STATE ENERGY STRATEGY

FOR GEORGIA

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Governor's Energy Policy Council

Division of Energy Resources of the
Georgia Environmental Facilities Authority (GEFA)

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INTRODUCTION

On March 1, 2006, the Georgia Environmental Facilities Authority (GEFA) launched the process to develop the first comprehensive energy plan for Georgia. This *State Energy Strategy* strives to balance a number of significant issues including the affordability, reliability and environmental sustainability of our energy resources as well as to maximize the benefits derived from locally available energy resources, industries and expertise.

The development process of the *State Energy Strategy* offered several opportunities for public involvement. A framework of six chapters was posted on the website www.georgiaenergyplan.org to serve as a stimulus for public comment. As a result of the posting, 222 participants registered to be part of the process and submitted 358 comments for consideration.

The comments were reviewed, and a first draft, drawing on those public comments, was posted on June 1. This first draft launched the second comment period during which citizens were asked to review and submit their comments through the website.

At the conclusion of the comment period for the first draft, 530 participants had registered and 727 comments were submitted. The comments were reviewed and considered in the development of the second draft.

The second draft included eight chapters. The chapters were realigned in response to comments and in an effort to fully develop the Strategy. The second draft included a format of policy options and implementation strategies.

Public meetings focusing on the second draft of the *State Energy Strategy* were held between September 25 and October 3, 2006, in Tifton, Savannah, Atlanta, Augusta and Rome. During the five public meetings, 108 citizens of the 381 in attendance offered oral comments on the second draft before representatives of the Governor's Energy Policy Council. Also, 98 written comments were submitted at the hearings and to the planning e-mail address during the nine days from the beginning to the completion of the hearings. Additionally, 500 individuals added their support through two group e-mails.

All comments on the second draft were compiled and posted on the website and provided to the members of the Governor's Energy Policy Council. Through individual review of the document and the public comments as well as discussion in four day-long meetings between September and December, members of the Council further refined the draft document. This document represents the culmination of all work carried out to develop a comprehensive energy strategy for Georgia. It is the *State Energy Strategy for Georgia.*

Governor's Energy Policy Council

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EXECUTIVE SUMMARY

The Governor's Energy Policy Council is proud to present to Governor Sonny Perdue the *State Energy Strategy for Georgia*. This Strategy embodies the vision, experience and hard work of the 22 members of the Governor's Energy Policy Council, the hundreds of members of the public who provided input, and the staff of several State agencies that helped craft the document. We believe that this *State Energy Strategy for Georgia* balances options for economic growth and sustained development with environmental concerns.

Over the past 30 years, the State of Georgia has experienced remarkable growth in population, economic activity and energy demand. During this period of sustained demand growth, Georgia's energy markets have performed reliably and the state's energy supplies have suffered few disruptions. This has been an important factor in Georgia's prosperity, and it is a level of success that must be sustained to support Georgia's high quality of life into the future.

During this same time frame, though, Georgia has grappled with a number of growth and energy dilemmas including substandard air quality, water quality issues and water supply constraints. Additionally, Georgia and the nation as a whole have endured substantial energy price increases and price volatility, elevating the issue of energy in the minds of all the state's residents. The hurricanes of 2005 underscored Georgia's continued reliance on out-of-state, fossil fuel energy resources and the infrastructure that delivers them to our homes and automobiles. Finally, concerns about ecological impacts and the financial risk of global climate change continue to grow. Being a coastal state that relies heavily on carbon-intensive fuels, Georgia shares in these national and international concerns.

Georgia is now the ninth most populous state in the country, with expectations that its population will continue to grow rapidly. Current estimates predict that Georgia's population will increase nearly 50 % in the next 25 years, with concurrent and comparable increases in energy demand. Now is the right time for Georgia to examine energy production and consumption and make decisions that will be best for Georgians.

The *State Energy Strategy* contains detailed policy objectives and implementation strategies that address many of Georgia's current and future energy concerns. Through its deliberations, the Governor's Energy Policy Council has identified five key themes that best embody the overall direction of the *Strategy*. The purpose of this Executive Summary is to present those five key themes and highlight important elements of the *Strategy* that support them.

Key Theme 1: Prioritize Energy Resource Development in the State – In order to meet Georgia's growing energy needs, Georgia should consider prioritizing the various energy resource options available to meet the state's growing energy demand. The Council recommends as its highest priority that Georgia should aggressively pursue all cost-effective energy efficiency opportunities. In order to focus this effort, the Governor should consider, after a thorough cost-benefit analysis and jointly with the General Assembly, an energy efficiency goal to significantly reduce the forecast load growth over the next 10 years. For purposes of scope only, other states

have set goals from 20 to 30 percent. The second priority should be renewable energy resources, particularly utilization of Georgia's significant biomass resources. The third priority should be advanced conventional energy resources, such as advanced coal gasification and combined cycle technology and advanced nuclear reactors.

