Energy Efficiency as a Public Priority

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Table of Contents

Tables

Introduction

From 1990 to 2005 energy consumption in the U.S. has increased by 19 percent from 84.65 Quadrillion Btu to 100.69 Quadrillion Btu (EIA, 2007), faster than the population has grown. This increase is even more dramatic from 1949 to 2005 at a staggering 214.85 percent, more than double the rate of population growth over that half-decade period.

Coal, oil, and natural gas, also known as *fossil fuels,* are the primary sources for this energy consumption. This heavy reliance on fossil fuels has increased in the U.S. dependence upon foreign countries for its energy source and way of life, in addition to exacerbating pollution problems across the globe. As former U.S. Congressman Lee Hamilton (2007) points out in a commentary for the Woodrow Wilson International Center for Scholars:

> …our economy is dangerously vulnerable because of the necessity of oil and gas to heat our homes, power some industry, and – most importantly – keep our vehicles moving. Because of this dependency, we suffer economic shocks when our access to oil and gas is threatened: the OPEC embargo, the Iranian revolution, Iraq's invasion of Kuwait, the war in Iraq, Hurricane Katrina, and militia attacks in southern Nigeria are just a handful of incidents that have driven up oil and gas prices, slowing growth and making life harder for millions of Americans (¶1).

A relatively simple way to reduce energy consumption is through the use of more efficient versions of the products currently used in U.S. homes and businesses. Energy efficiency, "…encompasses all changes that result in decreasing the amount of energy used to produce one unit of economic activity (e.g. the energy used per unit of GDP or value added) or to meet the energy requirements for a given level of comfort" (World Energy Council, 2007).

Citizens and policymakers in the U.S. have found a renewed and increased interest in becoming more energy efficient and is not a trend that is likely to fade in the future. With energy costs continuing to soar, concerns over global warming increasing, and repeated supply shocks occurring, it can be expected that consumers and public entities alike will continue searching for ways to improve energy efficiency in their homes and offices.

In addition to the general reduction in energy use, more efficient products save consumers money, reduce greenhouse emissions, and help reduce the dependence upon foreign energy supplies. As the Consumer Federation of America (no date) explains:

> Choosing energy efficient products is one of the smartest ways consumers can reduce energy use and help prevent greenhouse gas emissions. A household that buys energy-efficient equipment instead of standard new equipment can substantially reduce carbon dioxide emissions over the lifetime of the products – pollution savings equivalent to taking a car off the road for seven years. Using energy efficient products in your home can also reduce nitrogen oxides, which are primary contributors to smog and acid rain (¶ 3).

Even with the obvious and potentially substantial benefits achieved from a switch to more energy efficient products, energy efficient practices are not uniformly followed across the country. Lack of awareness and the expense associated with more efficient products are two of the most cited reasons for a consumer or business not to use more efficient products.

Both of these obstacles can be addressed and minimized by interested public entities such as state and local governments. Specifically, through the use of public example and incentive programs, public entities may work to encourage the use of energy efficient equipment, reaping benefits for all involved.

This practice guide illustrates some of the ways that public entities can encourage energy efficiency within their jurisdictions. The guide begins with a review of what many states are currently doing to promote energy efficiency, then moves on to show how public entities can serve as guiding examples to consumers, and finally, concludes with some examples of simple calculations of the benefits of adopting incentive programs directed at encouraging energy efficiency.

Existing Energy Efficiency Programs

States currently use a variety of mechanisms to encourage energy efficiency. Programs include a variety of tax incentives as well as loan programs that offer builders and consumers low- or no-interest loans in order to purchase energy efficient equipment. Some states provide programs in which grants are awarded to businesses for the pursuit or manufacturing of renewable energy sources. *Table 1* provides a brief look at what states are doing to encourage energy efficiency. However, for a more comprehensive listing of incentives available go to http://cepm.louisville.edu/Pubs_WPapers/practiceguides/PG20 - Matrix.pdf .

State Economic Incentives for Energy Saving Investments

Table 1

Incentive Type	Description
Tax deduction	Lowers taxable income by allowing taxpayer to subtract the expense from gross income.
Tax credit	Tax credits are treated as payments to the amount of taxes owed by taxpayer.
Tax holiday	A temporary reduction or elimination of a tax.
Tax exemption	An exemption from paying a particular tax.
Rebate	A partial or whole refund on the purchase price of a specified item.
Grant	A gift in a predetermined amount to be used in a predetermined manner.
Loan	A debt that must be repaid usually with a predetermined interest rate over a set period of time.

There is enormous diversity in the current public programs, opportunities, and incentives across the 50 states. Other avenues for incentives can be found in the investor-owned or cooperative utility companies that offer a variety of rebates, grants, and/or loans to individuals, government bodies, or schools. In addition to these state and investor-owned or cooperative private incentives for energy efficiency, the federal government offers some valuable economic incentives to individuals, small businesses and corporations. Many past energy efficiency and economic incentive studies have indicated that building upon existing programs is a good place for lower level governments to start. More specifically, economic incentives offered by the federal government should be used as a foundation upon which state and local governments can build their own energy efficiency programs in order to maximize their potential results.

The most common economic incentives directed at energy efficiency include, but are not limited to, business, personal and property taxes and tax holidays, exemptions, credits and deductions. It has been demonstrated in past studies that these types of incentives provide the greatest motivation to develop and implement energy efficient technology (Harrington and Morgenstern, 2004; Brown, et al., 2002). Other studies have revealed that when making a decision to purchase an energy-consuming product, the consumer is quite unaware of energy efficient alternatives (Roberts, 2005). Furthermore, when the consumer is exposed to energy efficient alternatives, he/she will opt for the less expensive technology even though long term savings are to be found in the energy efficient products (Brown, et al., 2002). These studies conclude that economic incentives provide consumers with the motivation to purchase energy efficient products by making the products more competitive with the ones that have long been established on the market. However, it is important to note that any incentive a public entity elects to implement will need to be promoted and publicized to consumers and businesses so that individuals who may benefit become aware of the program.

Understanding the real benefits to be gained from pursuing energy efficiency as a policy choice, this guide offers some tangible calculations concerning how public entities can encourage and facilitate energy efficiency. Both public example and public incentive programs are discussed in the remainder of this guide. Although these calculations are based upon data applicable to Kentucky, other states and localities can draw from these calculations and use this information in the pursuit of locally relevant energy efficiency programs.

Letting the Public Sector Set an Example

A logical and good first step for public entities looking to encourage energy efficiency is to evaluate their own practices. That is, in order to encourage energy efficiency, first look to the public sector for potential efficiency gains that would both save money and set an example for the private sector. The benefits from public programs are twofold: (1) real current expenditure savings for the public sector and (2) an educational opportunity for the private sector. Although the route to energy efficiency in the public sector has many paths, an area where real energy savings can be found fairly easily is in lighting. Using Kentucky as an example, this section shows some potential savings for lighting in two sub-sectors of the state-owned building stock: offices and education buildings. It can be expected that the private sector will be encouraged, motivated, and educated by the state's effort at energy efficiency. Furthermore, the savings realized in the public sector will translate into a lower deficit, lower taxes, or more discretionary funds or tax savings at the state level. Any of these outcomes is a net gain for the state.

Office Lighting

Within the commercial sector in the U.S., offices make up approximately 22 percent of total fuel expenditures as compared to other end uses (Commercial Buildings Energy Consumption Survey, 2003). This accounts for the highest total proportion of fuel expenditures within the 16 identified building end uses in the commercial sector. Within the classification of offices, lighting makes up the largest end-use consumption intensity at approximately 22,827 BTU per square foot of office space per year (National Lighting Inventory and Consumption Survey, 2002). Only space heating comes close to this level of end-use consumption.

