State of Energy and Climate in Maine
State of Energy and Climate in Maine 2008

Samantha Buck, Megan Saunders, and Lewis Seton

Executive Summary

Climate change is an important environmental issue worldwide. Expected impacts of climate change in Maine include rising sea levels, shorter ski seasons, more extreme winter storm events, and a loss of biodiversity. Maine's residential energy use emits substantial amounts of greenhouse gases into the atmosphere, contributing to climate change. We explore the state's residential heating and electricity use by looking at sources, use, prices, poverty, housing stock age, government policies, and greenhouse gas emissions. To do so, we conducted a literature review, interviews, and analyses using Geographic Information Systems (GIS). Mainers are more dependent on fuel oil than any other state in the US. At the same time fuel oil prices are increasing. Northern Maine has high poverty rates and Maine has an old housing stock. All of these factors leave Maine residents highly vulnerable to price shocks. We conclude that Maine has effective policies addressing residential electricity use and the resulting carbon dioxide emissions, but does not have effective policies directed at home heating use.

Introduction

History and Context

Global climate change is the defining environmental issue of our time. Caused by the buildup of greenhouse gases in the atmosphere, the changing climate has been linked to an increase in extreme weather events, the spread of infectious diseases, the loss of biodiversity, and a rise in sea levels. The root of global warming is largely man-made, stemming from a reliance on fossil fuels for our energy needs (IPCC 2007).

In addition, energy use is increasing worldwide and this trend is expected to continue into the future. Growing economies, especially in Asia, have recently increased energy consumption in all sectors. High energy use contributes to rising greenhouse gas emissions worldwide (WRI 2007).

Across the country, energy use, especially in households, is increasing (IEA 2007a). Residential energy use has environmental impacts, especially with regards to climate change (IPCC 2007). In the United States (US), greenhouse gas emissions come primarily from the combustion of fossil fuels for energy use (EIA 2008a). In addition, concerns over energy prices, use, and emissions are growing at the national and state level. These issues are especially pressing in colder regions of the nation, which require substantial energy inputs for home heating.

Relevance to Maine's Environment

In Maine, residential energy is the second highest energy-consuming sector in the state, falling slightly behind industry (EIA 2008b). Because of its relative size, residential energy consumption has a significant environmental impact in the form of greenhouse gas emissions. Currently, the state emits close to six million tons of carbon dioxide each through electricity generation and residential heating (US Census Bureau 2000, EIA 2002, Elder et al. 2007, RGGI 2008). In Maine, climate change is predicted to cause more extreme winter storms, erode the coastline through rising sea levels, shorten the ski season, and threaten biodiversity with extinction through species' range shifts.

Focus of the Chapter

There are two separate components to residential energy use: home heating and electricity. In this chapter we consider residential heating as space heating in homes and household electricity, particularly for appliances, as a separate category.

We explore current and historical trends in both home heating and residential electricity use. We study current use, affordability, and the emissions of each type of energy use, looking first at home heating and second at residential electricity use. Current use examines recent trends in energy consumption and sources. Affordability explores trends in prices, as well as factors such as poverty, housing stock, and social services programs to determine the true cost of home heating and residential electricity use. Emissions looks at the impact of residential heating and electricity consumption on the climate. We discuss three possible scenarios for the future of energy use in Maine. We conclude with our recommendations to direct the state towards a more sustainable future.

Laws

Household electricity and heating consumption are regulated through federal and state laws. These laws define standards that are important for safety, health, and energy conservation. Additionally, Maine has made greenhouse gas emissions a politically important issue through state laws and actions.

Federal Laws

Table 1.1 summarizes federal laws related to home electricity use, home heating, and energy supply. Consumer rights in federal laws are protected through regulations preventing utility monopolies. Additionally, the federal government attempts to protect consumers through social services programs managed through individual states. There are no federal laws regulating or directly related to greenhouse gas emissions, but renewable energy production is promoted for energy independence reasons by several laws.

<p>| Table 1.1 Federal laws relating to residential energy use, residential space heating, and renewable energy. |</p>
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<thead>
<tr>
<th>Law</th>
<th>Year</th>
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<tbody>
<tr>
<td>Public Utility Holding Company Act (PUHCA)</td>
<td>1935</td>
<td>Prevents monopolies of utility companies and protects the consumer from high prices.</td>
<td>USC Title 15 Chapter 2C §79 -79z-6</td>
</tr>
<tr>
<td>Natural Gas Act</td>
<td>1938</td>
<td>Gives FERC authority to set rates for transmission of natural gas in interstate commerce.</td>
<td>Pub. L. 75-688</td>
</tr>
<tr>
<td>Energy Policy and Conservation Act</td>
<td>1975</td>
<td>Set appliance efficiency targets.</td>
<td>USC Title 42 Chapter 77 §6201-6422</td>
</tr>
<tr>
<td>Department of Energy Organization Act</td>
<td>1977</td>
<td>Created the United States Department of Energy.</td>
<td>USC Title 42 Chapter 84 §7101-7386k</td>
</tr>
<tr>
<td>Public Utility Regulatory Policies Act (PURPA)</td>
<td>1978</td>
<td>Promotes renewable energy and energy conservation, improves utility distribution.</td>
<td>USC Title 16 Chapter 45 §2601-2645</td>
</tr>
<tr>
<td>Natural Gas Policy Act</td>
<td>1978</td>
<td>FERC has authority over gas production. Established price ceilings for natural gas.</td>
<td>USC Title 15, Chapter 60, §3301-3432</td>
</tr>
<tr>
<td>Natural Gas Wellhead Decontrol Act</td>
<td>1989</td>
<td>Removed all price ceilings for natural gas.</td>
<td>USC Title 42 Chapter 91 §8201-8287d</td>
</tr>
<tr>
<td>Energy Policy and Conservation Act Reauthorization</td>
<td>2000</td>
<td>Northeast Home Heating Oil Reserve creates oil reserve to stabilize price and ensure supply.</td>
<td>USC Title 42 Chapter 134 §13201-13574</td>
</tr>
<tr>
<td>Energy Policy Act</td>
<td>2005</td>
<td>Repealed PUHCA and created a new PUCHA. Provides funding for certain renewable energy projects. Promotes expansion of current energy production.</td>
<td>USC Title 42 Chapter 134 §13201-13574</td>
</tr>
</tbody>
</table>

**Utility Regulation**

In 1920, the Federal Power Act created the Federal Energy Regulatory Commission (FERC). FERC regulates electricity, oil, and natural gas distribution among states. In Maine, FERC is actively involved in permitting and regulating hydropower dams, because hydroelectric facilities generate around 30% of Maine’s electricity (MPUC 2008a). Additionally, FERC provides licensing to energy sources such as natural gas (FERC 2008b). In 1938, Congress passed the Natural Gas Act which gave FERC the authority to set rates for transmission of interstate natural gas. Furthermore, it allowed FERC to issue permits letting companies charge customers for a percentage of the pipeline construction costs (Pub. L. 75-688 1938). Maine receives the majority of its natural gas from out-of-state sources and these rates are therefore regulated by FERC (EIA 2008c).

In 1978, FERC gained further control over natural gas production and distribution when the Natural Gas Policy Act was passed. This Act granted FERC the authority to regulate intrastate natural gas production, in addition to interstate transmission. It also established natural gas price ceilings (EIA 2005b). As a result, FERC has authority over all natural gas production and sale in the state of Maine.
Utility companies were also regulated from 1935 to 2005, by the Public Utility Holding Company Act (PUHCA). The Act was intended to protect consumers by preventing unnecessarily high energy prices that could result from monopolies. PUHCA was also designed to stabilize often volatile energy prices. The Energy Policy Act of 2005 revised PUHCA to give FERC the right to access utility company records. At the same time, the Energy Policy Act also increases funding for certain renewable energy projects and expands oil, coal, and nuclear energy generation. In addition, the act encourages utilities to improve and increase generation and transmission infrastructure (Lookadoo 2008, Public Citizen 2005).

Consumer Protection

The federal government has created multiple social services programs attempting to help citizens who cannot afford their heating or electricity needs. In 1976, the US Department of Energy (DOE) founded the Weatherization Assistance Program (WAP) (DOE 2008b). The program is run by individual states and DOE provides funding and technical assistance. WAP implements energy efficiency measures in low-income homes to reduce energy bills, providing savings to millions of families (DOE 2008d).

Meanwhile, in 1981, the federal government established the Low Income Home Energy Assistance Program (LIHEAP), a program to provide low income families with financial assistance for the purchase of heating and electricity. Congressional funding is distributed annually through states, who then distribute funding to homeowners (DOE Information Administration 2008). The state government implements this program through the Maine State Housing Authority (MSHA) (DHHS 2008).

The federal government found that citizens in the Northeast required a greater safety net against unstable heating prices than previous programs could provide. Therefore, in 2000, the Energy Policy and Conservation Act created the Northeast Home Heating Oil Reserve. This reserve was meant to provide a more stable supply and price of oil for the millions of customers in the Northeast region (DOE Information Administration 2008).

In addition to these laws, federal courts have influenced the energy policy affecting consumers. The court case New Hampshire v J.C. Oliver Enterprises was determined in 2000. This case concluded that unless an oil dealer states that prices are subject to change, the dealer must provide the oil at the quoted price (Perkins 2000). Consumers are thus warned that prices are subject to unexpected fluctuations.

