Energy Efficiency: Georgia's Highest Priority

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Energy Efficiency White Paper

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The 2006 report of the Governor's Energy Policy Council states: "The Council recommends as its highest priority that Georgia should aggressively pursue all cost-effective energy efficiency opportunities."[1] In a November, 2008 letter to State utility regulators, the Edison Electric Institute and the Natural Resources Defense Council write "While the market and today's codes and standards drive energy efficiency investment to a certain degree, utilities and regulators must work more aggressively to take it to the next level."[2] Energy efficiency is the cheapest and cleanest way to enhance electric power supply in Georgia. Like Ben Franklin's admonition that a penny saved is a penny earned, a kilowatt-hour (kWh) saved is a kilowatt-hour produced.

> *Georgia should aggressively pursue all cost-effective energy efficiency opportunities*
>
> *- Governor's Energy Policy Council*

In the past two years, three large electric power plants have been proposed for Georgia. A consortium of 10 electric membership corporations (EMCs) has proposed building an 850-megawatt coal plant in Washington County about 125 miles southeast of Atlanta and the owners of Vogtle Electric Generating Plant located near Waynesboro just south of Augusta, including Georgia Power, Oglethorpe Power, the Municipal Electric Authority of Georgia and the City of Dalton, have proposed expanding the plant by adding two 1,100-megawatt nuclear power plants. In addition, LS Power Energy Associates plans to build a 1200-megawatt coal plant in Early County some of whose power may be sold out of state. Construction of power plants would drain capital away from more cost effective, environmentally preferred alternatives, and would result in fewer jobs than comparable investments in energy efficiency and renewable energy[3].

This report shows that by investing up to $5,400 on low-cost energy efficiency measures in Georgia's existing single-family homes and up to $2,500 on single-family homes constructed over the next ten years, 15 million megawatt-hours (MWh) of cost-effective annual energy savings is available. By aggressively pursuing these cost-effective energy efficient measures, as well as equally attractive opportunities in commercial and industrial buildings, Georgia could potentially delay or eliminate the immediate need for new electric generating facilities. Furthermore, the estimated cost of implementing these efficiency measures is one-half to one-third the cost per kilowatt-hour of the energy produced by new coal or nuclear power plants. These energy efficiency investments will pay for themselves in 6.5 years in existing homes and 3.5 years in new homes.

Energy efficiency saves water—in Georgia approximately 0.8 gallons of water is required to produce one kilowatt-hour of electricity from coal and nuclear energy[4]. Since Georgia imports nearly all of its energy resources, investments in energy efficiency strengthen our state's economy and create good-paying jobs that cannot be exported. Improving the energy efficiency of buildings is particularly important in addressing climate change. According to the U.S. Energy Information Administration, 48 percent of U.S. greenhouse gas emissions are due to buildings.

Calculating the Opportunity for Energy Efficiency

Georgia currently has approximately 3,160,000 single-family homes. To model the energy savings for this analysis, two-thirds of the total homes are assumed to be in the northern, Atlanta weather zone and the rest in the southern, Macon weather zone. According to 2006 census data estimates, 60 percent of these homes are heated with gas[5]. The homes were divided into three age groups roughly coinciding with changes in building patterns. These age groups and their energy features are listed in Table A1 in Appendix A.

RemRate software version 12.5 was used to model the energy saved from a series of proven efficiency upgrades to these homes. Table A2 in Appendix A lists these upgrades and their estimated cost as part of a large-scale home energy upgrade program. Upgrade costs range from $5,400 for older homes to $2,100 for newer homes. Significantly more energy could be saved in these homes if inefficient windows and heating and cooling equipment were replaced with more efficient units. However, neither replacement of equipment nor windows was considered to keep the upgrade costs below a threshold of about $5,000 per home.

Since heating and cooling equipment typically has a useful service life of approximately 15 years, a certain percentage of homes could be expected to replace equipment over the next ten years. Upgrading the efficiency of replacement equipment is highly cost effective. The additional energy savings potential from upgrading the efficiency of replacement heating and cooling equipment is estimated in this report but not included in potential savings.

New housing starts have averaged between 60,000 and 90,000 units per year in Georgia the past few years. With the recent downward trend in housing starts, a conservative 60,000 units per year is assumed. So, in 10 years 600,000 new homes are estimated to be built in Georgia. Table B1 in Appendix B lists the code compliant energy features of these homes, the upgrade features modeled and the estimated incremental cost of incorporating these features in new homes. Additional cost for the upgrade features for new homes was estimated to be about $2,100 for an all electric home and $2,600 for a home with natural gas.