In Kentucky, there are 264 state-owned buildings used as offices according to a listing maintained by the Finance and Administration Cabinet's Division of Real Properties (Commonwealth of Kentucky, 2007). The total net square feet in these buildings is 4,733,223. Reliance on the "net square feet" measure understates the total square area of the buildings, since it excludes hall space, elevators, and ancillary spaces, and counts only the actual amount of space provided for each specific function or office (Walls, 2000). Given the fact that these calculations rely upon national averages reported in secondary sources, the properties with zero net square feet have been eliminated from the calculations in order to better ensure the accuracy of the projections.) *Table 2* summarizes the details of the state-owned buildings classified as offices.

State-Owned Offices Floor Space

Table 2

Total Net Square Feet	4,733,223
Average Square Feet per Building	17,930
Total Buildings	264

Source: Commonwealth of Kentucky, 2007

In 2002, the Department of Energy commissioned a study by Navigant Consulting that outlined national averages of lighting use in the U.S. Several pieces of data from this study are particularly useful for estimating potential savings in lighting in Kentucky (and for any other state looking to examine efficiency opportunities). Using national averages is not ideal and will suffer some degree of inaccuracy in these estimates. However, when used broadly, they can offer some insights for policymakers and administrators in terms of what the potential for savings may be.

To determine what can be done to improve the lighting efficiency in the state-owned office space, we must first estimate current usage. According to the study noted above, the average commercial building (of which offices are a subset) has the following breakdown of lighting:

Lighting in the Commercial Sector

Table 3

Types of Lighting in Commercial Sector per building	**Number of bulbs per building**	**Standard Operating Hours per day**	**Average Wattages**
Incandescent	91	10.2	83
Fluorescent	324	9.7	41
HID	7	10.1	404
Solid State	0.4	23	5
TOTAL	422.4		

Source: Navigant Consulting, 2002

In *Table 4* we use these estimates of the national averages of installed lighting to calculate current electricity consumption in state-owned office buildings.

Energy Consumption and Cost of Lighting in state-owned offices in KY

Table 4

	Absolute Number	Average Wattage	Hourly kWh Use	Daily kWh	Annual kWH	Total Stated Owned Offices Annual Lighting kWh Consumption	Annual Cost of Lighting *
Incandescent	24,024	83	0.083	0.8466	309.0090	7,423,632.22	
Fluorescent	85,536	41	0.041	0.3977	145.1605	12,416,448.53	
HID	1,848	404	0.404	4.0804	1489.3460	2,752,311.41	
Solid State	105.6	5	0.005	0.1150	41.9750	4,432.56	
TOTAL	111,513.6			5.4397	1985.4905	22,596,824.71	$1,325,303.77

Source: Navigant Consulting, 2002

***** Using a cost of $0.05865/kwh (the average electricity price 2000-2005 in Kentucky)

In *Table 5*, we check the reliability of the estimates using calculations from the Navigant lighting study which estimates that the average office consumes 22,867 kWh per square foot.

Total Cost of Lighting Consumption

Table 5

LIGHTING CONSUMPTION	
kWh/sq ft	22,867
Total sq ft **	4,733,223
Consumption	108,234,610,341
kWh	31,712,455.42
TOTAL COST	$1,859,935.51 **#**

**Source: Navigant Consulting, 2002*

***Source: Commonwealth of Kentucky, 2007*

***#** Using a price of $0 .05865/kwh, the 2000-2005 KY average*

The calculations in *Table 4* concerning number and type of lighting in commercial buildings is not as detailed as the per square foot estimate in *Table 5*. Taking the difference between the commercial sector lighting averages and the office per square foot averages reveals that the offices may actually spend more on energy for lighting than the original estimates state, by about $500,000 annually. This implies that the cost savings outlined in this report for state-owned offices are likely understated.

A logical first step to increase energy efficiency in offices is to introduce compact florescent lights (or CFL's) in place of the less efficient incandescent bulbs. The benefits are outlined below.

Incandescent to Fluorescent in State-Owned Offices

The cost of an incandescent bulb is approximately $0.40 depending upon its type, manufacturer, and whether or not it is purchased in bulk. Incandescent light bulbs are the most inexpensive bulb available. Alternatively, the cost of a CFL, or compact fluorescent light, bulb ranges from $2.00 to $3.50 depending of the brightness of the bulb and whether or not it is purchased in bulk. A CFL is designed to be used in a standard light bulb socket. "Fluorescent lighting works by passing a current through a gas-filled tube. Incandescent light works by heating up a metal filament until it is white-hot. Incandescent bulbs produce mostly heat …" (Georgia Interfaith Power and Light, n.d.). The up-front price differential is a prime reason why the incandescent bulb is still favored although it is much less efficient than the CFL bulb and costs more over the long term. *Table 6* summarizes key differences between an incandescent bulb and a CFL bulb.

CFL and Incandescent Cost

Table 6

	CFL	**Incandescent**
Energy Output (watts)	13	60
Light Output (lumens)	810	830
Useful Life (hours)	10,000	1,500
# of Bulbs for 10,000 hours	1	6.7
Bulb Costs for 10,000 hours of use *	$3.50	6.7@$.40 = $2.68
Electricity Used (kWh)	130	600
Electricity Costs @ .0565 per kWh	$7.35	$33.90
TOTAL COST	$10.85	$36.58

Source: Georgia Interfaith Power & Light, n.d. (Modified to fit Kentucky's costs).
* Note: This figure ignores higher labor costs incurred for bulb replacement

Examining the 264 state-owned office buildings reveals some substantial savings that can result from the introduction of CFL bulbs in place of the incandescent bulbs currently used in many of these offices. The calculations of potential savings if all incandescent bulbs were changed to ENERGY STAR CFL bulbs are summarized *in Table 7*. These calculations assume the average wattage of the CFL is 15.

Switching to CFL

Table 7

		Average Wattages	**Hours Used**	**Daily kWh Used**	**Annual KwH Used**	**Total KwH Consumption**	**Annual Operating Cost**
CFL	24,024	15	10.2	0.1530	55.8450	1,341,620.28	
Fluorescent	85,536	41	9.7	0.3977	145.1605	12,416,448.53	
HID	1,848	404	10.1	4.0804	1489.3460	2,752,311.41	
Solid State	105.6	5	23	0.1150	41.9750	4,432.56	
						16,514,812.78	$968,594
ANNUAL SAVINGS over the current operating cost determined in Table 4							**$356,710**

Thus, CFLs a major annual cost saving over the long run when compared to standard incandescent bulbs. The savings themselves can more than cover the debt service on bonds, if the up-front cost differential for purchase of the CFL bulbs were to be financed by borrowing. That comparison, of the annual cost savings to the debt se4rvice for the initial investment, will serve as an example of the fact that the initial cost need not pose a problem for a more widespread acceptance of the CFL bulbs. Both states and local agencies also could work to implement an incentive program directed at the added costs of CFL bulbs (possibly using the funds freed annually through their own conversion to CFLs). Alternative mechanisms for increasing the consumption of CFLs in the private sector follow the education buildings section of this guide.