Renewable Energy Promotion

Federal laws have attempted to reduce the nation's reliance on foreign fossil fuels by promoting other energy sources, including renewable energy sources, and energy conservation. The Public Utility Regulatory Policies Act (PURPA) of 1978 promotes the construction of renewable energy and cogeneration plants nationwide. Additionally, utilities must interconnect and buy the total amount and capacity offered by qualified facilities, forcing utilities to buy independently produced energy, which is often renewable energy. Congress passed this act in response to the energy crisis of the early 1970s and it represents an attempt to decrease national dependence on foreign energy sources, particularly oil (Union of Concerned Scientists 2008b).

Around the same time, the Energy Policy and Conservation Act of 1975 set non-mandatory energy efficiency targets for appliances (Geller 1995). Later federal laws, such as the National Appliance Energy Conservation Act (NAECA), set mandatory appliance efficiency standards. NAECA requires minimum efficiency levels for 12 types of household appliances, including refrigerators, freezers, furnaces, water heaters, dishwashers, ovens, and clothes dryers (EIA 2005c). These regulations were set to standardize the many state efficiency regulations throughout the nation. NAECA also provides a system to update efficiency standards and to add standards for new appliances (Geller 1995). In addition, the Energy Policy Act of 1992 creates incentives for energy efficiency, especially through building codes. The act provides tax incentives for renewable energy development and increases opportunities for small-scale electricity generation by creating a new electricity producer category. Additionally, the act creates a framework for electricity markets to sell wholesale electricity (EIA 2005a, Kenney 2006).

More recently, the Energy Independence and Security Act of 2007 requires DOE to set new efficiency standards for residential appliances, lighting, and heating equipment (Pub. L. 110-140 2007). It authorizes regional variations in heating standards, provides additional funding for WAP, and requires DOE to begin studying the program's future requirements (Sissine 2007).

State Laws
Table 1.2 State laws relating to residential energy use, residential space heating, and greenhouse gas emissions.

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<td>Unfair Trade Practices</td>
<td>1969</td>
<td>Unfair or deceptive acts or practices in the conduct of any trade or commerce is declared unlawful</td>
<td>MRS Title 5 Chapter 10 § 207</td>
</tr>
<tr>
<td>An Act to Restructure the State’s Electric Industry</td>
<td>1997</td>
<td>Each investor-owned electric utility required to divest all generation assets and business activities. Created 30% renewable portfolio standards.</td>
<td>MRS Title 35-A Chapter 141 §6</td>
</tr>
<tr>
<td>An Act to Establish the Regional Greenhouse Gas Initiative Act of 2007</td>
<td>2007</td>
<td>Binds Maine to stabilizing and reducing greenhouse gas emissions from the power industry to 10% under 2009 levels.</td>
<td>MRS Title 35-A Chapter 317 §3211-A</td>
</tr>
<tr>
<td>An Act to Stimulate Demand for Renewable Energy</td>
<td>2007</td>
<td>Creates a renewable portfolio goal to increase new renewable energy capacity by 10% by 2017.</td>
<td>MRS Title 35-A Chapter 403 §3210-3212</td>
</tr>
<tr>
<td>An Act to Lower Energy Costs and Increase Renewable Energy in Maine</td>
<td>2008</td>
<td>Supports net energy billing, allows utilities to charge more for energy use at peak times, and gives money to state energy efficiency programs.</td>
<td>MRS Title 35-A Chapter 183 §3210-E, §1415-J, §4722</td>
</tr>
<tr>
<td>An Act to Protect Electricity Consumers of Northern Maine</td>
<td>2008</td>
<td>Removes state-granted right of eminent domain for transmission lines that adversely affect utility ratepayers.</td>
<td>MRS Title 35-A Chapter 575 §3132</td>
</tr>
</tbody>
</table>

The State plays an active role in protecting Mainers during the winter months. Published by the Maine Attorney General’s Office, the Maine Consumer Law Guide has an entire chapter covering the rights of home heating customers. The guide is based on the Unfair Trade practices law passed in 1969, which declares unfair or deceptive acts in the conduct of commerce illegal (MRS Title 5 Chapter 10 §207 1969). The guide guarantees customers the ability to obtain heating oil and propane throughout the winter, even if they owe the distributor money, as long as they have enough money to purchase the next delivery. If a dealer goes out of business without providing adequate service, the Maine government will aid its customers in getting their money returned. The guide strictly controls delivery surcharges and guarantees that all average established customers are offered the same services and prices. For Mainers who heat their homes with natural gas and electricity, it is illegal for the electric utility to disconnect a household if they are complying with the terms of their agreement. The guide also protects the right to service for at least thirty days if a member of the household falls seriously ill, even if the customer is overdue on the bill.

Through programs like LIHEAP, the Central Heating Improvement Program (CHIP), WAP, and the Home Energy Loan Program (HELP), Maine offers many different ways to aid those who cannot afford to heat their homes. CHIP and WAP provide grants to low-income homeowners and renters to reduce energy costs by improving home energy efficiency. HELP provides low-interest rate loans to moderate-income homeowners for energy efficiency improvements. Mainers are eligible for assistance in most of these programs if they fall within 107% of federal poverty guidelines. These programs are run through MSHA and as of 2008, over 90,000 people receive funds or services.
Maine has passed several laws in the last decade devoted to electricity generation with a focus on moving away from non-renewable resources. In 1996, Maine passed the Restructuring Act requiring that the wholesale generation of electric energy be separated from the transmission of electricity. This deregulation of Maine’s utilities required power companies to sell off their generation assets so that Maine consumers can purchase competitively priced energy. Renewable portfolio standards were also part of this bill, requiring 30% of all electricity generation to come from renewable resources (MRS Title 35-A Chapter 141 §6 1997). In 2007, An Act to Stimulate Demand for Renewable Energy was passed, creating a renewable portfolio goal to increase new renewable energy capacity 10% by 2017 (MRS Title 35-A Chapter 403 §3210-3212 2007). Maine signed onto the Regional Greenhouse Gas Initiative (RGGI) in 2007, requiring Maine to stabilize and then reduce greenhouse gas emissions from the power generation industry 10% below 2009 levels by 2019 (MRS Title 35-A Chapter 317 §3211-A 2007).

Maine has also passed acts supporting both solar and wind power development in the state. An Act to Encourage the Use of Solar Energy was passed in 2007 with the purpose of reducing the cost of solar installations to promote solar energy use (MRS Title 35-A Chapter 493 §3211-A 2005). An Act to Implement Recommendations of the Governor’s Task Force on Wind was passed in 2007 to encourage the development and siting of appropriate wind energy production in Maine. It also set ambitious goals for the role of wind power in Maine, calling for 2,000 megawatts (MW) of wind power capacity by 2015 and 3,000 MW of wind power capacity by 2020 (MRS Title 35-A Chapter 661 §3401-3404 2007).

Stakeholders

A diverse group of stakeholders have vested interests in Maine’s energy use and its impact on the environment. Key stakeholders actively involved include national and state governments, committees, and NGOs as well as energy distributors, suppliers, and Maine consumers.

National

The US Congress House of Representatives passes laws through bills and resolutions. Within the House there are focused energy and climate Committee Offices (US House of Representatives 2008e). The Committee on Energy and Commerce jurisdiction ranges from the generation, regulation, and production of all energy resources to the general management of the Department of Energy (DOE) and FERC (US House of Representatives 2008c). The Committee on Natural Resources deals with mining interests and petroleum conservation on private lands (US House of Representatives 2008d). The Committee on Science and Technology controls all energy research, development and demonstration and the commercial application of energy technology (US House of Representatives 2008a). The Select Committee for Energy Independence and Global Warming studies and develops recommendations on technologies intended to reduce US dependence on foreign energy. This Select Committee also strives for reductions in emissions which contribute to climate change (US House of Representatives 2008b).

Executive agencies of the US government are responsible for enforcing the federal laws discussed in the laws section. The three vital agencies concerned with energy are the DOE, Environmental Protection Agency (EPA), and FERC.

DOE’s mission is to advance the national, economic, and energy security of the US through its promotion of science and technology (DOE 2008a). EPA implements Congress’s environmental laws through regulations and national standards that states self-regulate. EPA also awards grants for environmental studies, educates the public on environmental issues, and publishes reports (EPA 2008a).

FERC regulates the interstate transmission of natural gas, oil, hydropower, and electricity. The Commission also reviews proposals for interstate natural gas pipelines, licenses hydropower projects, and builds liquefied natural gas terminals. FERC promotes the development of a strong energy infrastructure, supports competitive markets, and prevents market manipulation (FERC 2008a).

State

The current governor of Maine, John Baldacci, and his legislature have set up many programs to help homeowners afford energy, with particular interest in home heating. Governor Baldacci has announced many initiatives, including the "Wood to Energy Initiative", and has created the Task Force on Wind Energy Development (State of Maine 2008). Recently, the Governor announced a short-term energy strategy to address high energy prices this winter. He attended Bangor Hydro’s Maine Winter Expo 2008 to encourage residents and businesses to use new technologies that would increase energy efficiency and thus save money (State of Maine 2008).

The Governor’s Office of Energy Independence and Security promotes energy independence, economic development, and environmental health (State of Maine 2008). The Maine Attorney General’s job is to protect the public interest and the public rights of Maine residents (State of Maine 2008). In 2004, Maine Attorney General, Steven Rowe, issued the Consumer Home Heating Rights, which regulates the sale of home heating oil during the winter months in Maine. The Public Advocate represents Maine consumers in matters regulated by MPUC to make sure that they are receiving the best services possible (State of Maine 2008).

Maine Department of Environmental Protection (MDEP) is directed by legislative mandate to “prevent, abate, and control the pollution of the air, water, and land” (State of Maine 2008). The Board of Environmental Protection, controlled by MDEP, consists of a ten member citizen board appointed by the Governor and is responsible for providing a public forum for department decisions (State of Maine 2005).