The *State Energy Strategy* includes numerous strategies that support this theme as highlighted below.

Aggressive energy efficiency

- Create incentives for, and remove hurdles delaying, the adoption of efficient building technologies and practices (Strategy 3.8).
- Strongly promote energy efficiency in State-owned buildings and the use of life-cycle cost analysis to support the construction of high performance buildings (Strategy 3.9).
- Explore alternative ratemaking policies in order to provide stronger financial incentives to utilities to pursue energy efficiency (Strategy 3.15).
- Create incentives to increase the adoption of fuel efficient vehicles (Strategy 3.1).
- Create an energy improvement revolving loan fund for public facilities (Strategy 5.4).
- Create a Georgia Clean Energy Fund for energy efficiency and other clean energy strategies (Strategy 5.3).
- Continue current efforts to maximize alternative commuting modes, particularly telecommuting (Strategy 3.5).
- Deploy idle reduction technologies (Strategy 3.3) and "smart" traffic control technologies (Strategy 3.4) and support effective transportation demand management programs (Strategy 3.6) to improve the efficiency of the transportation system.

Renewable energy

- Use State purchasing power, where appropriate, to stimulate demand for biomass-based transportation fuels and clean energy (Strategies 2.2 and 2.6).
- Evaluate a comprehensive clean energy income tax credit program (Strategy 5.2).

Advanced fossil fuel and nuclear technologies

- Implement a suite of policies to encourage highly efficient distributed generation, including the development of statewide interconnection standards (Strategy 1.9) and the development of a Georgia combined heat and power roadmap (Strategy 1.10).
- Support for the deployment of integrated gasification and combined cycle coal technology and advanced nuclear reactors (Strategies 1.12 & 1.13).

Key Theme 2: Take a Leadership Role in the Development of Alternative Fuels – To enhance Georgia's economic development and reduce Georgia's reliance on imported fuels, Georgia should become a leader in the production and consumption of bio-based fuels such as cellulosic ethanol and biodiesel, particularly those produced from feedstocks that are already grown or available within the state.
The *State Energy Strategy* includes several recommendations that support this idea as highlighted below.

- Support development of biomass fuel industry (Strategy 4.4) and supporting public-private partnerships to coordinate renewable energy research and development (Strategy 4.1).
- Create a Georgia Renewable Transportation Fuels Advancement Fund (Strategy 5.1).
- Conduct an assessment of biofuels delivery infrastructure needs to focus efforts on enhancing the delivery infrastructure (Strategy 2.3).
- Develop an industrial recruitment strategy to attract businesses producing renewable transportation fuels and clean energy (Strategy 4.5).
- Ensure availability of high quality alternative fuels through the support of ASTM standards in the state (Strategy 2.1).

Key Theme 3: Encourage State Government to Lead by Example – The government of the State of Georgia should lead by example. State government can improve its building and vehicle energy efficiency and, at the same time, substantially cuts its costs. Additionally, as a large energy buyer, the State can boost the markets for advanced technologies and clean energy sources. The State should adopt and implement energy management practices and utilize renewable fuels and resources where doing so has a life cycle cost benefit or can assist in transforming the market for these practices and technologies.

The *State Energy Strategy* includes several recommendations that support this idea as highlighted below.

- Establish energy reduction goals for public facilities based on life cycle cost analysis (Strategy 3.9).
- Develop purchasing criteria for the State of Georgia to increase the overall fuel efficiency of the vehicles in its fleet (Strategy 3.2).
- Create an energy improvement revolving loan fund for public facilities (Strategy 5.4).
- Establish minimum energy performance criteria for appliance and equipment purchases (Strategy 3.13).
- Use State purchasing power, where appropriate, to stimulate demand for bio-based fuels and clean energy (Strategies 2.2 and 2.6).

Key Theme 4: Educate the Public About Energy Issues and Provide Appropriate Incentives to Guide Individual Consumers and Market Participants Toward Wise Energy Choices – To ensure that Georgians continue to make energy use decisions that benefit themselves and the state as a whole, the State should provide resources including education and financial incentives to promote the wise use of increasingly valuable energy resources.

The *State Energy Strategy* includes several recommendations that support this idea as highlighted below.

- Conduct a public awareness campaign to educate Georgians on how to improve energy efficiency (Strategy 7.1).
- Develop an energy information website or "portal" for easy access to energy information about Georgia (Strategy 7.2).
- Coordinate efforts to incorporate energy into curricula throughout the state (Strategy 7.3).

- Provide resources to support the *State Energy Strategy* (Policy Objective of Chapter 5).

Key Theme 5: Continue Prudent Energy Planning for the State – Georgia should maintain and improve its high quality of life and its reputation as a desirable place to do business by updating the *State Energy Strategy* on a periodic basis and supporting the recommendations developed through this public and stakeholder-driven consensus-based process.