Education Building Lighting

Education buildings are considered part of the commercial sector. According to the Navigant report mentioned previously, education as a sub-sector uses approximately 11 percent of the total of the lighting consumption in the commercial sector. This ranks as third across the sub-sectors following only behind offices (1) and warehouses (2). (Note that the Navigant study does *not* include the buildings operated by public universities and other post-secondary institutions, plus all the k-12 schools districts in the Commonwealth.) Following the same methodology and assumptions we used for the office calculations, we can estimate the energy and cost savings for educational buildings if CFLs are introduced. *Table 8* summarizes the size and number of state-owned education buildings with greater than zero net square feet in Kentucky.

State-Owned Education Buildings

Table 8

Total Net Sq Ft	1,117,784
Average	12,019
Total Buildings	93

Source: Commonwealth of Kentucky, 2007

Table 9 estimates current lighting consumption and cost by these buildings.

Annual Cost of Lighting

Table 9

Lighting Types in State-owned Educational Facilities		Average Wattage	Hourly hWh Usage	Daily kwh Usage	Annual KwH Usage	Stated-Owned Educational Facilities Annual Lighting KwH Consumption	Annual Cost of Lighting
Incandescent	8,463	83	0.083	0.8466	309.0090	2,615,143.17	
Fluorescent	30,132	41	0.041	0.3977	145.1605	4,373,976.19	
HID	651	404	0.404	4.0804	1489.3460	969,564.25	
Solid State	37.2	5	0.005	0.1150	41.9750	1,561.47	
TOTAL	39,283.2			5.4397	1985.4910	7,960,245.07	$466,868

Source: Navigant Consulting, 2002

Once again, cross checking these figures with the square foot of educational buildings estimate from the Navigant lighting study reveals the following calculations.

Assumed Lighting Consumption

Table 10

Cost	$710,366
KwH	12,111,948

Source: Navigant Consulting, 2002

When the calculation is made based upon a smaller sub-sector of the commercial sector, the energy costs are underestimated by almost $300,000. This indicates that the state-owned educational facilities are likely to use more lighting electricity than is estimated in this report and therefore are likely to be able to realize greater savings from an implemented lighting efficiency program.

In *Table 11*, we estimate the savings that could occur if all incandescent bulbs were replaced with CFL bulbs.

Switching to CFL in Sate-Owned Education Buildings

Table 11

		Average Wattages	Hours Used	Daily kWh Used	Annual kWh Used	Total	Annual Cost
CFL	8463	15	10.2	0.1530	55.8450	472616	
Fluorescent	30132	41	9.7	0.3977	145.1610	4,373,976	
HID	931	404	10.1	4.0804	1489.3500	1,386,581	
Solid State	53.2	5	23	0.1150	41.9750	2,233	
						6,235,406	$365,706
ESTIMATED SAVINGS relative to Table 9 current cost estimates							**$101,200**

Again, these figures are likely underestimated due to the lack of ideal data. However, even these conservative estimates represent substantial savings.

The calculations presented in *Table 11* represent a very small portion of the potential savings that could realized by implementing a widespread lighting efficiency program for the education sector. As noted, above, there are far more buildings in the sector in Kentucky than those few owned by the state. Conversion for those 93 buildings could, however, provide demonstration data that would accelerate conversion by the hundreds of public and private universities and school systems in the Commonwealth.

This example underscores the value of starting with the public sector as a way to demonstrate to the private sector the potential savings offered by a switch to CFL bulbs. In the future, states might consider offering a sales tax exemption on the CFL bulbs to offset the initial added costs and help encourage wider private usage. The next section takes a look at some states' successes in energy efficiency incentives programs and offers a short discussion of related programs and incentives that states could consider to encourage a wider spread use of CFL lighting.

Alternative Incentives for Lighting

Example: Incentive Using Rebate Programs

To further encourage the use of CFL lighting, rebate programs may be a good route for some public entities. These rebate programs require a public entity to partner with major and local retailers (such as Wal-Mart and Home Depot, both of which have nationwide initiatives to promote compact fluorescent light bulbs) to promote and encourage the usage of rebates.

To provide an example of how this incentive would work, it is suggested that the state offer its residents and small business owners a $2.00 rebate per ENERGY STAR-labeled CFL bulb purchased. As previously stated, the cost of a CFL bulb ranges from $2.00 to $4.00 depending of the brightness of the bulb and whether or not it is purchased in bulk (Hamilton, W.L., 2007). The cost of an incandescent bulb is approximately $.40 depending on its type, manufacturer and whether or not it is purchased in bulk. A rebate of $2.00 thus makes the price of the CFL bulb competitive with that of the incandescent bulb. A hypothetical example follows: If Kentucky sets a goal to generate conversion of 100,000 bulbs to CFLs using rebates, and does so successfully, spending $200,000 on rebates, consumers would see a cumulative life-cycle savings in the amount of approximately $4.15 million as well as a reduction in CO_2 emissions in the amount of 64 million pounds, which is the equivalent of taking about 5,500 cars off Kentucky roads for a year. For additional benefits, see *Table 12*.

Benefits of 100,000 Light Bulb Conversions to Compact Fluorescents

Table 12

Benefit	Amount
Initial cost difference	$300,000
Life cycle savings	$4,478,085
Net life cycle savings (life cycle savings - additional cost)	$4,178,085
Life cycle energy saved (kWh)	44,760,000
Life cycle air pollution reduction (lbs of CO_2)	64,006,800
Air pollution reduction equivalence (number of cars removed from the road for a year)	5,537
Air pollution reduction equivalence (acres of forest)	8,729
Savings as a percent of retail price	1.2%

Source: ENERGY STAR, Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Compact Fluorescent Lamp(s), 2007

Performance Contracting

As demonstrated in the previous section, states could achieve substantial energy and cost savings by installing energy efficient lighting systems in its public buildings. Drawing from other states' experiences, it is possible that many states can do so without any up-front costs by partnering with local utility service providers. Under this proposed partnership, local utilities would install energy efficient lighting systems into public buildings, i.e., schools, libraries, hospitals, etc., using performance contracting as the financing mechanism. Performance contracting is an alternative financing mechanism in which the performance contractor makes a guarantee to the client that once the energy efficient lighting system is installed the client will realize energy and cost savings immediately. The client will repay the performance contractor for his/her services with the savings on his/her energy bill (Alliant Energy–Interstate Power and Light Company, 2006). Benefits of using performance contracting are:

- Investing in new energy and cost saving technology without any up-front capital investment cost to the consumer.
- Guaranteed energy and costs savings.
- No participation on behalf of the client is necessary – the entire installation and administration process is performed by the contractor (Alliant Energy–Interstate Power and Light Company, 2006).

Installing energy efficient lighting systems has a relatively short payback period, with some sources indicating a range of five to 20 years, depending on the size and structure of the building (Singer, T. and Johnson, M. 2001). As energy costs rise over time, the payback period (number of years before the investment has been paid back by savings) declines.

See *Table 13* for some examples of the use of performance contracting.

Performance Contracting Case Studies

Table 13

Client	Energy Cost Savings	Replaced	Project Scope	Payback Period
New Jersey Public Schools	$393,000 in addition to 2.2 million kilowatt-hours saved annually.	Ballasts, fixtures, lamps	18 schools: classrooms, halls, auditoriums, gymnasiums, multi-purpose rooms; 2,700 electronic ballasts, 6,300 fixtures, 38,700 energy-efficient lamps.	3 years
Hill Air Force Base, Utah	30 buildings: $445,500 annually, hospitals: $485,650 (1st six months), repair hanger: $140,000 annually.	Ballasts, fixtures, lamps	Five-year performance contract to retrofit 1,400 buildings.	18 years
Grayling and Cadillac, Michigan: Mercy Hospitals	Grayling: $27,000 annually; Cadillac0: $45,000 annually.	Ballasts, fixtures, lamps	Two hospitals: Grayling, MI, replaced a total of: 1,100 electronic ballasts, 2,400 fluorescent fixtures, 3,300 energy-efficient lamps. Cadillac, MI, replaced a total of: 1,600 electronic ballasts, 2,400 fluorescent fixtures, and 4,800 energy-efficient lamps LED exit signs.	3 years
Reading, PA: Parking Authority	$40,000 annually, 50 percent of annual lighting bill.	Ballasts, fixtures, lamps	300,000 sq. ft. garage, 220 energy efficient HID fixtures, 55 LED exit signs.	< 4 years

Source: Smart Solutions, n.d.