MSHA’s goal is to help Mainers acquire and “maintain decent, safe, affordable housing and services suitable to their unique housing needs. In carrying out this mission, Maine Housing will provide leadership, maximize resources, and promote partnerships to develop and implement sound housing policy” (Maine State Housing Authority 2008). MPUC regulates the electric, gas, telecommunications, water, and ferries for the state of Maine (State of Maine 2008). Efficiency Maine was created by MPUC and is funded by electricity consumers to fulfill the Energy Conservation Act through conservation programs (PUC 2008).

Non-Governmental Organizations (NGOs)

Many NGOs are directly involved in influencing Maine’s residential energy use. Some of the most influential include the National Resources Defense Council (NRDC), the American Council on Renewable Energy (ACORE), the Environmental Studies Institute (EESI), and the Union of Concerned Scientists (UCS).

The priorities of NRDC include reducing greenhouse gas emissions and changing US dependence on environmentally degrading energy sources which contribute to global warming (NRDC 2008).

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ACORE is based in Washington, DC and has members across many different sectors including renewable energy industries, financial institutions, government leaders, and professional service providers. ACORE publishes briefings and books to generate better understanding of renewable energy and the effects of its use. As a result, community members are granted access to these publications and therefore have these resources at their disposal. ACORE has also established several focused committees, including the Utility Committee and the Biomass Coordinating Council (ACORE 2008).

EESI is a non-profit organization formed by members of Congress that attempts to provide timely information and policy solutions which “set us on a cleaner, more secure and sustainable energy path” (Environmental and Energy Study Institute 2008). EESI accomplishes this by policymaker education during Congressional briefings, coalition building through diverse member involvement, and policy development for Congressional offices (Environmental and Energy Study Institute 2008).

U.S. Census Bureau provides information about the quality and affordability. The majority of our information was gathered through literature review, especially government reports and documents. In addition, relevant government agencies and programs were contacted for data or interviews. We also used documents published by the Maine State Planning Office, the Energy Information Agency (EIA), and DOE. We contacted the major electric utility companies in Maine (Bangor Hydro-Electric, CMP, and MPS) for residential energy use data. Interviews were conducted with former Governor and current wind entrepreneur Angus King in November 2008. Senator Philip Bartlett III and retired Colby Professor Tom Tietenberg were also interviewed. The majority of the data used for residential heating came from the US Census Bureau and ACS.

Regional Transmission Organization (RTO)

RTOs are responsible for moving electricity across state lines. International Standard of Organization - New England (ISO-NE) is the RTO which serves the New England states by ensuring daily operation of bulk power generation and transmission system. They accomplish this by overseeing and ensuring administration of the region’s wholesale electricity markets and managing comprehensive, regional planning processes (ISO New England 2008).

Suppliers/Distributors

Determining the number of households per county that use each source of heating. We then calculated the number of households per county that use each source of heating.

Maine Consumers

Residents of the state’s total household income and benefits in real 2007 dollars was under $80,000 (ACS 2007c). Approximately 15% of children under 18 and 9% of people over 65 were below the poverty level in 2007 (ACS 2007c). These statistics are important when considering the ability of Mainers to afford current and future energy prices.

Methods

The majority of our information was gathered through literature review, especially government reports and documents. In addition, relevant government agencies and programs were contacted for data or interviews. We also used documents published by the Maine State Planning Office, the Energy Information Agency (EIA), and DOE. We contacted the major electric utility companies in Maine (Bangor Hydro-Electric, CMP, and MPS) for residential energy use data. Interviews were conducted with former Governor and current wind entrepreneur Angus King in November 2008. Senator Philip Bartlett III and retired Colby Professor Tom Tietenberg were also interviewed. The majority of the data used for residential heating came from the US Census Bureau and ACS.

We used Geographic Information Systems (GIS) to perform analyses on average electricity use per household, location of Community Action Program (CAP) agencies, and greenhouse gas emissions per county. Household electricity use was determined by averaging utility-reported numbers. The most precise data available was divided by service providers. We compared this data to locations of electricity distribution lines. We also identified major cities and the Maine counties with the highest poverty rates to determine if CAP agencies were appropriately located within the State. We accomplished this by mapping the addresses of the CAP agencies and classifying poverty rates for each county. Additionally, we identified the counties with the highest per-household percentages of greenhouse gas emissions by calculating the average quantity of carbon dioxide emitted per type of heating source and calculating the number of households per county that use each source of heating.

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Residential Heating

Use

Residential heating use is an important concern primarily because Maine is the seventh coldest state in the nation, according to heating degree days. According to DOE, heating degree days are calculated as the number of hours over the course of a year that the air temperature is below 65° Fahrenheit, divided by 24 in order to represent the number of days (Energy Efficiency and Renewable Energy 2008a). Between 1980 and 2008, Maine’s average number of heating degree days has been consistently higher than that of any other New England state (Figure 1.2).
Figure 1.2 Average heating degree days in Maine and New England from 1980 to 2006 (DOE 2008). Heating degree days are the number of hours over the course of the year that the air temperature is below 65° Fahrenheit divided by 24.

Utility gas is defined to include gas piped underground from a central system to consumers and includes natural gas (American Community Survey 2007). In 2000, a natural gas pipeline was built connecting Canada and the rest of New England, offering Maine residents a new option in home heating for the first time. However, due to cheap fuel oil in the last decade and the expense of expanding distribution lines in Maine's rocky soil, natural gas use has been slow to expand in the state (Turkel 2008). By 2006, only 3% of Maine residents used utility gas to heat their homes (Figure 1.3).
Electric heating accounts for 5% of home heating use in Maine and is supplied by above or underground electric power lines (American Community Survey 2007). One third of US homes heat with electricity as their primary fuel (Elder et al. 2007).

LP gas is the third largest heating source used in Maine (Figure 1.3). ACS defines LP Gas as liquid propane gas that is stored in bottles or tanks that are refilled or exchanged when empty (ACS 2007a). According to the 2007 MHHR, there were 29,168 Maine homes heating with this energy source (Elder 2007). The estimated average annual heating cost to LP gas consumers in the 2003-2004 heating season was $2,772 (Elder 2007).

Wood is the second largest home heating source in Maine (Figure 1.3). ACS defines this heating source to include "purchased wood, wood cut by household members on their property or elsewhere, driftwood, sawmill or construction scraps, and the like" (ACS 2007a). According to the 2000 US Census, Cumberland County burned the highest quantity of wood (Table 1.3) and used approximately one-fifth of all wood burned in Maine that year.
Table 1.3 Wood combustion rates in Maine based on state average fuel consumption and county population. Total cords burned is estimated from the US Census Bureau's 2000 estimates of the total households in Maine multiplied by the approximate number of cords burned in the households participating in the survey (BAQC Maine 2006).

<table>
<thead>
<tr>
<th>County</th>
<th>Total Households</th>
<th>Total CordsBurned (estimated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumberland</td>
<td>107,989</td>
<td>110,353</td>
</tr>
<tr>
<td>York</td>
<td>74,563</td>
<td>76,195</td>
</tr>
<tr>
<td>Penobscot</td>
<td>58,096</td>
<td>59,368</td>
</tr>
<tr>
<td>Kennebec</td>
<td>47,683</td>
<td>48,727</td>
</tr>
<tr>
<td>Androscoggin</td>
<td>42,028</td>
<td>42,948</td>
</tr>
<tr>
<td>Aroostook</td>
<td>30,356</td>
<td>31,020</td>
</tr>
<tr>
<td>Oxford</td>
<td>22,314</td>
<td>22,802</td>
</tr>
<tr>
<td>Hancock</td>
<td>21,864</td>
<td>22,343</td>
</tr>
<tr>
<td>Somerset</td>
<td>20,496</td>
<td>20,945</td>
</tr>
<tr>
<td>Knox</td>
<td>16,608</td>
<td>16,972</td>
</tr>
<tr>
<td>Waldo</td>
<td>14,726</td>
<td>15,048</td>
</tr>
<tr>
<td>Lincoln</td>
<td>14,158</td>
<td>14,468</td>
</tr>
<tr>
<td>Washington</td>
<td>14,118</td>
<td>14,427</td>
</tr>
<tr>
<td>Sagadahoc</td>
<td>14,117</td>
<td>14,426</td>
</tr>
<tr>
<td>Franklin</td>
<td>11,806</td>
<td>12,064</td>
</tr>
<tr>
<td>Piscataquis</td>
<td>7,278</td>
<td>7,437</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>518,200</strong></td>
<td><strong>529,543</strong></td>
</tr>
</tbody>
</table>

Fuel oil and kerosene use comprised the largest source of heating at 77% (Figure 1.3). This source includes fuel oil, kerosene, gasoline, and alcohol (ACS 2007a). Since there is great reliance on these heating methods, they are the most vital for stakeholders. Vulnerability of consumers is most critical because of fluctuating price trends and uncertain availabilities in the future.

Use of fuel oil and kerosene has increased from 1940 levels, with a substantial jump occurring between 1940 and 1960. During the 1970s, however, fuel oil and kerosene use dramatically decreased while the use of alternative heating sources increased. This was likely caused by the energy crisis of 1973, in which OPEC cut oil production and embargoed shipments to the US (Yergin et al. 2008). This embargo raised prices and forced consumers to switch to alternative fuels because of their comparative affordability.