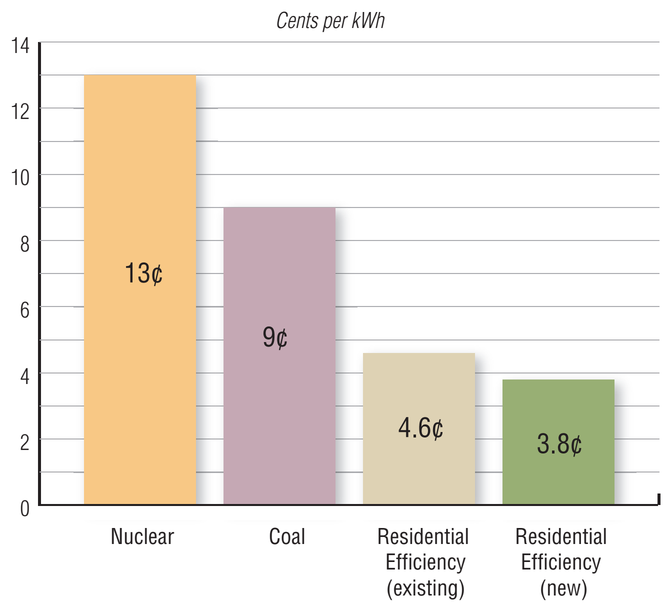
Analysis

1. Cost Savings from Energy Efficiency Measures

To determine costs of the energy savings measures that can be compared to the cost of new coal and nuclear power plants, the total cost of all upgrades was divided by the total electricity saved in 15 years for the all-electric homes. Figure 1 shows the costs expected from new nuclear and coal power plants[6] and the costs of energy efficiency calculated in this study.

The cost of electricity from nuclear and coal plants includes capital, fuel, operation and maintenance, and transmission and distribution costs. Energy efficiency can deliver energy savings at approximately 3.8 cents per kWh for new homes and 4.6 cents per kWh for existing homes or one-third to one-half the cost of electricity from new coal and nuclear plants. Marketing and administration costs could add 15 percent to the cost of energy efficiency if part of a large state-wide efficiency program[7]. Note also that the 9 cents per kWh cost of electricity from coal does not include any costs of reducing CO_2 emissions or paying for CO_2 emissions allowances. These costs may add 2 to 6 cents per kWh to the future cost of electricity from a coal plant[8]. Homes heated with natural gas also save at the rate of 50 cents per therm. Current natural gas rates are about $1.00 per therm.

Figure 1. Estimated costs per kWh of new nuclear, coal[6], and energy efficiency in single-family homes in Georgia.



2. Annual Savings to Homeowners

Table 1 shows the annual amount of energy cost savings to homeowners in the northern Atlanta region of Georgia based on the age of the house and type of fuel used for heating. These savings are from implementing the package of low-cost energy efficiency upgrades listed in Appendix A for existing homes and Appendix B for new homes. Older homes see the greatest savings and will have energy bills reduced by 30 percent from the energy efficiency measures applied to them. On average the energy efficiency upgrades applied had annual cost savings of 30 percent, 16 percent and 14 percent for the older, middle and newer homes respectively. For new homes that will be built over the next 10 years, average cost savings of 17 percent were seen in the all-electric homes compared to homes built to current energy code. New, gas-heated homes show large energy cost savings (about 21%), which includes the savings from installing high efficiency condensing furnaces. Simple payback periods for all energy efficiency upgrade packages range from 4.5 to 6.5 years. Savings for the homes in southern Georgia are similar.

Table 1. Annual energy cost savings to households in Atlanta by house age and heating type.

Home Type	Home Age	Annual Savings ($)	Annual Savings (%)	Annual Savings (kWh)	Annual Savings (therms)
All Electric Home	Older [a]	820	29.7	8,813	
	Mid-Aged [b]	390	15.8	4,098	
	Recent [c]	327	13.8	3,205	
	New	367	16.5	3,765	
Gas Heated Home	Older	942	30.0	3,030	482
	Mid-Aged	453	16.5	2,614	132
	Recent	347	13.5	2,417	87
	New	573	21.1	2,665	238

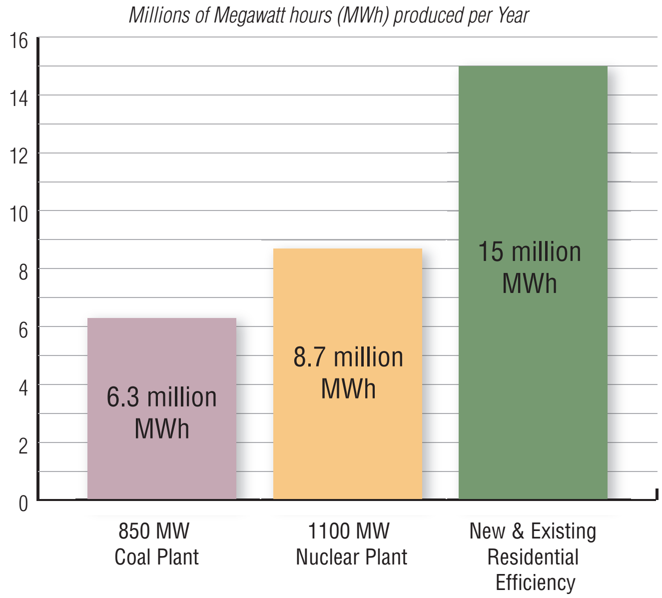
a) 1979 and older; b) built 1980 to 2005; c) built 2006 to present