Performance contracting is recommended for states for several reasons, the primary reason being financial benefits. Additionally, because performance contracting allows the management of the building to continue as usual while every aspect of the installation and administration process is carried out by the utility service provider, the state does not need to perform any part of the transition itself, aside from locating a utility service provider, and is therefore relieved of the responsibility to incur new internal costs resulting from the transition.

Additional Public Incentive Programs

Although serious constraints exist in data availability to assess potential benefits accruing from public incentive programs, this guide has also examined, for educational purposes, several additional incentives within Kentucky's residential, commercial, and public sectors so that we might suggest that there are benefits to be achieved from the implementation of efficiency programs. We include calculations that indicate some possible savings in terms of energy and expenditures if these proposed changes are fully taken advantage of by the appropriate recipient. Each sector is elaborated on in the following sections. Methodology and assumptions are detailed in the respective sections.

Residential Sector Energy Efficiency Incentive Possibilities

In the year 2005 in Kentucky, the residential sector accounted for approximately 19 percent of the total state's energy consumption (Energy Information Administration [EIA], 2003). Within that sector, single-family homes account for approximately 80 percent of total residential energy consumption (EIA, 2001). In order to maximize potential impact on the residential sector, this study examined single-family homes in Kentucky. Although some of the following savings potential tabulations are only for single-family homes, these methods can also apply to mobile homes and to multi-family homes.

Two key potential efficiency incentives are highlighted in this section: ENERGY STAR Qualified New Homes and ENERGY STAR Appliances. As previously noted, these particular programmatic choices help build upon the federal ENERGY STAR incentives and also build upon each other, thereby increasing their likelihood of success and impact on energy consumption in Kentucky. Methodology and results are detailed under each section.

ENERGY STAR Qualified New Homes

New home builders can become certified through the federal ENERGY STAR program as being an *ENERGY STAR Qualified Home* by being at least 15 percent more energy efficient than homes built to the 2004 International Residential Code (IRC). The route to gaining that level of energy efficiency is flexible and can be achieved through a number of energy efficient features such as insulation, high performance windows, certain construction practices that help a home conserve energy, the use of more efficient heating and cooling equipment, and/or the use of ENERGY STAR lighting and appliances within the homes (ENERGY STAR, 2007). Although any type of home can gain this designation and save energy and money, this guide elects to examine only single-family homes as they account for over 70 percent of new home construction in Kentucky (American Community Survey [ACS], 2005).

National data indicates that approximately 10 percent of all new single-family homes built in the U.S. in 2005 were certified as ENERGY STAR qualified. This accounts for approximately 149,568 homes (ENERGY STAR, 2007) "To date, over 525,000 ENERGY STAR qualified new homes have been built, translating to estimated annual savings of 989 million kilowatt-hours (kWh) of electricity, 75 million therms of natural gas, $124 million in utility bills, and 1.13 million metric tons of CO2 released into the air" (ENERGY STAR, 2007).

In 2006 Kentucky fell below the national average of 10 percent. Roughly 6 percent of all the new Kentucky homes permits in 2006 were certified as ENERGY STAR qualified (ENERGY STAR, 2008). Approximately, 97 builders working in Kentucky are partnered with ENERGY STAR to build qualified homes. Of these firms, only 8 are committed to building 100 percent of their newly constructed homes by ENERGY STAR qualified standards. The builders committed to building only ENERGY STAR qualified homes report completing construction on only 925 qualified homes (statewide) over the life of the program.

With 13,496 permits for single-family homes in Kentucky in 2006, there is obviously a great deal of room for improvement. The federal government currently offers home builders a $2,000 tax credit for each new energy efficient home achieving 50 percent energy savings over the 2004 International Energy Conservation Code (IECC). The state of Kentucky could capitalize and build upon this federal tax incentive, first, by making sure more builders in the Commonwealth know about, and take advantage of, the federal program. If necessary, additional state-level incentives could be offered for achieving ENERGY STAR qualified status. The combination of a federal and state tax credit could lead more builders to accepting the challenge to become ENERGY STAR qualified, while those already partnered could be persuaded to increase the proportion of their new construction that qualifies..

To determine the possible energy and monetary savings Kentucky could incur as the result of an increase in the percentage of new ENERGY STAR qualified homes being built, we used multiple data sources and made certain assumptions. As previously stated, data availability on energy use, housing details, and related information is not always readily available at the state level. This problem often requires the use of non-ideal data such as national data and averages. To provide for the variation in using this imperfect data, we calculated savings using two separate energy figures – American Community Survey reported data and national averages. The assumptions are detailed below.

American Community Survey Data Use

The U.S. Census Bureau publishes data obtained in a national sample in the American Community Survey (ACS). The ACS is a "…nationwide survey designed to provide communities a fresh look at how they are changing. It will replace the long form in future censuses and is a critical element in the Census Bureau's reengineered 2010 census plan" (ACS, 2006). Included in the ACS data are estimates on home energy costs broken down by year built, type of home, state, and type of fuel. It is possible to extrapolate this data and make some approximations on the energy usage for single-family homes built in Kentucky from 2001 to 2005. Unfortunately, data in this ACS is not always totally accurate as often respondents do not fully answer each question and, as with any sample, the results have standard errors. Furthermore, the ACS only includes homes that are currently occupied when the sample is taken. To deal best with the spotty data in the ACS, single-family homes that use both electricity and natural gas were included. These homes make up a majority of the new homes in Kentucky. The calculations used with the ACS data was checked with Kentucky homes that reported only using electricity and the findings were consistently similar, thereby providing an additional check on the usefulness and accuracy of this data.

As illustrated in *Table 14*, the ACS reports 118,016 single-family homes were built in the state of Kentucky over the period 2000-2006. This represents approximately 63 percent of all new residential units built during those years. The reported average monthly electricity cost for these homes is $118.20. Average monthly natural gas is $46.70.

Newly Constructed Single-Family Homes 2000–2006

Table 14

		Percentage of Total Residential Units Built 2000-2006
Total Residential Units Built 2000-2006	186,043	

Single-family Homes Built Post 2000*	118,016	63%
Average Monthly Electricity Price Single-family Homes built post 2000*	$118.20	
Average monthly gas cost single-family homes built post 2000*	$46.70	

**Note: This data is extracted for single-family homes built 2000-2006.*
These calculations are for homes that use both gas and electricity.
Source: American Community Survey, 2006 Retrieved from Data Ferret February 2008

It is possible to use this data to make some inferences about approximate energy use for these new single-family homes. According to the Energy Information Administration's (EIA) State Energy Profiles, Kentucky had an average rate of $.0543 per kWh for electricity and a rate of $13.75 per 1000 cu ft of natural gas in 2006 (See *Table 15*).