Following the 1973 Energy Crisis, fuel oil and kerosene use continued to decrease while wood and electric heating use increased (Figure 1.4). Between 1970 and 1980, use of electric heat jumped from 1.9% to 10.6%. From 1980 to 2000, LP gas use increased to approximately 8% of total energy use. Utility gas and coal use remained low because there was little supply of either. Utility gas was unable to be utilized for home heating until a natural gas pipeline was built through Maine in 2000, while there is comparatively no coal use in the state compared to the rest of the US. Since 1990, however, the use of fuel oil, LP, and utility gas has continued to increase, resulting in an increased and continuing dependence on foreign energy sources.
Affordability

Maine fuel oil comes from both domestic refineries and foreign imports, with the majority of supply coming from Canada, the Virgin Islands, and Venezuela (EIA 2007a). The Maine oil supply is also dependent upon the inventories from domestic refineries and the ability of these refineries to increase heating oil production (EIA 2007a). Therefore, price increases in early 2009 are expected because of increased demand for heating oil and the resulting increased costs to refineries (Figure 1.5).
US heating oil prices, adjusted for 2007 inflation, steadily declined from the 1980s until 2000, then gradually increased until summer 2008 (Figure 1.5). Prices unexpectedly dropped in July 2008 below three dollars per gallon. Underlying explanations for these fluctuating oil prices vary greatly from competition in local markets to changes in the cost of crude oil (EIA 2007a).

There has been a trend of increasing heating oil prices in Maine over the past 18 years (Figure 1.6). According to the MHHR, the average oil consumption per Maine household was 1,009 gallons with an average annual heating cost of $1,322 (when heating oil cost an average of $1.31 per gallon) (Elder 2007). The trend line shows that, taking past prices into consideration, fuel oil prices in the long term future will likely increase (Figure 1.6).
Figure 1.6 Weekly residential heating oil real prices (in 2007 dollars) in Maine from 1990 to 2008 (EIA 2008). The trend line shows the general increase in home heating oil prices.

Homeowners are especially concerned with energy affordability, especially because prices are susceptible to great variability. As the amount of occupied housing units has been increasing fairly steadily from 1940, when there were 213,610 units occupied, to 2000 when there were 518,200 (US Census Bureau Housing and Household Economic Statistics Division 2004), there will be a greater need for affordable and long lasting heating methods.

Another factor that increases the need for immediate action on energy prices is the old Maine housing stock compared to the rest of the US. Between 14,000 and 44,000 kWh of energy are required to heat an average-sized home during the winter (TechLine 2004). Housing stock age has a considerable impact on the amount Mainers must spend to heat their homes because an aging stock results in decreasing efficiency levels. Residential home inefficiency can be caused, for example, by old or cracked moldings and caulk around windows and doors, or by inadequate insulation. Figure 1.7 shows the percentage of housing units built in Maine compared to the rest of the US. About 30% of the housing stock in Maine was built before 1940, compared to less than 15% in the US, and could thus have severe impacts on heating efficiency in Maine.
High poverty levels in northern counties raise concern about needy Mainers occupying inefficient housing stock. Figure 1.8 identifies areas of greatest concern by classifying percentages of Mainers below the 2006 poverty level in counties and the locations of Community Action Program (CAP) agencies. The counties with the lowest percentage of their population in poverty are York, Cumberland, Sagadahoc, and Hancock. No CAP agencies are located in Cumberland County or Hancock County. The counties of Aroostook, Somerset, and Washington have higher poverty levels. In Somerset County, CAP agencies are only located in major cities in the south. CAP agencies in Aroostook County are mostly located in its major cities with the exception of Caribou, which lacks an agency. Washington County also lacks an agency location in its major city, Calais.
Figure 1.8 Percent of population under the poverty level by county (US Census Bureau 2006) and Maine's Community Action Program Agencies (MSHA 2008). US Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty; if a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty (US Census Bureau 2006).
Locations of the larger towns and cities in Maine show that the major population centers are located mainly in the counties of York, Cumberland, and Kennebec, and in the southern portion of Penobscot County. The locations of CAP agencies are also shown with a concentration of locations located in the southern section of Franklin County. The CAP agency locations are less available in the northern regions where there is a higher rate of poverty.

**Emissions**

It is also important to examine how different sources of residential heating impact the environment. A significant environmental byproduct of residential energy use is carbon dioxide, thought to be a major cause of global warming. Figure 1.9 shows the carbon dioxide emissions from each type of home heating.

![Figure 1.9 Metric tons of carbon emitted per household by heating source in Maine (EIA 2007).](chart)

The small percentage of Maine homes that use natural gas for heating becomes more important when looking at global warming. Because it takes a smaller quantity of gas to heat a residence, natural gas produces significantly less gas than any other type of home heating. Fuel oil, on the other hand, is an inefficient source of residential heating because of its high carbon dioxide emissions.

Currently, the average Maine household produces roughly 11 tons of carbon emissions annually through home heating (EIA 2002, Elder et al. 2007, US Census Bureau 2000). However, these emissions vary in different counties. While roughly 80% of each county relies on fuel oil, the remaining energy use comes from a variety of different sources throughout the state (US Census Bureau 2000). Some parts of the state rely more on natural gas, while other parts are more reliant on wood or liquid petroleum gas. Figure 1.10 shows the varying amount of carbon emissions from different counties of Maine.
Figure 1.10 Metric tons of carbon dioxide emitted per household from residential heating by county in 2000 (EIA 2007, MOEIS 2003, US Census 2000).
Despite having the largest population and the highest total greenhouse gas emissions, Cumberland County has the lowest per household carbon emissions in the state. This is due to the county's higher use of natural gas for residential heating. Cumberland is unique in the state because it is the only county with both a natural gas pipeline and a sufficient population density to make natural gas an economic choice.

**Residential Electricity**

**Use**

About 680,000 residential consumers in Maine use electricity for space heating, water heating, air-conditioning, or electrical appliances (EIA 2007b). Maine households use an average of 6,348 kWh of electricity annually (EIA 2007b, 2008c), while the average US household uses about 10,000 kWh per year (EIA 2001). Current sources of electricity generation in Maine consist primarily of natural gas, hydroelectric, and wood (Figure 1.11). 23% of Maine’s electricity is produced through hydroelectric dams, which is one of the highest percentages in the country. Petroleum and coal only produce 5% of the state's electricity while coal produces more than 50% of electricity in the US (EIA 2008b).

![Figure 1.11 Net electricity generation by energy source in Maine (EIA 2008).](image)

Electricity is used in households for appliances, water heating, and air-conditioning. In relatively few households in Maine, electricity is also used for space heating instead of other heating options, but this is a relatively minimal energy expense for the state in general. Only 22% of Maine households use electric space heating at all, and two-thirds of these households employ electric heating as a secondary heating source (EIA 2005c). Electric air-conditioning equipment, found in 59% of households, is more common in Maine households than electric space heating. However, air conditioners only comprise about 1% of total household energy expenses in the Northeast (Figure 1.1). Electric water heating makes up a large percentage of Maine electricity use and is used in over 25% of Maine households. Significantly, electric appliances make up the majority of residential electricity use and some appliances are so prevalent that they occur in almost every household in Maine (EIA 2005c).

Of all appliances, refrigerators use the most electricity of total home energy use (EIA 2001). Lighting and clothes dryers use the second and third largest amounts of electricity (Appendix A). Overall, the top ten electricity consuming appliances use 47% of total household energy. In addition to refrigerators, clothes dryers, and lighting, these include: freezers, furnace fans, color televisions, electric stove tops, dishwashers, ovens, and microwaves (EIA 2001). Some of these highest electricity consuming appliances are the most prevalent appliances in the state. Almost 100% of Maine homes contain refrigerators, lighting, and color televisions (Appendix B). Compared to the rest of the nation, refrigerators and freezers in Maine use less electricity per appliance. On average, Maine refrigerators use about 19% less electricity per year than the rest of the US, although Maine’s refrigerator stock tends to be older and less efficient overall (EIA 2005c). The lower rate of electricity use is likely due to Maine’s colder climate. Refrigerators and freezers have to work less because there is less of a temperature change between the ambient air and the inside of the refrigerator than in warmer regions. Additionally, refrigerators in Maine tend to be smaller than in other parts of the US (EIA 2005c).
Residential electricity use is not equal throughout the state. Consumers in Kennebunk Light and Power District’s distribution area and CMP’s distribution area, both in Southern Maine, use more electricity per household than any other area in Maine (Figure 1.12). Southern Maine is also the area with the most electricity distribution lines. In contrast, households in the utility areas off the coast of Maine use the least amount of electricity per customer in all of Maine (Figure 1.12) (BH 2008, CMP 2008, EMEC 2008, FIEC 2008, HWC 2008, KLPD 2008, MEGIS 2000a, b, MEW 2008, MPS 2008b, SIEC 2008, VBLPD 2008).
Statewide, average household electricity use has been increasing over time. Electricity use per consumer has increased by 4.3% from 2004 to 2007. Since 2004, electricity use averages an annual increase of almost 1.5% for Maine households (Figure 1.13). Electricity use per household reached its lowest point since the 1970s in the late 1990s (BH 1988, 1992, 1998, CMP 1991 1995, 1998, MPS 1988, 1999). This lower electricity use is unrelated to prices as prices have been relatively stable. It could be due to an increased political focus on energy efficiency programs because of the Energy Policy Act of 1992 (Gellings et al. 2006). Since 1998, electricity use has increased past the historical high from the late 1980s (Figure 1.13). Electricity use per household could be increasing because of the growing prevalence of larger appliances, especially with high electricity consuming standby modes. Standby modes are found on many appliances including televisions, radios, and computers. This function uses electricity even when the appliance is turned off. Standby modes have been found to consume as much as 5% of a households total electricity use (IEA 2007b). Additionally, a growing number of telecommuters in the state would increase residential energy use (Baer et al. 2002).