3. The Potential for Residential Energy Efficiency in Georgia

Figure 2 shows the amount of energy that could be saved each year in Georgia by energy efficiency if the energy upgrades are performed on all existing homes and 600,000 new homes built over the next ten years. Also shown in Figure 2 is the expected output of an 850 MW coal plant and an 1,100 MW nuclear plant. A coal plant will produce 6.3 million MWh, the nuclear plant 8.7 million MWh, and residential energy efficiency 15.0 million MWh per year. This means that residential energy efficiency has the potential to replace the output of two coal plants or nearly two nuclear plants. In addition to electricity saved by these energy efficiency upgrades, 550 million therms of natural gas will be saved.

Note that these savings are due solely to the implementation of energy efficiency measures in single-family residences. In Georgia, residential use (including multi-family) accounts for only 40 percent of electricity consumption[9]. The rest is from the commercial and industrial sectors. Since energy efficiency savings in commercial and industrial buildings is often more cost-effective than in residences, potential savings from energy efficiency could be 2.5 times greater than is presented here if we include commercial and industrial efficiency. In addition, over the next 10 years many existing SEER 10 or lower air conditioners and heat pumps will be replaced as the older units expire. The current minimum federal efficiency standard for new cooling equipment is SEER 13 so all of the replaced units will be more efficient. The energy savings that accrues from these replacements will add approximately 4.75 million MWh per year to the energy efficiency total potential in Georgia. These savings were not included in this analysis.

Figure 2. Energy efficiency potential in single-family homes in Georgia after 10 years.



4. Energy Efficiency Implementation

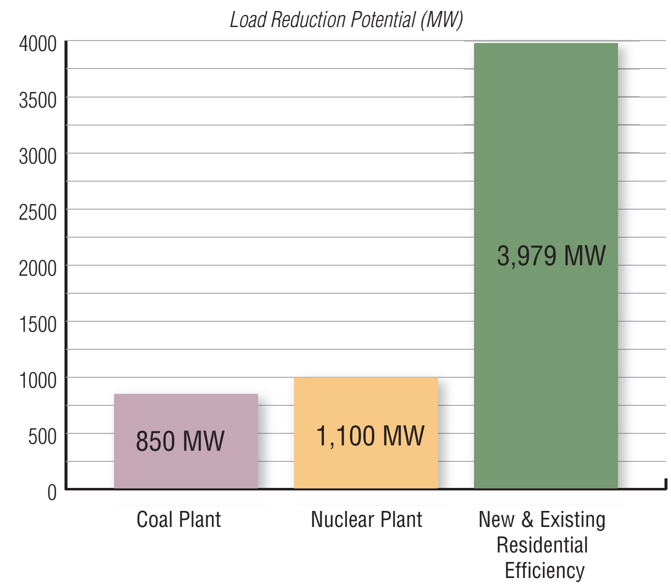
The Governor's Energy Policy Council recommends as its "highest priority that Georgia should aggressively pursue all cost-effective energy efficiency opportunities." If this recommendation is followed, how fast can we expect energy efficiency to be implemented in homes in Georgia? Several utilities in this country have achieved greater than 1 percent per year reductions in electricity sales by implementing aggressive energy efficiency programs. These include Western Massachusetts Electric Co., Southern California Edison, and Connecticut Light and Power, and the City of Burlington[10]. A 2007 Georgia Power study[11] reported that a 9 percent reduction in residential electricity sales could be achieved through aggressively promoting energy efficiency over 10 years.

Residential electricity usage in Georgia was 51 million MWh in 2004[9]. If we assume 52 million MWh per year today, then a 1 percent energy reduction could be achieved if 520,000 MWh is saved each year. This could be achieved from energy efficiency if 3.5 percent of the existing homes and 30 percent of new homes in Georgia are upgraded each year. After ten years over 5 million MWh of electricity and 170 million therms of natural gas could be saved each year in Georgia in single-family residences if energy efficiency is aggressively pursued. By investing $493 million per year plus $74 million per year in program costs into residential energy efficiency, Georgians would be saving $770 million in energy costs each year after 10 years. This represents a tax-free return on investment of nearly 14 percent.