State Energy Profiles – Kentucky

Table 15

Gas Prices (2006 average)	$13.75/1,000 cu ft
Electricity Prices (2006 average)	$.0543/kWH
Average Electricity Prices 2000-2005	.0603/kWh
Average Gas Prices 2000-2006	$10.30/thousand cu ft

Source: Energy Information Administration, State Energy Profiles, 2007

Given while there has been a slight upward trend in these prices in recent years, month to month fluctuations could make season-sensitive calculations very difficult. Therefore, we took the averages of these prices from 2000-2006 to make the calculations. The averages over these time periods are as follows: $.0603 per kWh (rounded to $.06) of electricity and $10.30 per thousand cubic feet of natural gas (See *Table 15*). Making some simple calculations indicate that the average single-family home in Kentucky (built post-2000) consumes the following amounts of energy: 23,700 kWh annually of electricity and 54.40 thousands of cubic feet in natural gas annually. Translating this into Btu's reveals the following calculations and estimations: 81 MMBtu in electricity and 56 MMBtu in natural gas per home for a total of 137 million Btu per home built in Kentucky from 2000-2006 (See *Table 16*).

Natural Gas Consumption per New Single-Family Home in Kentucky

Table 16

Average Annual Electricity Cost	$118.20*12 = $1418.40
Average Monthly Electricity Usage in KWh using average price	$118.50/$.06 = 1975 KWh

Annually in kWh (using average prices):	1975 KWh*12= 23,700 KWh	1 kWh = 3413 BTU
Average Annual Electricity usage in BTU	23,700 KWh *3413 = 80,888,100 BTU	
Average Annual Gas Cost	$46.70*12 = $560.40	
Monthly Gas Usage in 1,000s of cubic feet	$46.70/$10.30 = 4.5334	
Annual Gas Usage in 1,000s of cubic feet	4.5334*12= 54.4008	1 cu ft=1031 BTU
Annual Gas Usage in BTU	54.4008*1031*1000= 56,087,224.8	56 million BTU annually
TOTAL BTU ENERGY USAGE	80,888,100+56,087,225 = 136,975,325	Approximately 137 million BTU

Important to note here is that this estimate is likely high for several reasons. Most at cause for the inflated estimates is a problem that is inherent to most census data – the error that occurs as a result of self-reporting. For example, when respondents are asked what their average monthly gas expenditures are, they are likely to overestimate and give a figure which includes all taxes and utility fees. However, with no real source to turn to for Kentucky-specific new home energy use, this data is the best available at this level and does provide a ballpark estimate of the consumption of these new single-family homes. However, to also provide a more conservative estimate, the national average data is utilized in this section as well.

Although the ACS data is an imperfect approximation of average new single-family home energy usage, it provides a good estimate that can be used to infer some potential savings. Revisiting the data on ENERGY STAR qualified new homes will provide sufficient data to make some conservative estimates on potential savings if more new homes were built ENERGY STAR qualified. According to the ENERGY STAR program, a new home must be at least 15 percent more energy efficient than the 2004 IRC. Kentucky currently uses the IECC 2000 for the residential sector. Differences in the 2000 IECC and 2004 IRC do exist, however, determining the exact nature of these changes on the energy consumption of homes is beyond the scope of this guide. It can be assumed that this will only work to reduce the potential savings calculations as the 2004 IRC will likely produce more energy efficient homes than the 2000 IECC. Furthermore, by using a straight 15 percent energy consumption reduction, these estimates will be underestimated and conservative. However, they will represent the minimum possible energy and money savings for the state of Kentucky for an increased percentage of new homes being built ENERGY STAR qualified.

Using our estimate calculated from ACS data that the average new home in Kentucky uses 137 Btu annually, a 15 percent reduction would mean that the ENERGY STAR qualified homes would use 116.5 Btu annually. Again, it is important to recognize that this number will be underestimated. With an ENERGY STAR qualified home, by definition, being at least 15 percent more efficient than the 2004 IRC (not the current Kentucky building code, which is older and potentially less energy efficient), more savings may be realized through an increase in new homes constructed in this manner.

Using permits issued in 2006, a total of only 809 homes were built that were certified ENERGY STAR qualified in Kentucky that year. . Important to note here is that these figures are for permits authorized in 2006 and does not reflect only completed and occupied homes. Using the figures tallied above implies that these new single-family homes would have used approximately (137 MMBtu * 12,687) + (116.5 MMBtu * 809) = 1,832,367.5 MMBtu or approximately 1.8 trillion Btu in 2006. If Kentucky had been able to get up to the national average for ENERGY STAR qualified homes (currently at 10 percent) the new energy use would have been as follows: (137 MMBtu * 12,146) + (116.5 MMBtu * 1350) = 1,821,277 MMBtu. This represents a savings of 11,090.5 MMBtu annually in Kentucky power usage that could be attained just by reaching the national average in proportion of new ENERGY STAR homes.

In addition to these savings, future savings will be realized as well given that constructing homes in this manner will enable energy savings over the course of many years to come; these qualified homes will use less energy each year than the non-qualified homes. Taking these estimates further and calculating a more aggressive 100 percent of newly built homes being ENERGY STAR qualified reveals the following minimum potential savings: 1,832,367.5 - (116.5 MMBtu * 13496) = 260,083.5 MMBtu annually (See *Table 17*).

BTU Savings From ENERGY STAR Qualified Homes
Using Kentucky American Community Survey Data*

Table 17

	Usage by Non-ENERGY STAR homes built post 2000	**Energy Use Savings assuming minimum of 15% reduction in energy use, 100 percent of homes were ENERGY STAR qualified**	**New Energy Use if all were ENERGY STAR qualified**
	1,738,119	396,514.8	1,572,284
BTU Energy Use at Current Scenario of 6% ENERGY STAR Homes	1,832,367.5		
BTU Savings at 100% ENERGY STAR Qualified	260,083.5		
BTU Energy Use at 10% ENERGY STAR Homes	1,821,277		
BTU Savings at 10% ENERGY STAR Qualified	11,090.5		

**These calculations assume an Energy Star Qualified Home has the same locational, size and utility inclusion characteristics of a non-energy star qualified home.*
Sources: American Community Survey, 2005 and ENERGY STAR, ENERGY STAR Qualified Home Partners in Kentucky, 2007

Although these initial estimates for savings may not seem to be immense, they are relatively easy to obtain and, given the fact that Kentucky falls into the below-average category for newly built ENERGY STAR qualified homes as compared to the rest of the nation, it is an area that can be greatly improved upon. Furthermore, these savings estimates will be vastly underestimated as a result of the lack of data in some areas and the reliance upon less than ideal data. Many ENERGY STAR qualified homes already receive a federal tax credit so the addition of a Kentucky state tax credit should help the state rise to the national average. The builders in Kentucky that already participate in this program can be encouraged to rise to the 100 percent level of new homes constructed rate with the use of a state tax credit for builders.

National Average Data Usage

In addition to the use of Kentucky ACS data, calculations were made using national average energy use data. According to the ENERGY STAR program, a conservative average for new single-family home energy use is 90 MMBtu annually. This is relatively consistent with the EIA regional residential energy usage data as well. Using this figure to calculate savings in much the same way provides a more conservative estimate of minimum savings by encouraging and increasing the participation in the ENERGY STAR qualified new home program. These calculations will again use the minimum efficiency increase of 15 percent over the 2004 IRC. These calculations will have the same assumptions and limitations as outlined above. Although not a perfect measure, these estimates will provide a general idea of potential savings through an increase in ENERGY STAR qualified new homes. It will be assumed that the average new ENERGY STAR qualified home will use 76.5 MMBtu annually instead of the 90 MMBtu indicated by the ENERGY STAR national data. Calculations follow using this assumption.