Affordability

The average Maine household spends about $850-$900 annually on electricity, which is about 2.7% of the average Mainers annual income (BEA 2008). Maine residents pay substantially more than the majority of the country for their electricity (EIA 2008c). However, Mainers pay less on average than residents of other New England states (Figure 1.14). Among New England consumers, only Vermont consumers pay less for electricity than Maine consumers, and consumers in Massachusetts and Connecticut pay considerably more.
While there is considerable electricity rate variation within the US, there is also a wide range of electricity rates within Maine. The three largest electricity distributors, CMP, MPS, and Bangor Hydro-Electric, all charged between 15 to 18 cents per kilowatt hour (¢/kWh) in October 2008, which is higher than the state average (Figure 1.15). CMP, serving 80% of Maine’s electricity load, had the lowest rate of these three companies (MPUC 2008a). Only one company, Fox Island Electric Company, charged a higher rate than CMP, Bangor Hydro, and MPS. On the other hand, two companies, Madison Electric and Houlton Water, charged significantly less than the three dominant companies, with rates below 10 ¢/kWh (Office of the Public Advocate 2008).

This rate variation among utilities reveals a general trend that consumers on average use less electricity when prices are higher (Figure 1.15). Consumer response to higher energy prices in all energy markets shows a similar trend of decreasing use as prices increase. Energy and electricity tend to be relatively inelastic commodities, meaning immediate energy demand changes little with changes in prices, but consumers will attempt to use less in the short term and invest in more efficient products in the long run (NEB 2006).

In addition to being higher than electricity rates in the majority of the country, Maine's electricity rates have increased recently (Figure 1.16) (MPUC 2008a). From 2004 to 2007, electricity rates increased over 50%. Thus, electricity rates have been increasing at an average of about 16% per year since 2004 (Figure 1.16). Historically, electricity rates remained relatively stable with a real price (in 2007 dollars) between 13.6 to 17 cents per kilowatt hour (¢/kWh). However, in the past 30 years, nominal electricity rates have increased over 186% (BH 2008, CMP 2008, EMEC 2008, FERC 2008a, HWC 2008, KLPD 2008, MEW 2008, MPS 1988, 2008b, SIEC 2008, VBLPD 2008).
To reduce the rising expense of household electricity on residents, Maine has been attempting to reduce growing household electricity use through programs and incentives. Efficiency Maine provides incentives for consumer purchases of energy efficient light bulbs. These incentives are a $1.50 to $2.00 rebate per light bulb purchased by consumers. Consumers receive this rebate through instant coupons at the time of purchase. In 2007 alone, 813,981 efficient light bulbs were purchased through the incentive program (Efficiency Maine 2008a). This is estimated to have saved residential consumers over 40 million kWh of electricity during the seven year lifetime of the bulbs. This results in total light bulb lifetime benefits of over $36 million from 2007 programs (Efficiency Maine 2007). Since 2004, Efficiency Maine’s programs have led to 2,103,430 megawatt hours (MWh) of saved electricity (Efficiency Maine 2007). Since the start of the Low Income Program, a program within Efficiency Maine, over 7,500 refrigerators have been replaced with energy efficient ones, but this is only about 0.1% of all refrigerators in Maine. In addition, the Low Income Program has supplied over 82,600 energy efficient light bulbs to low income households. These efficiency improvements save these households an average of $300 on their annual electricity bills (Efficiency Maine 2003, 2004, 2005, 2006, 2007).

Emissions

Maine has a higher percentage of electricity generated from renewable energy than any other state in the nation. This is due to Maine’s relatively small population size compared to a wealth of natural resources in the form of rivers, wood, wind, and ocean currents. Maine has 117 hydroelectric dams, which have a collective generating capacity of 766 MW (Walsh 2008), while six biomass facilities provide another 170 MW of electricity (Efficiency Maine 2008c). Maine’s first wind farm was built on Mars Hill in 2007 and currently provides 42 MW of wind power capacity. Two others are in construction on Stetson Ridge and Beaver Ridge, which are together expected to provide another 61.5 MW of capacity (Wind Powering America 2008).

Currently, Maine’s electricity generation produces roughly 5.6 million metric tons of carbon dioxide emissions annually (RGGI 2008). All of these emissions come from burning natural gas, wood, wood chips, coal and petroleum, as neither hydroelectric nor wind power emits any carbon dioxide in the production of electricity.

Maine has shown a desire to cut back significantly on its greenhouse gas emissions. In 2007, Maine signed onto the Regional Greenhouse Gas Initiative (RGGI), the first regional mandatory program in the US, which has committed them to reducing greenhouse gas emissions from power plants over a ten-year period. Through a cap-and-trade system, ten Northeastern and Mid-Atlantic states have agreed to reduce their greenhouse gas emissions 10% from 2009 levels by 2019. At the beginning of 2009, the ten states’ power industries will be allowed to emit 188 million tons of greenhouse gases. By the end of 2018, this number should drop to roughly 169 million tons. Compared to a scenario with no restrictions, RGGI would cut emissions by an estimated 17% (RGGI 2008).

Under RGGI, Maine’s pro-rata annual share from 2009-2014 is six million allowances, where each allowance is equal to one ton of carbon dioxide emissions. Beginning in 2015, there will be a 2.5% annual reduction of allowances until 2018. Maine has chosen to auction off all of its allowances on an annual basis, which is expected to raise approximately $18 million a year. At least 85% of the money raised will go to support energy efficiency measures in the state, while the remaining 15% may be used for measures that would decrease the consumption of fossil fuels in the state. Since the first auction in September 2008, $750,000 has already been directed to energy efficiency programs for low-income residents (Energy Efficiency and Renewable Energy 2008b).
In addition to these programs, Maine has the highest renewable portfolio standards in the nation. In 1999, Maine passed a law requiring that competitive electricity providers supply at least 30% of their total retail electric sales through electricity generated by renewable resources. In 2006, Maine lawmakers raised the renewable portfolio standards to increase new renewable energy capacity 10% by 2017. An important qualification of this new law is that the new renewable energy systems have to be built in 2005 or later. While Maine already has 40% of its electricity generated from renewable resources, the provision for new renewable energy systems has stimulated growth in the renewable energy sector. Lawmakers also restricted new renewable energy production to exclude municipal waste facilities, combined heat and power systems, and any hydropower facility that does not meet state and federal fish passage requirements. The new portfolio renewable standard will be met by increasing the standard 1% annually until 2017. If electricity providers fail to meet the goal, they are subject to certain penalties, license revocation, or an optional penalty to the Renewable Resource Fund.

The Renewable Resource Fund, another program of MPUC, is a voluntary fund allowing customers to support renewable energy projects. MPUC has adopted rules requiring the state's utilities to offer consumers the option of donating to the fund by checking off a contribution of $1, $5, $10 or other amount each month on their electric bill. Every six months, each utility must notify its customers of the existence and purpose of the fund, the means to contribute to the fund, and summaries of projects that have been supported by the fund (DSIRE 2008). The other source of money comes from the state's renewable portfolio standards, as described below. As of 2007, the fund contained more than $400,000 (PUC 2007). The fund supports grants for renewable energy research and small-scale community projects designed to show the affordability and cost-effectiveness of clean energy options. In 2007, it gave grants to ten projects with focuses on wind, solar, and tidal power.

Implications

The use of both nonrenewable and renewable energy sources for residential heating or electricity has numerous consequences for Maine residents. Residential energy use also has considerable impacts on Maine's environment. The implications of Maine's residential heating and electricity use are explored in this section.

Residential Heating

Use

During the past few years, fluctuations in fuel oil prices can be explained as a result of weather variations. For example, the Short-Term Energy and Winter Fuels Outlook stated that Hurricanes Ike and Gustav caused levels of crude oil production to decrease below 2007 levels (EIA 2008e). Howard Gruenspecht, administrator for the EIA, suggests other causes of changing prices including global economic growth, exportation decisions of the Organization of the Petroleum Exporting Countries (OPEC), non-OPEC supply growth, and refinery outages (Gruenspecht 2008). He also states that US winter heating oil consumption in 2008 will increase 5%, average price by 17%, and total expenditures by 24% (Gruenspecht 2008).

Prices for LP and utility gas may vary for many reasons such as the prices for competing fuels or the amount used by customers (EIA 2008d). Demand for the residential sector tends to be seasonal which creates a build-up of inventories during the summer when consumption is low (EIA 2008d). Pressure to increase prices can be caused because there are no readily available reserves to use once the stored inventories are consumed.

As Maine is a heavily forested state with around 17 million acres that could be harvested commercially (Quinn 2008), it seems logical that the use of wood would continue to be the most prevalent source of home heating as it was in the 1940s. Wood trails fuel oil and kerosene, however, which could be caused by wood use as a secondary heating source. Despite heavy forest cover in Aroostook, Piscataquis, Somerset and Penobscot counties, these counties do not use the most wood (Table 1.3). Penobscot County ranked third for estimated total cords burned while Aroostook County was ranked sixth and Somerset County ninth. Piscataquis County ranked a distant last according to this data, which could result from land ownership in the area. Much of it is owned by timber companies and therefore it may be more difficult to obtain enough wood for that to be the primary source for heating homes in that area. This higher-than-expected demand is creating a shortage of dry wood for dealers, also creating fears that consumers will burn wood before it is dry enough to be used safely (Arsdale 2008).