5. The Potential for Reducing Peak Electric Loads

Peak electrical loads in Georgia occur on hot summer afternoons. Utilities build power plants to meet these peak loads. By reducing peak loads fewer power plants need to be built and the average cost to produce electricity can be reduced. Using RemRate software's peak load reduction algorithm, the energy efficiency measures examined were found to reduce a home's peak summer electrical loads by an average of over 30 percent. Efficiency measures in existing homes and in new homes built over the next ten years have the potential to reduce Georgia's peak load by nearly 4,000 megawatts. A summer coincident peak factor of 0.58 was assumed in these calculations based on average values for energy efficiency measures found in the literature[12]. Figure 3 shows the peak load reduction potential of energy efficiency compared to the power output of an 850-MW coal plant and a 1,100-MW nuclear plant

Figure 3. Peak electrical load reduction potential from energy efficiency



Conclusion

This analysis shows that energy efficiency is one-half to one-third as expensive as electricity from new power plants and should be a priority in energy planning and production for Georgia. In setting a realistic goal of reducing residential energy use by 1 percent per year, Georgia's households would save $770 million in energy costs per year in ten years. This would require an investment of $567 million per year in residential energy efficiency and provide a return on investment of nearly 14 percent. The future environmental and health costs of coal and nuclear power further highlight the need to focus on energy efficiency. Energy efficiency creates more jobs than investments in power plant construction and operation. Since Georgia imports all of the fuel for power plants from other states and foreign nations, energy efficiency reduces the export of energy dollars and generates wealth for all Georgia communities. In addition, energy efficiency protects Georgia's valuable water resources.

Energy efficiency is one-half to one-third as expensive as electricity from new power plants

Appendix A

Existing Single-Family Characteristics and Energy Upgrades Applied

Table A1. Characteristics of existing single-family housing stock in Georgia modeled

	Built 1979 or before	Built 1980 to 2005	Built 2006 to present
# of houses	1,300,000	1,604,200	256,000
Size	1,800 sq ft	2,200 sq ft	2,500 sq ft
Windows	single pane	double pane	double pane low-e
Infiltration (cfm50)	4,000	3,500	3,000
Duct Leakage (cfm25)	300	250	200
Ceiling insulation	R-11	R-19	R-30
Wall insulation	none	R-11	R-13
Floor to crawl insulation	R-11	R-19	R-19
A/C efficiency	SEER 9	SEER 9	SEER 12
Furnace efficiency	75 percent	75 percent	80 percent
Heat pump heating efficiency	HSPF 6.8	HSPF 6.8	HSPF 7.7

Table A2. Efficiency upgrades modeled in RemRate by existing housing age and upgrade cost as part of a large-scale upgrade program

Energy Efficiency Measure	Built 1979 or before		Built 1980 to 2005		Built 2006 to present	
	Applied	Cost	Applied	Cost	Applied	Cost
Duct & envelope sealing	X	$750	X	$750	X	$750
R-30 attic insulation	X	$900	X	$750		
R-13 wall insulation	X	$2,500				
Radiant barrier in attic	X	$450	X	$450	X	$450
50 percent of lights replaced with CFLs	X	$60*	X	$60*	X	$60*
R-5 water heater jacket	X	$30	X	$30	X	$30
Refrigerator, dishwasher, and clothes washer upgraded to ENERGY STAR	X	$500	X	$500	X	$500
A/C & heat pump tune-up	X	$500*	X	$500*	X	$500*
Total Cost		$5,410		$2,760		$2,010

** present value of 15-year expense*

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Appendix B

New Single-Family Characteristics and Energy Upgrades Applied

Table B1. Characteristics of new single-family housing in Georgia modeled

	Built 2008 to 2018	Upgrade	Incremental Upgrade Cost	
# of houses	600,000		Gas	Electric
Size	2,500 sq-ft			
Windows	double pane low-e U: 0.38; shgc: 0.38	none		
Infiltration (cfm50)	3000	2250	$200	$200
Duct Leakage (cfm25)	200	100	$100	$100
Ceiling insulation	R-30	R-30 + Radiant barrier	$200	$200
Wall insulation	R-13	R-13 + R-3 continuous	$500	$500
Floor to crawl insulation	R-19	none		
A/C efficiency	SEER 13	SEER 14	$250	$250
Furnace efficiency	80 percent	92 percent	$650	
Heat pump heating eff.	HSPF 7.7	HSPF 8.0		$200
Appliances	Conventional	ENERGY STAR	$500	$500
Water Heater	EF=0.58 gas; EF=0.90 electric	EF=0.63 gas; EF=0.93 electric	$150	$150
Lighting	Incandescent	50 percent lights CFL	$30	$30
Total Cost			$2,580	$2,130

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