CURRENT STATUS: (809* 76.5) + (12687 * 90) = 1,203718.5 MMBtu or approximately 1.204 trillion Btu current use by the 2006 built single-family homes. Assuming Kentucky was able to reach the national average of 10 percent the new energy usage would be: (12146* 90) + (1350 * 76.5) = 1,196,415 MMBtu or approximately 1.196 trillion Btu. This represents a savings of 7303.5 MMBtu annually over the current status of new homes. Again, projecting to 100 percent of new homes being built ENERGY STAR qualified will reveal the following calculations: (13,496 * 76.5) = 1,032,444 MMBtu use. This represents a savings of 1,203,718.5 MMBtu – 1,032,444 MMBtu = 171,274.5MMBtu annually. These numbers can be considered to be the absolute minimum amount of savings achievable through an incentive program directed at increasing the number of newly built ENERGY STAR qualified homes (See *Table 18*).

Calculated Btu Savings for New Single-Family Homes in Kentucky – 2005

Table 18

2005 Building Permits in Kentucky (single-family homes)	13,496
6% ENERGY STAR qualified	809
National Energy Use averages (90 M Btu per house) for Non-ENERGY STAR Homes	(13,496-809) * 90 = **1,141,830 Btu** Used TOTAL by Non-ENERGY STAR Homes (809*76.5) = **61,888.5 Btu** Used TOTAL by ENERGY STAR Homes (6%) 1,141,830+61,889= **1,203,719 Btu** TOTAL
100% ENERGY STAR Consumption (assuming a 15% [from ENERGY STAR site statement of minimum requirements] reduction in energy use compared to new homes)	13,496 * (90*0.85) = **1,032,444 Btu**
ANNUAL SAVINGS	**171,275 Btu**
10% of new homes, ENERGY STAR Qualified Homes use (BTU)	(13,496*.10) * 76.5 = **103,244.4 Btu**
90% non-ENERGY STAR Qualified Homes use (Btu)	(13,496* 0.90) * 90 = **1,093,176 Btu**
Btu SAVINGS (Over status quo)	**7,298.6 Btu**

Reiterating the point that these figures are all underestimated and absolute minimums reveals that Kentucky could have a long-term impact on energy use in the residential sector by promoting the increase in ENERGY STAR qualified homes being built in Kentucky. This incentive would complement the federal incentive available under the Energy Policy Act of 2005 and would work to bring Kentucky up to the national average in terms of energy efficiency in new homes. Implementing this program would have long-term impacts upon the residential sector with real benefits in terms of energy and monetary savings.

ENERGY STAR Appliance Income Tax Deduction and/or Sales Tax Exemption

Approximately 31 percent of energy use in homes in the U.S. is from lighting and appliances (EIA, 2001). Having drawn lessons from other states and scholars about the importance and potential benefits that can accrue as a result of piggybacking incentives, this section will outline potential savings for an increased consumer use of ENERGY STAR appliances

The ENERGY STAR program publishes the percentage of appliance sales in each state that is an ENERGY STAR appliance. *Table 19* summarizes 2005 ENERGY STAR appliance sales in Kentucky. It also details the regional percentages and the national percentages for comparison's sake.

ENERGY STAR New Appliance Sales in Kentucky – 2005

Table 19

	Kentucky	Regional (Lower Midwest: AR, KS, KY, MI, OK, TN)	National	Difference at National Scale (KY minus Nat'l)	Difference at Regional Scale (KY minus Reg)
Dishwasher	72.62%	77.44%	82.02%	-9.40%	-4.82%
Refrigerator	22.15%	25.99%	32.98%	-10.83%	-3.84%
Air Conditioner	53.84%	49.27%	52.12%	1.72%	4.57%
Clothes Washer	32.02%	31.08%	36.45%	-4.43%	0.94%

Note: Percentages indicate the percentage of the total sales of these items that were ENERGY STAR appliance sales.
Source: ENERGY STAR, 2006

As can be seen from the table above, Kentucky does reasonably well in air conditioner sales, actually buying more efficient units than the regional and national averages. However, in terms of dishwasher, refrigerator, and clothes washer sales, Kentucky does not do as well and is consistently, with the exception of clothes washers, falling below both the national and regional averages. *Table 20* outlines Kentucky's ENERGY STAR appliance sales in the last five years:

Kentucky ENERGY STAR Appliance Sales

Table 20

	2004	2003	2002	2001	2000
Dishwasher	77.75%	63.61%	43.37%	21.00%	8.02%
Refrigerator	26.53%	18.23%	18.04%	15.23%	23.61%
Air Conditioner	27.91%	9.62%	25.79%	4.96%	18.41%
Clothes Washer	17.75%	12.85%	8.42%	4.77%	6.06%

Source: ENERGY STAR, 2005 ENERGY STAR Qualified Appliance Retail Sales Data, 2006

Trends seem to indicate that Kentuckians are averaging more appliance purchases in the ENERGY STAR appliance category over the last several years. This is likely a result of an increase in supply of such units and an increased awareness of the benefits. However, a great amount of room for improvement exists.

If, through an incentive, Kentucky can further encourage purchases and increase the sales of ENERGY STAR appliances, then some real benefits can accrue. In the following section, the potential savings are detailed along with methodology and assumptions.

Potential Savings through Increased Purchases of ENERGY STAR Appliances

As with the previous calculations, data availability is often a problem when trying to determine the potential savings that can accrue from the switch to a more energy efficient product. However, it is possible to make some strong inferences about three appliances and the potential savings for Kentuckians buying these appliances using secondary data sources. These appliances are *dishwashers*, *clothes washers*, and *refrigerators*. Although it would be ideal to include *air conditioners* in these calculations and in the potential for energy efficiency in Kentucky, data are simply not available to include this particular appliance. The first step in calculating potential savings is determining approximately how many of these appliances currently exist in the state. Drawing from a secondary data source, it is possible to come up with a good estimate of the numbers of appliances in Kentucky's households. Specifically, in 2001, the EIA produced a report detailing the connection between household incomes and the presence or absence of certain appliances. It is possible to use these national projections at the state level drawing on census data to determine the approximate number of these appliances that exist within the state.

Household Income and Appliances in Kentucky

According to the 2000 U.S. Census, there were approximately 1,591,739 households in Kentucky (U.S. Census, 2000). The income breakdown of these households is detailed in *Table 21*.

Kentucky Households by Income Level 2000

Table 21

Total Households	1,591,739
Household Income:	
Less than $15,000	354,669
$15,000-$29,999	359,736
$30,000-$49,000	366,926
$50,000-$$74,999	274,530
Over $75,000	235,878

Source: U.S. Census, 2000, Data Set: DP-3

Table 22 demonstrates the EIA indication of the relationship between household income and appliance ownership. Each row represents an income grouping as is divided above. The percentages are from the EIA 2001 report on what percentages of certain incomes groups own certain appliances. The absolute numbers are the author's calculations of the estimated number of those appliances in Kentucky, given the number of households in each income category.