Many factors influence the price of wood, causing its price to vary considerably. Some factors include the region of Maine in which the wood is purchased, quality of wood, and the volume purchased (Elder 2007). Another factor that may influence the price of wood is the number of other people trying to buy wood from the same supplier, the quantity available from that supplier, and possible natural disasters that may have occurred (such as fires or hurricanes).

The decreasing trends seen in wood and coal use can be attributed in part to the Clean Air Act (CAA) which reduced smog and air pollution (EPA 2008b). CAA also reduced particle pollution which is formed in chemical reactions from burning fuels like wood, coal, and oil. The shift from coal use stemmed from this reduction in particulate matter and called for reduction in ground-level ozone from power plants (EPA 2008b). This eliminated the majority of coal use in heating residences.

In 2004, LP and utility gas were 79% efficient with a total annual fuel cost of $1,730 (TechLine 2004). Although its efficiency rate and cost are higher than other energy sources, people may be continuing to use LP and utility gas because it is less expensive to repair their old systems than to purchase different ones. Users may have had tanks and other technologies installed in their home and therefore had an incentive to continue using those products as the start-up costs were already paid. There may have been no further incentive to return to fuel oil use after these preliminary purchases and start-up costs were taken into account.

Affordability

It is unclear whether oil prices will continue to decrease as they have during the past few months or if they will spike again. This has homeowners who locked in prices with oil dealers upset because some had pre-purchased last spring when they worried about prices continuing to increase. Although the decreasing prices are beneficial for those who are struggling, those who committed will be unable to pay less for oil as companies already purchased oil based on their contracts (Grard 2008).

Recently, heating oil prices have been declining rapidly. As of November 10, 2008, kerosene averaged $3.38 a gallon and propane sold for $2.99 (Associated Press 2008). The unreliable prices of heating sources could cause economic issues, however, if the trend line continues to increase as history has suggested (EIA 2008b). Crude oil prices peaked on July 11, 2008 at $147 a barrel and a domestic retail price of $4.80 per gallon (Grard 2008). The average use of heating oil in Maine in 2008 is 900 gallons, which would result in an average cost per household of $4,100 (Quinn 2008). The aggregate cost of residential oil heat is expected to exceed $1.8 billion for the 2008-2009 season (Wood-to-Energy Task Force 2008).
With increasing projections seen for future fuel oil price trends, it is likely that Mainers will be paying higher than historical rates in coming winters to heat their homes. Higher rates will have a crippling effect on LIHEAP’s energy programs. In a 2005 article, MSA’s manager for LIHEAP, Jo-Ann Choate, stated that although new applications were being submitted, there was limited State buying power as it is currently more expensive to buy the same amount of oil (Fialka 2005). The limited budget forces Maine to focus their attention on the elderly, disabled, and families with small children (Fialka 2005). The limited budget Fialka spoke of in 2005 will have been further constricted by the current recession, which may become apparent in a future decline of available funds for assistance programs such as LIHEAP and Efficiency Maine.

Although some CAP agency are located in areas near major towns and cities in Maine, it does not appear that there are enough opportunities for those most in need to receive help weatherizing their homes and repairing their heating systems. More CAP agency locations are required because Maine’s older houses are less energy efficient due to insufficient seals around doors and windows or insufficient insulation to keep the heat in. From 1940 to 2006, the trend of increasing housing units helps our belief in increasing future demand for heating fuels and more energy efficient housing options.

Poverty rates in Maine in 2007 were at 12%, where 15% of children under age 18 and 9% of elderly people over age 65 were below the poverty line (ACS 2007b). These poverty levels have decreased since 2006, when 13% of Mainers were in poverty (17% of children and 10% of elderly were below the poverty line in 2006) (ACS 2006). Although the poverty rate in 2005 was also at 13%, fewer children were below the poverty line in 2006 and more elderly were below the poverty line in 2006 (ACS 2005). These data show a disparity emerging between the two age groups most vulnerable to cold weather. This may be caused by a greater number of elderly being able to access and receive assistance through CAP agencies as the State views them as a needier age group. Children may not be viewed to be as needy as the elderly because children generally still live with parents or guardians, who would receive CAP assistance.

CAP agency programs are essential to help Mainers decrease their heating bills, especially during the long winter months. LIHEAP funds CAP agencies to assist residents in paying heating bills (Maine State Housing Authority 2008). CAP agencies are also responsible for taking applications for other assistance programs including CHIP. Agency programs like CHIP are and will continue to be important as the housing stock ages. It will become more important that weatherization techniques and energy efficiency measures are taken with this aging stock.

Emissions

Maine’s dependence on fuel oil has had major impacts on the environment. Because of the harshness of Maine winters, per household energy use for heating is one of the highest in the country. Not only do Mainers consume more energy to heat their homes than the rest of the country, but they use fuel oil, an inefficient method of residential heating in terms of annual carbon output. Heating homes through natural gas emits significantly less carbon dioxide than fuel oil, but is used in just 3% of homes statewide (Figure 1.3). While Maine has been a leader in reducing carbon emissions from electricity generation, the State has done little to reduce emissions from residential heating. As household heating rates have remained high, the same amount of carbon dioxide as electricity generation does statewide, the State of Maine needs to act to improve energy efficiency in the home.

There are no easy solutions to Maine’s dependence on fuel oil. Natural gas pipelines are costly to build and maintain, and all other choices emit as much carbon dioxide as fuel oil. Because of the rising prices of fuel oil, however, Maine needs to look to other sources of residential heating fuel. In the short term, wood makes a lot of sense. Maine has an enormous supply of timber, of which some could be used towards residential heating. During the oil crisis in the 1970’s, wood consumption in residential consumption increased significantly (Figure 1.4). It is likely that wood will be turned to as a solution if fuel prices rise. However, burning wood to heat homes emits even more carbon dioxide than using fuel oil to heat homes (Figure 1.9). Wood can work as an interim fuel source for residential heating to deal with rising oil costs, but it should not be the long-term solution.

Increased energy efficiency and weatherization programs will be vital for decreasing overall energy use. As explained earlier, Maine’s housing stock is old, and old homes waste energy through simple inefficiency. Weatherization programs can help to reduce heat waste in homes by improving insulation and weatherstripping doors and windows. Energy conservation efforts will lead to some immediate reduction of state carbon emissions.

Most importantly, in the long run, Maine needs to find a cheaper and more environmentally friendly way to heat residential homes. Winters will still be cold in Maine for at least the next fifty years, and residents will need a way to heat their homes without emitting large quantities of greenhouse gas. The most exciting piece of new technology in the realm of home heating is the geothermal heat pump. Electric heat pumps are the basis for this new technology. Used primarily in the southeastern US, they extract warmth from air or ground water and transfer it in order to heat or cool living space. Because of Maine’s climate, electric heat pumps are less efficient in the Northeast. Geothermal heat pumps, a technology developed in the last decade, are high-efficiency electric heat pumps that are especially designed for below freezing weather. Although primary installation costs can run as high as $10,000, the pumps have been able to halve annual residential heating costs in many homes (Turkel 2007).

The geothermal heat pump could be a great partner to wind development because the pump is powered by electricity. Wind power is strongest in the winter, and particularly during the nighttime. Assuming that wind power capacity is strengthened in Maine over the next decade, Maine consumers could use geothermal heat pumps to store heat overnight and be able to heat their homes using almost entirely carbon-free electricity. Although capital costs will have to decrease in order to make the new technology feasible in the state, geothermal heat pumps are one potential remedy for Maine’s addiction to fuel oil.

Residential Electricity

Use

Maine electricity rates are separated into electricity production and electricity distribution because of the 1997 Restructuring Act. The division went into effect on March 1, 2000 (MPUC 2008a). The transmission companies, regulated by MPUC, include CMP, Bangor Hydro-Electric Company, and MPS.

Electricity generation was deregulated by the Restructuring Act to allow competition among electricity providers. Energy production companies like Florida Power & Light have taken control of the generation facilities of CMP, Bangor Hydro, MPS, and other utilities (Office of the Public Advocate 2005a).

Although MPUC oversees the electricity generation market, ISO-NE is the Regional Transmission Organization (MPUC 2008a). ISO-NE controls the daily operation of the electricity grid throughout New England. Additionally, ISO-NE administers the market according to PERO tariffs and rules. Since 2007, however, MPUC has been considering whether or not to continue participating in ISO-NE because the Commission determined that continued participation in ISO-NE as it currently is would prevent Maine from achieving its policy and environmental goals, including having 40% renewable electricity generation by 2017. Therefore, MPUC is considering whether to reorganize ISO-NE, form an independent transmission organization in Maine, or form a new transmission organization with New Brunswick (MPUC 2008a).
In this new deregulated market, residential consumers have been provided with few choices. MPUC provides consumers with a standard offer option if consumers do not want to individually compare electricity rates among distributors. The standard offer is the wholesale rate set by MPUC after suppliers have bid (Bever 2008, Office of the Public Advocate 2005b). Almost all residential consumers choose the standard offer rate, while approximately two percent of consumers enter the competitive market (Bever 2008, MPUC 2008b).

Since the Restructuring Act, the State has made efforts to prevent monopolies that would unfairly increase prices. However, in 2006, MPUC established that competition was failing in northern Maine because only MPS bid for standard offer rights (MPUC 2008a). MPUC concluded that the electricity market in northern Maine is "too small and isolated to support a competitive market" in its current form (MPUC 2008a). This is due, in part, to the lack of transmission lines connecting northern Maine to the regional electricity market (Figure 1.12). As a result, the Maine Power Connection Project is in the planning stages of attempting to connect northern Maine to the rest of Maine and the extended region (MPUC 2008a). MPS plans to build this transmission line. In addition, CMP recently proposed 550 miles of new transmission lines from southern Maine to Bangor. This proposal is currently in the public hearing stage of the MPUC approval process (Stone 2008).

