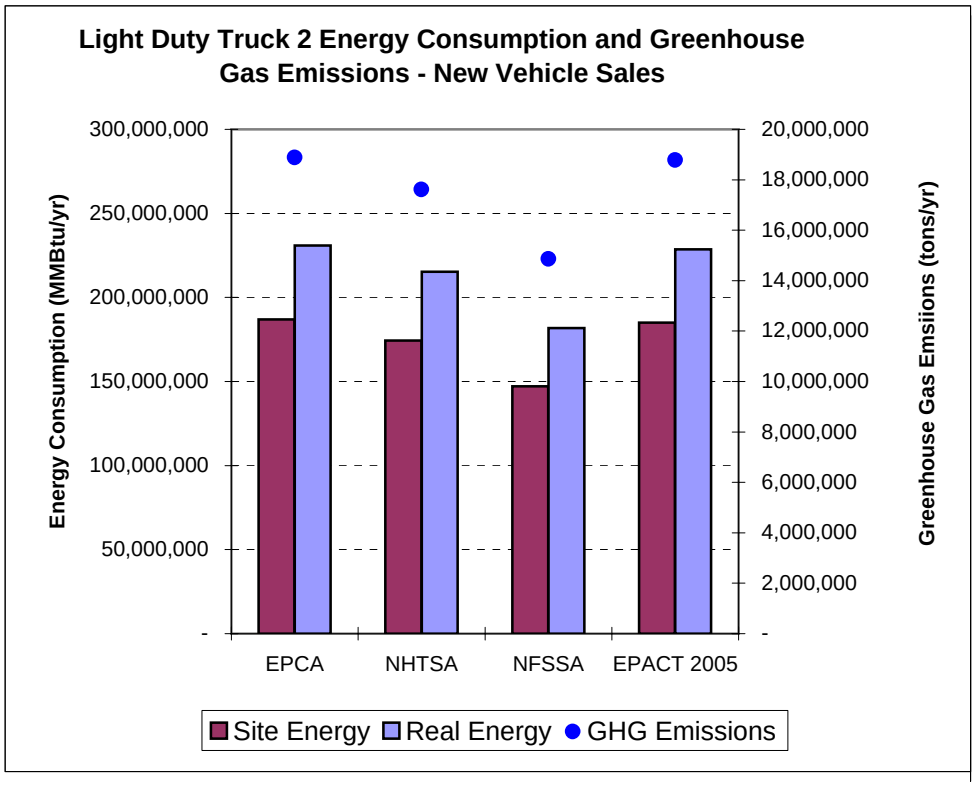


[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

Light Duty Truck 2 Energy Consumption and Greenhouse Gas Emissions

Annual Energy Consumption & GHG Emissions - New Vehicle Sales

	Site Energy (MMBtu/yr)	Real Energy (MMBtu/yr)	GHG Emissions (tons/yr)
EPCA	186,944,347	230,851,184	18,887,571
NHTSA	174,312,972	215,253,131	17,611,384
NFSSA	147,138,706	181,696,559	14,865,883
EPACT 2005	185,006,049	228,633,036	18,786,280



[1] The term Energy Policy Act of 2003 (EPACT 2003) as used in this appendix refers to legislation that was first introduced into both houses of the U.S. Congress in 2003 but which had still not been approved or implemented at the time this analysis was completed. This bill with minor modifications was passed into law on August 8, 2005 as the Energy Policy Act of 2005 (EPACT 2005).