Household Income and Appliance Ownership

Table 22

Income Bracket	Dish-washer	Absolute	Refrigerator	Absolute	Clothes Washer	Absolute	2 or more Refrigerators	Absolute
			99.99%	1,575,821				
Under $15,000	18%	63,840			57%	202,161	6%	21,280
$15,000-$29,999	40%	143,894			72%	259,009	12%	43,168
$30,000-$49,999	55%	201,809			82%	300,879	16%	58,708
$50,000-$74,999	71%	194,916			89%	244,331	22%	60,396
$75,000 or more	83%	195,778			94%	221,725	31%	73,122
	TOTAL	800,239		1,575,821		1,228,107		256,675

Source: Energy Information Administration (EIA), The Effect of Income on Appliances in U.S. Households, 2004

The ENERGY STAR program publishes the average life expectancy for the appliances outlined in this report. According to the ENERGY STAR program, the average life expectancy for a dishwasher is 10 years, a refrigerator is 13 years, and a clothes washer is 11 years. Assuming that these life expectancies are the approximate frequency at which the average household will purchase this appliance, we can make reasonable average annual appliance sales estimates using the households who currently own these appliances. For example, the average consumer who currently owns a dishwasher will likely need to replace it every 10 years given the average life expectancy of that appliance. Not knowing the exact sales figures annually, this estimation can provide some insights useful for this analysis. Drawing on this logic, this study estimates that each year one-tenth of households who currently own a dishwasher will purchase a new one and in 10 years every household who currently owns one would have purchased a new one.

The same logic applies for refrigerators with one-thirteenth of households purchasing a new refrigerator annually and one-eleventh of households purchasing a new clothes washer annually. Although, in reality, the annual sales of appliances will not be as perfectly divided as this study assumes, the logic behind the replacement of these appliances is solid and can be used for this analysis. It is important to note as well that some appliances will surely last longer than these estimates and others will certainly need replacing earlier than these expectancies reported by the ENERGY STAR program. Furthermore, some households who currently do not own these appliances will enter the market- and perhaps others will drop out of the market.

The following table outlines the estimated number of appliance sales in Kentucky in 2005 as well as the percentage of those of which are ENERGY STAR appliances as reported by the ENERGY STAR sales data.

Appliance Sales – Kentucky, 2005

Table 23

	Total Units	Life Expectancy (years)	Annual Sales	Percentage ENERGY STAR	Estimated Absolute Number ENERGY STAR	Estimated Non-ENERGY STAR Sales
Dishwasher	800,239	10	80,025	72.62%	58,113	21,911
Refrigerator	1,832,497	13	140,961	22.15%	31,223	109,738
Clothes Washer	1,228,107	11	111,646	32.02%	35,749	75,897

Source: ENERGY STAR, 2005 ENERGY STAR Qualified Appliance Retail Sales Data, 2006

Using the average amount of energy a typical ENERGY STAR appliance and a comparable non-ENERGY STAR appliance uses can give some estimations of the status quo of energy usage by these three appliances in the residential sector. The following table provides some estimations of the energy usage as referenced by the ENERGY STAR program. Dishwashers and clothes washers are both estimated with a household containing a gas water heater and a household containing an electric water heater.

Typical Appliance Household Energy Usage

Table 24

	Average kWh / year		Therms / year	
	ENERGY STAR	**Non-ENERGY STAR**	**ENERGY STAR**	**Non-ENERGY STAR**
Dishwasher (gas water heater)	150	182	8	11
Dishwasher (electric water heater)	341	413	NA	NA
Refrigerator	442	520	NA	NA
Clothes Washer (gas water heater)	24	53	17	29
Clothes Washer (electric water heater)	243	529	NA	NA

Source: ENERGY STAR, Qualified Appliance Savings Fact Sheets, 2006

According to the EIA, Kentucky's region has a ratio of 5:4 when comparing the number of electric versus gas water heater units. Assuming Kentucky has a similar breakdown allows calculation of a weighted average for these appliances' energy usage. This is outlined in *Table 25* below.

Weighting ENERGY STAR and Non-ENERGY STAR Energy Use

Table 25

Weighted Averages*	**kWh**		**Therms**	
	ENERGY STAR	**Non-ENERGY STAR**	**ENERGY STAR**	**Non-ENERGY STAR**
Dishwasher	257	311	4	5
Refrigerator	442	520		
Clothes Washer	147	320	7	13

**Using the Regional Statistic of 44 percent gas water heaters; 56 percent electric water heaters*
Source: EIA, State Energy Profiles: Kentucky, 2003

With these figures, estimations, and assumptions it is now possible to assess the current status quo of energy use for these three appliances in Kentucky. *Table 26* outlines this current situation of energy use and expenditures.

Current Energy Use and Cost
For Dishwashers (D), Refrigerators (R), and Clothes Washers (C) in Kentucky

Table 26

	Assumed Absolute Number ENERGY STAR*	Non-ENERGY STAR Sales*	kWh Use Total	kWh Cost Using Averages**	1,000/cu ft	Gas Cost Using Averages**	Total Annual Energy Expenditures
D	58,113	21,911	21,749,362	$1,275,600	33,173	$319,124	$1,594,724
R	31,223	109,738	70,864,326	$4,156,192	0	0	$4,156,192
C	35,749	75,898	29,542,463	$1,732,665	119,973	$1,154,140	$2,886,805

* *As estimated in Table 23*
** *As estimated in Table 15*

These figures are calculated using the estimated annual sales of ENERGY STAR appliances versus non ENERGY STAR appliances, the average weighted energy usage of these two types of appliances, and the five year average price of electricity and gas in Kentucky.

A good starting goal for increasing sales of ENERGY STAR appliances is to increase Kentucky's sales to the same level as the national average. This calculation is outlined in the following tables.

Increasing ENERGY STAR Purchases to National Average

Table 27

	Kentucky Current Percentage of Energy Star	National average/ percentage Energy Star	ENERGY STAR Purchases (Using national average percentages)	Non-ENERGY STAR Purchases (using national average percentages)
Dishwasher	72.62%	82.02%	65,636	14,388
Refrigerator	22.15%	32.98%	46,489	94,472
Clothes Washer	32.02%	36.45%	40,695	70,951

Note: Numbers have been rounded
Source: ENERGY STAR, 2005 ENERGY STAR Qualified Appliance Retail Sales Data, 2006

Table 27 outlines the new annual sales required to raise Kentucky to the national average in ENERGY STAR sales. The following table indicates the new energy use for appliances in Kentucky if the state was able to get ENERGY STAR appliance sales up to the national average.

Energy Use and Costs with ENERGY STAR Appliances Bought at National Average Rates

Table 28

Difference kWh (Savings)	Therm Use Total	1000/Cu Ft	Difference in 1000/cu feet	KwH Cost Using Averages	Gas Cost Using Averages	New Total Energy Expenditure
406,242	334,484	32,443	730	$1,251,774	$312,102	$1,563,876
1,190,748	0	0	0	$4,086,355	0	$4,086,355
855,978	1,207,228	117,093	2880	$1,682,462	$1,126,434	$2,808,896

Note: Numbers have been rounded
Source: ENERGY STAR, 2005 ENERGY STAR Qualified Appliance Retail Sales Data, 2006

As is evidenced by the table above, the energy savings are sizable for only a marginal increase in ENERGY STAR appliance sales. The next table demonstrates the potential financial savings (using five-year energy cost averages) for consumers if Kentucky ENERGY STAR sales rise to the level of the national average.