The lack of electricity distribution lines to northern Maine could be a possible reason for the lower electricity use per household in that region of Maine. Southern Maine has much more extensive distribution networks than the rest of Maine and the region has been supplied with electricity for a longer period of time than the rest of Maine. In addition, northern Maine tends to have a higher number of low income households than southern Maine (Figure 1.5), which would reduce the number of appliances in households and the amount of electricity use a household would be able to afford (BH 2008, CMP 2008, EMEC 2008, FIEC 2008, HWC 2008, KLPD 2008, MEW 2008, MPS 2008b, SIEC 2008, VBLPD 2008).

**Affordability**

Maine residents pay less for their electricity than other Vermont states, except for Vermont, because Maine produces more electricity in-state than it uses (MPUC 2008a). A large percentage of this electricity production comes from hydroelectric dams. This supply surplus is sold to the wider, regional electricity grid and is used by other New England states. The cost of electricity importation increases the electricity rates for the rest of New England compared to Maine's rates. At the same time, Maine electricity rates are higher than in the majority of the US because Maine still imports most of its fossil fuel energy, mainly natural gas, from outside of the state (EIA 2008c, MPUC 2008a). These imports increase overall energy rates and thus electricity rates are higher than prices in states that produce fossil fuel energy themselves.

Maine's electricity rates have increased rapidly since 2004 mainly because of increasing oil rates nationwide (MPUC 2008a). The cost of fuel in nonrenewable electricity production, especially for oil, has been increasing due to reduced supply nationwide and worldwide. Furthermore, the cost of building, refurbishing, and running electricity production plants has increased because of higher fuel prices. The cost of constructing and maintaining electricity distribution lines has also increased due to higher fuel prices. Thus, increasing fuel prices have increased the cost of electricity production and distribution overall and these cost increases are passed onto the consumer through higher electricity rates.

Beginning in 2007, electricity rates increased partially because of transition payments related to the Forward Capacity Market Settlement, an ISO-NE agreement to increase energy generation in Connecticut and Massachusetts (MPUC 2008a). The agreement spread the cost of increasing production among the region's utilities, including Maine utilities. These payments are expected to increase residential rates by six percent over the next few years (MPUC 2008a). MPUC has argued to FERC against these electricity rate increases for Maine residents and commercial consumers. The need for increasing energy production in southern New England is a symptom of intense energy demand of Massachusetts and Connecticut residents. Maine residents are therefore paying for a solution to a problem they did not cause. FERC decided in favor of ISO-NE and MPUC has appealed to the federal court (MPUC 2008a).

As a result of rising electricity use, Maine has made specific efforts to improve energy efficiency in recent decades. Since 1996, Maine and all other New England states have been a part of the Northeast Energy Efficiency Partnership, which promotes efficiency through the Minimum Efficiency Standards Project (MESP) (EIA 2005c). MESP advocates for legislation on new efficiency standards in the Northeast region (NEEP 2006).

Efficiency Maine's commitment to energy efficiency extends to state programs. Efficiency Maine promotes the purchase of Energy Star lighting, including compact fluorescent lightbulbs (CFLs), throughout Maine from almost 300 distribution centers (Efficiency Maine 2007). Efficiency Maine has been active since 2003 and has increased the purchase of energy efficient lighting annually. The program has been successful at increasing consumer knowledge about efficient lighting. For example, in 2007, Efficiency Maine decreased its incentive per light bulb, but purchases of energy efficient lighting did not decrease (Efficiency Maine 2007). Through these efforts, Efficiency Maine aims to reduce electricity use and therefore overall energy costs (Efficiency Maine 2007).

Additionally, Efficiency Maine, along with MSHA, replaces refrigerators and freezers with more energy efficient ones in low income households. It targets low income households defined as having incomes at or below 150% of the poverty line (Efficiency Maine 2008b). Residential consumers benefit from greater energy efficiency through lower electricity bills for the lifetime of that appliance.

Efficiency Maine has been successful at targeting the most common household electrical appliances, refrigerators and lighting, which also consume the most electricity per household (EIA 2005c). These efficiency programs have been successful in promoting energy efficient appliance use in targeted households, but have still replaced only a small percentage of all of the refrigerators within Maine. Thus, energy efficient appliances are still rare overall in Maine households. Additionally, there are many other high energy consuming or very common appliances, such as clothes dryers and color televisions, which are not a part of Efficiency Maine's programs. While Efficiency Maine programs have resulted in a large amount of energy savings, energy conservation efforts have not yet halted the growth in annual electricity use. The majority of households are using more electricity due to older and less efficient appliances that cost Mainers more.

**Emissions**

Maine has led the US over the last decade in making its electricity generation more sustainable. Because the federal government has been skeptical of carbon reduction actions, there has been no regulation of carbon dioxide on a nationwide basis. Maine and the rest of the states involved in the RGGI agreement have taken the lead in the United States, agreeing to the first regional mandatory program to address greenhouse gas emissions from power plants. The Northwest has followed RGGI's lead by investigating a carbon cap-and-trade system of its own. Currently, the ten states involved with RGGI are the only US states that have set limits for their carbon emissions. Combining RGGI with new renewable portfolio standards and high oil prices has set the stage in Maine for an energy revolution.

Increasing energy combined with Maine's energy efficiency programs will allow for major greenhouse gas reductions. In 2006, Efficiency Maine was able to take the equivalent greenhouse gas emissions of 7,624 cars off the road through helping to make homes more energy efficient (Efficiency Maine 2007). Maine has decided to use nearly all of the money raised from auctioning off the annual RGGI allowances to aid efficiency programs in the State of Maine. This total excess energy might be able to be used to heat homes through electric heating or power electric cars if technology moves in that direction. Otherwise, selling excess energy would be a huge boost to Maine's otherwise depressed economy.
Maine consumers have two options if they would like to purchase more renewable energy than the minimum requirement. Consumers can either switch to clean energy or purchase clean energy credits. If there is clean energy in their service grids, consumers can choose to buy electricity for their homes through clean energy generators. An average Maine home uses 6,000 kilowatt-hours per year which, when using clean electricity over conventional sources, would add $10 per month (MPUC 2007). The other option Maine consumers have is to purchase clean energy credits, otherwise known as Renewable Energy Certificates (RECs). If there is not clean energy being offered in a consumer's utility service area, RECs ensure that the equivalent amount of clean energy is injected into the regional electrical grid instead. Assuming an average of 6000 kWh again, purchasing enough RECs to offset their electricity would cost a consumer $120 a year (MPUC 2007).

However, there are currently few options for consumers to buy truly green energy in Maine. There is only one hydropower dam in the state that has been certified as low impact, located on the Androscoggin River near Brunswick, with a capacity of 19.4 MW. The only other substantial green source of energy is the Mars Hill Wind Farm, with a capacity of 42 MW.

To help improve Maine's renewable energy portfolio, the Maine legislature has passed "An Act to Implement Recommendations of the Governor's Task Force on Wind Power Development (MRS Title 35-A Chapter 661 §3401-3404 2007)." The act set ambitious goals for wind energy development in the state and expedited permitting of grid-scale wind farms. The goals set by the act are to have at least 2,000 MW of installed capacity by 2015 and 3,000 MW of installed capacity by 2020. Most importantly, the bill expedites the permitting process in many parts of Maine. Maine is divided up into two roughly equal halves: the southern part of the state, where most of Maine's cities and towns are located, and the northern part of the state, known as the Unorganized Territory, which is mostly woodland with few communities. The Unorganized Territory is managed by the Land Use Regulation Committee, which was established in 1971 to serve as the planning and zoning authority for the state's expansive undeveloped land (LURC 2008). In order to even learn whether a wind farm can be built in a certain location, wind developers must pay between $1-2 million through various permitting procedures. The passage of this bill should make the permitting process significantly cheaper in the Unorganized Territory of Maine, encouraging the greater development of wind power in the state (King 2008).

Currently, there is one wind farm in operation, two wind farms in construction, one seeking permits, and five more in development. The Kibby Wind Power Project, which is likely to receive permits in the next year, is expected to have a 132 MW capacity. The biggest wind farm in development is one in Aroostook County with an expected 800 MW of capacity (DOE 2008). While no major permits have yet been filed, the permitting process is expected to begin for the massive project within the year. All together, these potential and existing wind farms could have a capacity of more than 1,000 MW. Angus King, former Governor of Maine, in conjunction with Independence Wind, has plans for a floating wind farm off the Gulf of Maine. Comparing the Gulf to the "Saudi Arabia of wind," King believes his project has the potential to power all of Maine when running at full capacity and a substantial amount of New England as well (King 2008). Despite a $15 billion price tag and still undeveloped technology, King thinks the offshore wind "ranch" would be cost-effective in a world of ever-increasing oil prices. If Maine were able to reach its goal of 3,000 MW of wind power by 2020, over 50% current electricity consumption could be generated by wind power.

However, critics say that wind is not a reliable source of power. Its capacity factor is lower than that of other types of energy sources. While nuclear energy and natural gas can run at full capacity between 90-100% of the time, wind energy will only run at full capacity roughly 35% of the time in Maine (King 2008). Because wind farms require constant air movement, wind power is most effective at different parts of the day and different parts of the year. Winds are strongest and most consistent during the winter months in Maine, while weakest in the summer. Although wind power's inherent instability means that it is unlikely to become the only source of power in Maine, it will be able to work with other, more consistent sources of power when the winds are not blowing. Natural gas would be the best choice to reinforce the power grid when winds are weak, as the infrastructure is already built and it is easy to increase and decrease the use of natural gas as needed through the state.