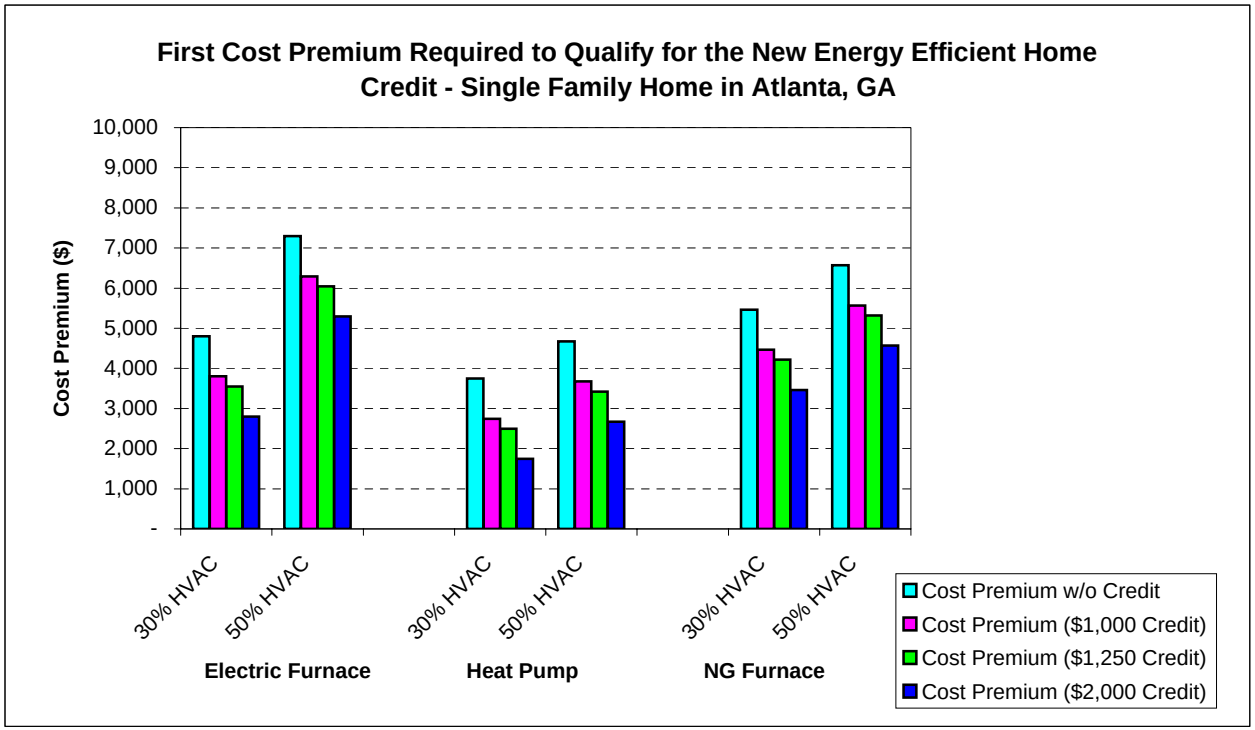
Appendix G

New Energy Efficient Home Credit Cost Premiums

REM/Rate Results - First Cost Summary

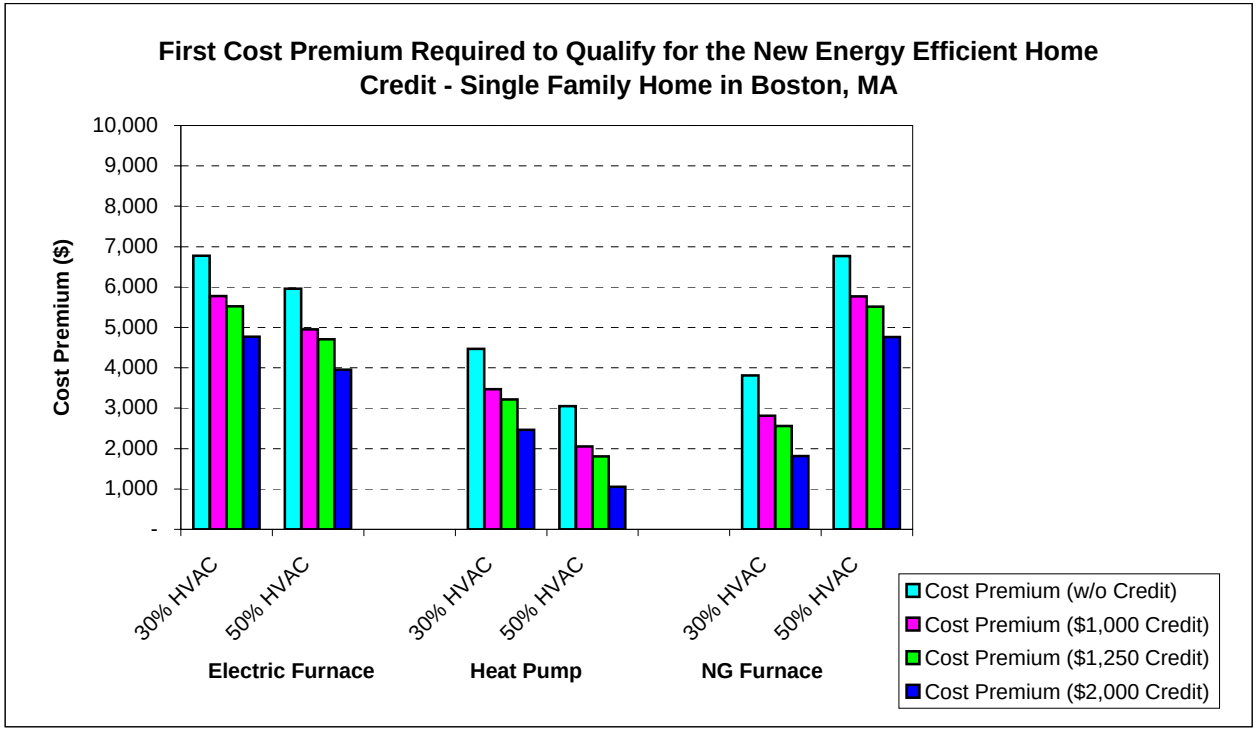
1-Story w/ Basement - Atlanta GA

Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium ($1,000 Credit)	Cost Premium ($1,250 