Potential Annual Energy Cost Savings if KY Households Bought ENERGY STAR Appliances at National Rates

Table 29

Appliance	Savings
Dishwasher	$30,848
Refrigerator	$69,837
Clothes Washer	$77,909
TOTAL	$178,594

If Kentucky consumers continue to increase the percentage of ENERGY STAR appliances they purchase annually, it can be expected that these savings will continue to grow until all appliances in Kentucky are ENERGY STAR certified. Fewer than 100 percent market saturation the following new energy uses could be achieved:

Energy Savings Potential at 100 Percent ENERGY STAR Saturation in KY

Table 30

	ENERGY STAR Appliances Sold Annually	kWh Energy Total Use	Therms Use	kWh Cost Using Averages	1000/cu feet	Gas Cost Using Averages
Dishwasher	80,024	20,566,168	320,096	$1,206,205	31,047	$298,672
Refrigerator	140,961	62,304,762	0	$3,654,175	0	.00
Clothes Washer	111,646	16,411,962	781,522.6	$962,562	75,802	$729,215

Note: Numbers have been rounded

At this 100 percent saturation point, the financial and energy savings each year for Kentucky households could be as follows:

Total Energy Cost and Savings from 100% ENERGY STAR Appliance Purchases*

Table 31

	Total Cost for Energy Star (Table 30)	**Total Cost at Status Quo (Table 26)**	**Difference from Status Quo**	**kWh Conserved**	**1000 cu ft conserved**
Dishwasher	$1,504,877	$1,594,724	$89,847	1,183,194	2126
Refrigerator	$3,654,175	$4,156,192	$502,017	8,559,564	0
Clothes Washer	$1,691,777	$2,886,805	$1,195,028	13,130,501	44,171
TOTAL SAVINGS			$1,786,892 Or approximately $1.8 Billion		

**Numbers have been rounded*

As illustrated by the tables and calculations presented in this section of this report, the energy and financial savings that can be achieved through the increased demand and market saturation of ENERGY STAR appliances is substantial. Keeping in mind these estimates are base upon current energy costs and if these costs continue to rise, these savings will be even greater. An initial and seemingly obtainable goal could be to increase the ENERGY STAR appliance sales to that of the national average. Beyond that attainment, Kentucky could work to continue the increase in sales to an eventual 100 percent market presence.

Although only two specific areas of energy efficiency for the residential sector have been reviewed in this section, the levels of greater energy efficiency that can be attained ar substantial;. Both of the areas outlined in this section can work together to achieve some sizable energy and financial savings for states. As more new homes are built across the U.S., it is worthwhile to encourage homebuilders to invest in our collective future through the ENERGY STAR qualified program. As the number of homes increases, it is important that energy efficiency aspects be grounded in these new units. The savings that are being lost by the lack of builder involvement is an unfortunate missed opportunity for many states, including Kentucky. Offering income tax credits or deductions to builders for participating in the ENERGY STAR qualified program can help capitalize on this lost opportunity. The example used in this section, Kentucky, falls into the absolute lowest percentage of ENERGY STAR qualified homes being built, an area where improvement is both necessary and reasonable. Furthermore, Kentuckians enjoy exceptionally low costs per kWH for electricity – underestimating the savings other states with higher energy costs could enjoy.

The second program reviewed in this section was the ENERGY STAR appliance program. Increasing the market saturation of ENERGY STAR appliances would provide sizable benefits for both consumers and local American manufacturers. In fact, these two programs work together in some important ways. Many home builders provide appliances in the new homes they built. By encouraging the purchase of the ENERGY STAR qualified appliances, home builders can use this incentive to build upon the ENERGY STAR qualified new home incentive possibilities outlined above.

The residential sector is an area where energy usage is sizable and energy savings potential is immense. Public entities can help achieve these savings through some combination of education and public incentives to defray any cost differentials that may exist between the more efficient products and the non ENERGY STAR qualified products.

It is important to repeat at this juncture that whatever the incentive offered by a public entity, the state must back the incentive with appropriate education in the implementation process. Without the necessary knowledge, individuals who might have taken advantage of the incentive may be left in the dark.

Funding State Offered Economic Incentives

Public entities need not fund incentives from discretionary funds alone. When tailoring an energy efficient program, it is suggested that the public entity refers to current and potential federal incentives for energy efficiency as a foundation upon which to build a state-wide program (Brown et al., 2002) in order to maximize the savings potential for consumers. Currently, all ENERGY STAR qualified windows and skylights, metal roofs, geo-thermal heat pumps and select doors are eligible for federal tax credits under the Energy Policy Act of 2005. As of this guide's publication, the federal government has been considering a bill that would provide tax credits for energy-efficient technologies that include: efficient new home and building designs, fuel efficient vehicles, select ENERGY STAR appliances, and select energy-efficient HVAC systems. Whether or not Federal support for adoption of newer available technologies is provided, state action could further stimulate construction of ENRGY STAR qualified homes and purchase of ENERGY STAR appliances.

Furthermore, public entities can offer tax incentives without depleting their fiscal capacities by collecting funds for this specific cause. For example, some states offer tax incentives for energy efficient technology funded though various regulatory mechanisms such as utility rates, special tariffs/rate riders, and/or public benefits fees. Public benefits are the most common among states making the transition to energy efficiency because they are an independent fund – one that has not compromised existing funds. Furthermore, a study evaluating the efficacy of public benefit funds revealed that none of the jurisdictions analyzed canceled their funds or projects and several extended them. As far as how effective they are at lowering energy consumption, the same study revealed that they are generating substantial energy savings coupled with cost-effective results. The "estimated benefit/cost ratios range from 1.0 to 4.3 (median in the ~ 2.1 to 2.5 range), and estimates of the cost of conserved energy range from $.023 to $.44/kWh (median = $0.03/kWh)" (Kushler, et al., 2004).

Public benefit funds are revenues collected by the regulated utility industry. The term 'public benefits' is synonymous with system benefits, public benefits funds, system benefits charge and public goods charge (Kushler, et al., 2004). Public benefits funds are developed by legislation through a fee levied on electricity distribution services (or any regulated utility industry) that cover the cost of programs promoting energy efficiency technology implementation. This fee cannot be avoided; it is a surcharge on everyone's utility bill and is expressed as a "mills per kilowatt-hour," mill meaning one-tenth of a cent (Kushler, et al., 2004). By increasing the cost of the power, the fee also increases incentive for the consumer to reduce energy consumption. However, this type of surcharge may place an undue burden on the poor, so some funds generated might have to be diverted to serve income equity objectives. An alternative to this method of collection is a flat monthly fee on everyone's utility services bill (Kushler, et al., 2004). According to the American Council for an Energy-Efficient Economy, 20 states have active public benefit funds with a total value of $1.7 billion.

Identifying funding sources for energy efficiency programs and properly marketing the programs are perhaps the most important factors in determining success. The greatest barrier to state-funded incentives is the lack of funding for implementation. Without the proper budget for implementation, the project runs the risk of starting off on the wrong foot – that is, without proper marketing. If consumers are unaware of the incentive, the program will falter. It is equally important to establish a cap for the incentive if tax breaks or other subsidies are provided if the funds available to support them are limited, so that it does not become viewed in a negative light by the implementing agency or (Brown et al., 2002).

In general, public incentives help to promote participation in energy efficiency programs by:

- helping to alleviate the initial cost burden of purchasing energy efficient products;
- making the efficient products more competitive with low-cost inefficient ones;
- Increasing experience with energy efficient products thereby reducing consumers' aversion to unfamiliar products;
- exposing energy-efficient products to consumers who might have otherwise remained unaware of their availability; and

Various incentives have been implemented alone, and in combination, nationwide.
The primary conclusion from reviewing existing state energy efficient programs is that there is not a single "correct approach" to adopt. While several states have had varying degrees of success with a variety of economic incentives for use within their energy efficiency policies – the key to success has been that each state must evaluate their individual needs, resources, strengths and weakness and then design a policy and economic incentive program that is individually tailored around that set of factors (Kushler, et al., 2004).

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