Other potential solutions might be found in the ocean. Currently, there are 14 tidal power project proposals being considered for funding by MPUC (DEP 2008). While there is still significant research to be done before any sort of mass tidal power goes online, there is considerable excitement around the technology. "Tidal is probably the next most substantial piece of technological innovation," PUC Chairman Kurt Adams says. "There are over 40 types of technologies for tidal energy. Investors are looking at understanding which of these are going to be successful, ... but I believe that in three to five years they'll be where wind is in Maine now" (Ravana 2008). Supporters believe that tidal power will be able to offer competitive prices and will be able to support wind power during periods of light winds.

There is research currently being explored in Maine in the realm of biomass as well. The US DOE just invested $86 million to investigate three new cellulosic ethanol biorefineries, including $30 million to a pulp and paper mill in Old Town, Maine. Hemicellulose from the wood pulp will be extracted and used to produce 2.2 million gallons of ethanol a year (DOE 2008c). This small scale refinery is meant to test conversion technologies, which would provide the information necessary to scale up the process to process in a commercial scale biorefinery, which would typically produce 20-30 million gallons of ethanol a year (DOE 2008c).

Governor Baldacci is also investigating the potential of electricity generation from scale farms. In his 2008 State of the State address, he introduced his Wood-to-Energy initiative by calling for an increase in domestic renewable energy production. Although his plan is still uncharted, Baldacci says "In this energy crisis, we will develop renewable sources of energy made in Maine, by Maine businesses for Maine people." (State of Maine 2008c) With all these new renewable energies currently being developed in the state, Maine's energy portfolio is likely to look dramatically different by the end of the next decade.

Scenarios

In the following section, we provide three possible scenarios for the future. Each is based on our research from the current state and implications of residential heating and electricity use.

Worst of the Worst: "Chicken Little"

Energy prices increase dramatically due to supply restrictions by energy producing organizations such as OPEC. This forces residents to reduce consumption in order save money. The State lowers taxes and pulls out of RGGI under heavy political pressure to provide consumer relief. Maine ceases funding the production of renewable energy sources due to budget restraints, thereby continuing reliance on foreign fossil fuels. The livelihoods of Maine residents are jeopardized by the combination of a reliance on fossil fuels, higher energy prices, and reduced supply. Mainers have some of the highest energy costs in the US, and rising energy prices have significant impacts on elderly individuals and low-income families, especially during the winter months. With higher income percentages spent on energy use, Mainers have less disposable income and are unprepared for emergencies.

Following Current Trends: "Foghorn-Leghorn"
Energy prices continue to rise following recent trends. Per capita energy use begins to decrease as efficiency programs expand. With improved efficiency, Maine households spend a smaller percentage of their incomes on energy despite higher prices. Higher energy prices provide an incentive to continue developing renewable energy sources in Maine. Once renewable energy sources have developed, energy prices will decrease as a result of lower input costs. Greenhouse gas emissions are reduced to the RGGI mandated levels through energy efficiency programs and increased renewable energy production.

Best of the Best: "Turducken"

Energy prices decrease because renewable sources are more affordable due to technological advancements, supportive government policies, and economies of scale. Maine is able to become completely reliant on domestic renewable energy sources through tidal power and a major wind project in the Gulf of Maine. As a result, Maine exceeds RGGI energy requirements and sells its excess renewable power to states through a cap-and-trade program. Money received from RGGI is used for efficiency programs and retrofitting houses with geothermal heat pumps.

Conclusion

Major Findings

Maine is more dependent on fuel oil for home heating than any other state in the nation, with 77% of households using heating oil (Figure 1.3). The state is therefore vulnerable to rising costs. Costs of home heating are already high for many, especially residents in northern Maine where poverty rates are higher than the national average (Figure 1.8). Maine's housing stock is older than the average US housing stock, resulting in many residents living in inefficiently heated houses (Figure 1.7). Statewide CAP agencies are expanding their efforts to help needy Mainers, but many residents still are unassisted. Residential heating sources, particularly fuel oil, emit almost six million tons of carbon dioxide (RGGI 2008, Figure 1.9). Maine does not have effective policies for addressing these greenhouse gas emissions or reducing the state's dependence on fuel oil.

From 2004 to 2007, electricity rates have increased over 50% (Figure 1.16). Electricity use per household is also increasing (Figure 1.13). Maine has an effective, although still small, program addressing the affordability of residential electricity through Efficiency Maine. The state's primary sources of electricity emit less greenhouse gas than the rest of the US, as natural gas emits smaller amounts of carbon dioxide than other non-renewable fuels (Figure 1.9). Almost 50% of the state's electricity is produced through hydro-electric dams, which produce no greenhouse gas emissions (Figure 1.11). Maine also has effective policies attempting to reduce the carbon dioxide emissions of electricity use.

Although Maine has been a leader in reducing emissions from electricity generation, there has been little focus on moving Mainers away from residential heating with fuel oil. The average resident emits more than twice as much carbon dioxide through residential heating as through electricity consumption (US Census Bureau 2000, EIA 2002, Elder et al. 2007, RGGI 2008). This will have serious impacts on Maine's environment and the global community through climate change. Global climate change is predicted to have severe political, social, economic, and environmental consequences.

Recommendations

We have four recommendations for the future of Maine's residential energy use and policies. These recommendations stem from our conclusions on Maine's current state of residential heating and electricity. We focus these recommendations on how the State could reduce risks to Maine's environment and reduce the risk of price shocks on Maine residents.

The funds resulting from RGGI auctions should continue to be spent on energy efficiency and home weatherization programs throughout the state. This increased funding to programs will improve LIHEAP and Efficiency Maine's ability to help Mainers unable to afford high residential energy prices. Additionally, these programs will reduce the state's overall greenhouse gas emissions by reducing residential energy use.

Maine needs to expand energy efficiency programs in two ways. First, Efficiency Maine's programs need to be expanded to impact the efficiency of more households throughout Maine. Second, Efficiency Maine should expand its focus to appliances other than lighting and refrigerators. To start, the program could expand to appliances such as clothes dryers and televisions, which are prevalent in most Maine homes and also consume considerable amounts of electricity. Funding for the expansion of Efficiency Maine programs could be supplied by RGGI auctions, which are expected to raise $18 million annually (Energy Efficiency and Renewable Energy 2008b).

LIHEAP needs to continue to expand assistance eligibility requirements to provide more Maine residents with heating assistance. Even modest levels of aid on heating bills would reduce the vulnerability of many residents during the winter. The increased funding necessary to provide expanded services would continue to come from Congress. While supplying assistance for high heating bills does nothing to reduce dependence on fuel oil or other expensive heating sources, this program is important to help Mainers until renewable heating sources are available.

Maine needs to implement policies promoting the residential use of less expensive and more sustainable heating sources. While there is no immediate solution to end Maine's reliance on fuel oil, wood could be a short-term alternative. Although still a heavy carbon dioxide emitter, wood is a domestic renewable heating source. In the long run, Maine needs to invest in the research and development of cleaner heating sources, such as geothermal heat pumps and solar heating. Such actions will promote energy independence and provide more stable heating prices for Maine's future.

Appendix A Percent of residential appliance energy use of various household appliances in the US in 2001 (EIA 2001).
<table>
<thead>
<tr>
<th>Appliance</th>
<th>Total Household Energy Use (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refrigerators</td>
<td>13.7</td>
</tr>
<tr>
<td>Lighting</td>
<td>8.8</td>
</tr>
<tr>
<td>Clothes Dryer</td>
<td>5.8</td>
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<tr>
<td>Freezers</td>
<td>3.5</td>
</tr>
<tr>
<td>Furnace Fan</td>
<td>3.3</td>
</tr>
<tr>
<td>Color TVs</td>
<td>2.9</td>
</tr>
<tr>
<td>Electric Range Top</td>
<td>2.8</td>
</tr>
<tr>
<td>Dishwasher</td>
<td>2.5</td>
</tr>
<tr>
<td>Electric Oven</td>
<td>1.8</td>
</tr>
<tr>
<td>Microwave</td>
<td>1.7</td>
</tr>
<tr>
<td>Pool Filter/Pump/Heater</td>
<td>1.6</td>
</tr>
<tr>
<td>Desktop Computer</td>
<td>1.5</td>
</tr>
<tr>
<td>VCR/DVD</td>
<td>1.0</td>
</tr>
<tr>
<td>Clothes Washer</td>
<td>0.9</td>
</tr>
<tr>
<td>Ceiling Fan</td>
<td>0.8</td>
</tr>
<tr>
<td>Coffee Makers</td>
<td>0.5</td>
</tr>
<tr>
<td>Stereo System</td>
<td>0.5</td>
</tr>
<tr>
<td>Dehumidifier</td>
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<td>Cable Boxes</td>
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<td>Toaster Oven</td>
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<tr>
<td>Satellite Dish</td>
<td>0.2</td>
</tr>
<tr>
<td>Printer/Fax/Scanner</td>
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</table>

<table>
<thead>
<tr>
<th>Appliance</th>
<th>%</th>
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<tr>
<td>Lighting</td>
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<tr>
<td>Stereo</td>
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<tr>
<td>Cordless Phone</td>
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<tr>
<td>Clothes Washer</td>
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<td>Answering Machine</td>
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<tr>
<td>Residual Energy</td>
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Works Cited


MRS Title 5 Chapter 10 § 207. 1969. Unfair Trade Practices.