Credit)	Cost Premium ($2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	4,801	3,801	3,551	2,801	20.8	26.0	41.7
50% HVAC Energy Cost Reduction	50% HVAC	7,294	6,294	6,044	5,294	13.7	17.1	27.4
30% HVAC Energy Cost Reduction	30% HVAC	3,747	2,747	2,497	1,747	26.7	33.4	53.4
50% HVAC Energy Cost Reduction	50% HVAC	4,674	3,674	3,424	2,674	21.4	26.7	42.8
30% HVAC Energy Cost Reduction	30% HVAC	5,465	4,465	4,215	3,465	18.3	22.9	36.6
50% HVAC Energy Cost Reduction	50% HVAC	6,569	5,569	5,319	4,569	15.2	19.0	30.4



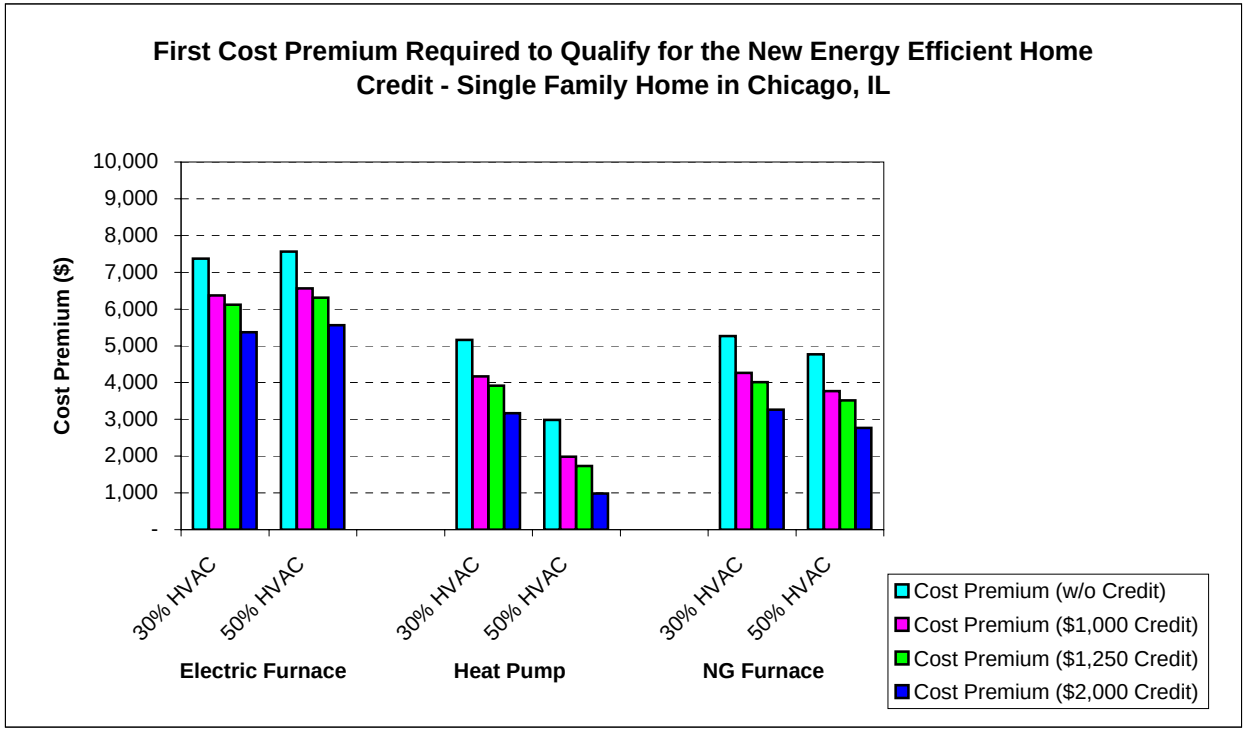
REM/Rate Results - First Cost Summary
1-Story w/ Basement - Boston MA

Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium ($1,000 Credit)	Cost Premium ($1,250 Credit)	Cost Premium ($2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	6,774	5,774	5,524	4,774	14.8	18.5	29.5
50% HVAC Energy Cost Reduction	50% HVAC	5,956	4,956	4,706	3,956	16.8	21.0	33.6
30% HVAC Energy Cost Reduction	30% HVAC	4,467	3,467	3,217	2,467	22.4	28.0	44.8
50% HVAC Energy Cost Reduction	50% HVAC	3,053	2,053	1,803	1,053	32.8	40.9	65.5
30% HVAC Energy Cost Reduction	30% HVAC	3,813	2,813	2,563	1,813	26.2	32.8	52.5
50% HVAC Energy Cost Reduction	50% HVAC	6,766	5,766	5,516	4,766	14.8	18.5	29.6



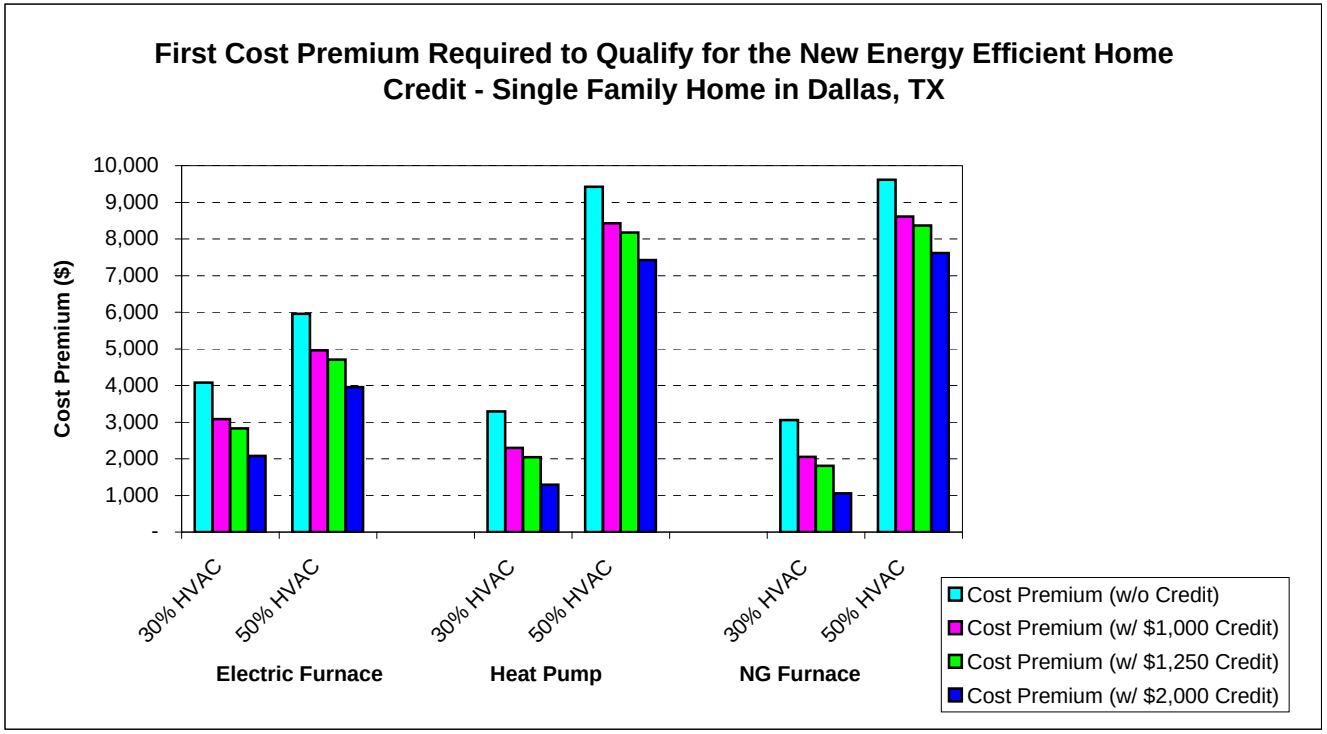
REM/Rate Results - First Cost Summary
1-Story w/ Basement - Chicago IL

Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium ($1,000 Credit)	Cost Premium ($1,250 Credit)	Cost Premium ($2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	7,372	6,372	6,122	5,372	13.6	17.0	27.1
50% HVAC Energy Cost Reduction	50% HVAC	7,559	6,559	6,309	5,559	13.2	16.5	26.5
30% HVAC Energy Cost Reduction	30% HVAC	5,165	4,165	3,915	3,165	19.4	24.2	38.7
50% HVAC Energy Cost Reduction	50% HVAC	2,986	1,986	1,736	986	33.5	41.9	67.0
30% HVAC Energy Cost Reduction	30% HVAC	5,264	4,264	4,014	3,264	19.0	23.7	38.0
50% HVAC Energy Cost Reduction	50% HVAC	4,768	3,768	3,518	2,768	21.0	26.2	41.9



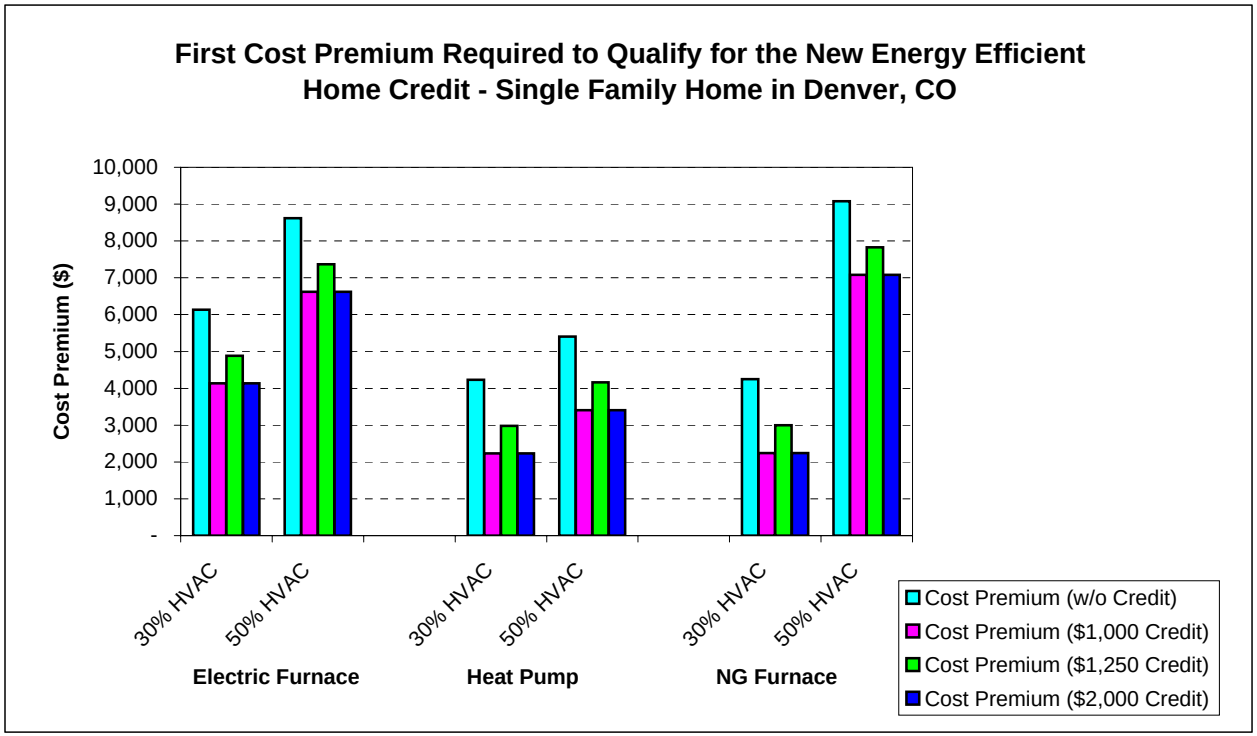
REM/Rate Results - First Cost Summary
1-Story w/ Basement - Dallas, TX

Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium (w/ $1,000 Credit)	Cost Premium (w/ $1,250 Credit)	Cost Premium (w/ $2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	4,081	3,081	2,831	2,081	24.5	30.6	49.0
50% HVAC Energy Cost Reduction	50% HVAC	5,957	4,957	4,707	3,957	16.8	21.0	33.6
30% HVAC Energy Cost Reduction	30% HVAC	3,293	2,293	2,043	1,293	30.4	38.0	60.7
50% HVAC Energy Cost Reduction	50% HVAC	9,428	8,428	8,178	7,428	10.6	13.3	21.2
30% HVAC Energy Cost Reduction	30% HVAC	3,055	2,055	1,805	1,055	32.7	40.9	65.5
50% HVAC Energy Cost Reduction	50% HVAC	9,614	8,614	8,364	7,614	10.4	13.0	20.8



REM/Rate Results - First Cost Summary
1-Story w/ Basement - Denver, CO

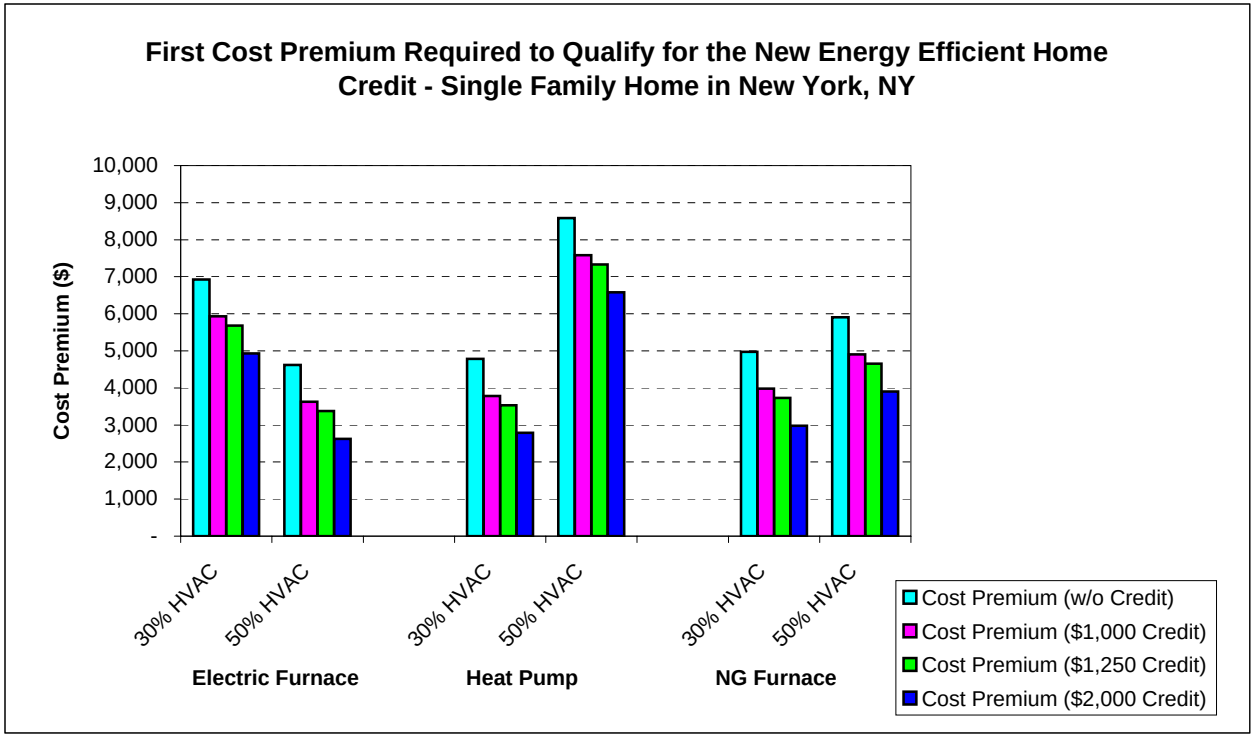
Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium ($1,000 Credit)	Cost Premium ($1,250 Credit)	Cost Premium ($2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	6,136	4,136	4,886	4,136	16.3	20.4	32.6
50% HVAC Energy Cost Reduction	50% HVAC	8,622	6,622	7,372	6,622	11.6	14.5	23.2
30% HVAC Energy Cost Reduction	30% HVAC	4,231	2,231	2,981	2,231	23.6	29.5	47.3
50% HVAC Energy Cost Reduction	50% HVAC	5,408	3,408	4,158	3,408	18.5	23.1	37.0
30% HVAC Energy Cost Reduction	30% HVAC	4,245	2,245	2,995	2,245	23.6	29.4	47.1
50% HVAC Energy Cost Reduction	50% HVAC	9,081	7,081	7,831	7,081	11.0	13.8	22.0



REM/Rate Results - First Cost Summary

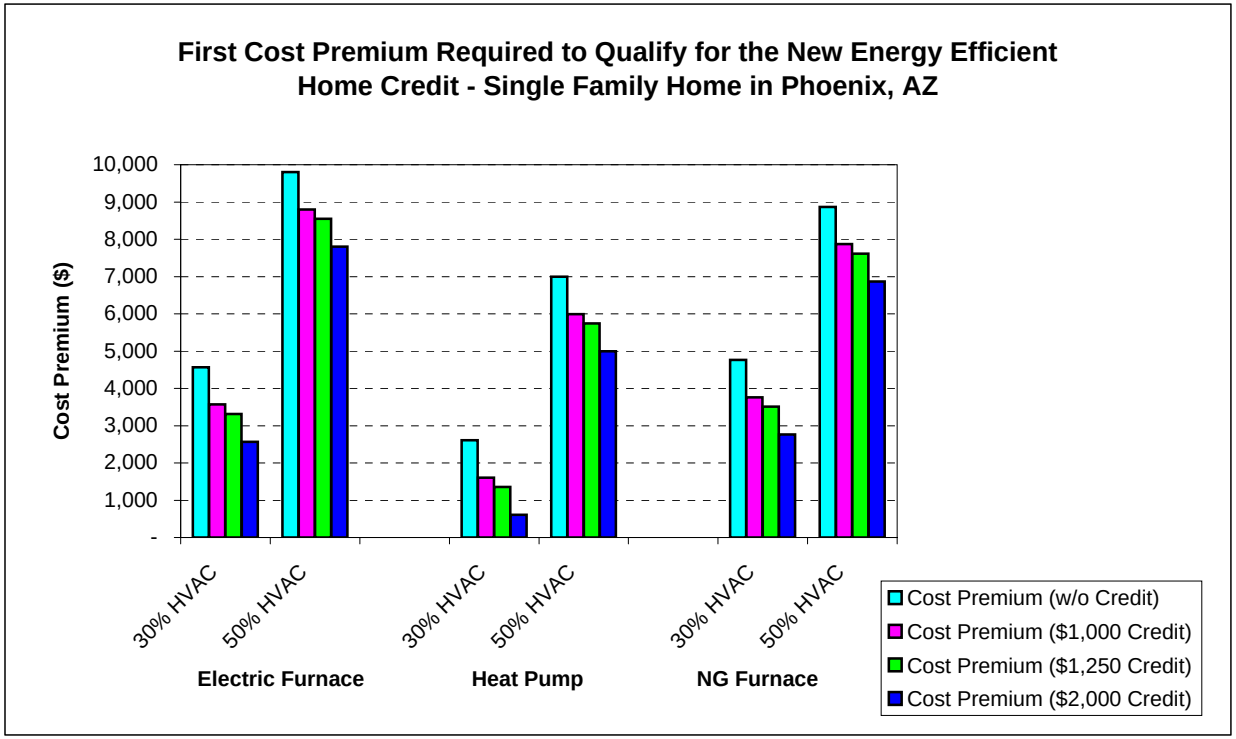
1-Story w/ Basement - New York, NY

Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium ($1,000 Credit)	Cost Premium ($1,250 Credit)	Cost Premium ($2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	6,930	5,930	5,680	4,930	14.4	18.0	28.9
50% HVAC Energy Cost Reduction	50% HVAC	4,623	3,623	3,373	2,623	21.6	27.0	43.3
30% HVAC Energy Cost Reduction	30% HVAC	4,786	3,786	3,536	2,786	20.9	26.1	41.8
50% HVAC Energy Cost Reduction	50% HVAC	8,583	7,583	7,333	6,583	11.7	14.6	23.3
30% HVAC Energy Cost Reduction	30% HVAC	4,977	3,977	3,727	2,977	20.1	25.1	40.2
50% HVAC Energy Cost Reduction	50% HVAC	5,905	4,905	4,655	3,905	16.9	21.2	33.9



REM/Rate Results - First Cost Summary
1-Story w/ Basement - Phoenix, AZ

Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium ($1,000 Credit)	Cost Premium ($1,250 Credit)	Cost Premium ($2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	4,567	3,567	3,317	2,567	21.9	27.4	43.8
50% HVAC Energy Cost Reduction	50% HVAC	9,802	8,802	8,552	7,802	10.2	12.8	20.4
30% HVAC Energy Cost Reduction	30% HVAC	2,609	1,609	1,359	609	38.3	47.9	76.7
50% HVAC Energy Cost Reduction	50% HVAC	6,994	5,994	5,744	4,994	14.3	17.9	28.6
30% HVAC Energy Cost Reduction	30% HVAC	4,761	3,761	3,511	2,761	21.0	26.3	42.0
50% HVAC Energy Cost Reduction	50% HVAC	8,867	7,867	7,617	6,867	11.3	14.1	22.6



REM/Rate Results - First Cost Summary
1-Story w/ Basement - Seattle, WA

Description	Chart Label	Cost Premium (w/o Credit)	Cost Premium ($1,000 Credit)	Cost Premium ($1,250 Credit)	Cost Premium ($2,000 Credit)	Tax Credit/Cost Premium (%) ($1,000 Credit)	($1,250 Credit)	($2,000 Credit)
30% HVAC Energy Cost Reduction	30% HVAC	8,409	7,409	7,159	6,409	11.9	14.9	23.8
50% HVAC Energy Cost Reduction	50% HVAC	4,769	3,769	3,519	2,769	21.0	26.2	41.9
30% HVAC Energy Cost Reduction	30% HVAC	6,265	5,265	5,015	4,265	16.0	20.0	31.9
50% HVAC Energy Cost Reduction	50% HVAC	3,480	2,480	2,230	1,480	28.7	35.9	57.5
30% HVAC Energy Cost Reduction	30% HVAC	3,345	2,345	2,095	1,345	29.9	37.4	59.8
50% HVAC Energy Cost Reduction	50% HVAC	4,720	3,720	3,470	2,720	21.2	26.5	42.4