The *State Energy Strategy* includes several recommendations that support this idea as highlighted below.

- Establish a formalized process for the periodic update and revision of the *State Energy Strategy* (Strategy 8.1).
- Provide a focus on energy information, planning and security by compiling a statewide energy supply and demand assessment for all fuels, and updating the assessment on a regular basis (Strategy 1.1).
- Prepare for carbon markets and potential regulations of the future by developing a Georgia greenhouse gas inventory (Strategy 6.8) and greenhouse gas registry (Strategy 6.9) and evaluating financial risk to Georgia from federal carbon regulation (Strategy 1.2).
- Evaluate output-based environmental regulations for cost-effective opportunities to promote more efficient energy generation (Strategy 6.3).
- Conduct a thorough analysis of energy efficiency and renewable energy potential in Georgia and update the analysis on a regular basis (Strategy 1.3).
- Consider establishing an ongoing advisory group that would oversee implementation of the Strategy and ensure continuation of the planning process and the discussion of State energy policy and planning issues.

While the Council reached consensus on the importance of these five themes as a foundation for Georgia's *State Energy Strategy*, there remain dissenting views on the specific strategies related to expanding the use of nuclear technology and the source of funding for a Clean Energy Fund to promote clean energy and energy efficiency options. Some Council members do not support the expansion of nuclear energy technologies in Georgia because of concerns about nuclear waste management and water supply constraints, although a majority of the Council feels such technologies offer promise in meeting Georgia's growing energy demand while reducing air emissions. There are strong viewpoints both for and against this option. Likewise, the Council strongly debated funding options for advancing the policy objectives and implementation strategies recommended in the document. While Council members agreed on the importance of funding to support the various elements of the Strategy, they did not reach consensus on how to develop a Clean Energy Fund.

This document completes the initial step of examining and planning energy production and use in Georgia in a comprehensive manner. It addresses a significant number of issues; it leaves other issues unresolved. Some of the strategies can be implemented with dispatch. Some will require defined funding mechanisms and detailed procedural guidelines. Others will require enabling legislation before they can be moved forward.

While the work of this Council will end with completion of this document, it is the expectation that the work of energy planning and review will be an ongoing process of continuous improvement. This comprehensive set of policy objectives and implementation strategies begins to orient Georgia toward an energy future characterized by affordable, reliable and environmentally responsible energy.

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CHAPTER 1: ENERGY RELIABILITY

The reliable delivery of affordable energy sustains Georgia's economy and promotes the well-being and productivity of all Georgians. Reliability requires the successful integration of many activities, including locating and extracting energy resources around the world, buying and selling those commodities in global markets, refining or converting raw energy resources and transporting energy resources across vast distances to the point of end use. Each of these energy-related "commodities" (i.e., resource supply, market liquidity, refining/conversion and transportation) must be adequate to meet demand and linked together to create a strong energy supply chain that stretches from the Persian Gulf to our gas tanks, and from the coal fields of Wyoming to the light bulbs in our living rooms.

Discussions of energy reliability often focus on how much supply can be extracted from the ground, how much gasoline U.S. refineries can process each day, the capacity of pipelines or how many megawatts of electricity can be generated. While this analysis is critical, discussions must also acknowledge that "adequacy" of energy supplies, refinery output, pipeline capacity or electricity generation involves *the relationship* of supply and demand. This perspective means that policies designed to enhance energy reliability should not address supply alone.

The relationship between energy supply and demand affects the price of energy every day. Price volatility in commodity markets, such as the increase in U.S. natural gas prices over the last few years, often results from a tightening between demand and available supply. The dramatic reduction of natural gas supply after the hurricanes of 2005 exacerbated this trend and pushed prices to record highs.

Considering Georgia's recent history, the state's demand for energy will continue to grow at a brisk pace. Between 1984 and 2004, the state's total energy consumption grew 76% from 1,731 Trillion British Thermal Units (TBtu) to 3,050 TBtu, a rate of growth far greater than the state's population growth over the same time period (51%) (Georgia Environmental Facilities Authority [GEFA], 2006). In the absence of reduced demand, Georgia's energy supply will have to expand considerably to avoid supply and demand imbalances that could destabilize the energy supply network and drive prices up.

This chapter advances options to enhance the reliable delivery and affordability of energy resources for Georgia. It addresses energy supply, demand management, delivery infrastructure and affordability issues in Georgia for conventional energy sources, including petroleum products (gasoline, diesel fuel and distillate fuel oil), natural gas, electricity and electricity fuels (coal, uranium, oil and natural gas).

Chapter 1 is organized around eight *policy objectives*, which are programs or policies intended to move Georgia toward affordable, reliable and environmentally responsible energy. Each policy objective is followed by associated i*mplementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Section 1: Energy Information, Planning and Security

Georgia boasts a remarkable number of participants in the energy market, including 96 electric utilities, 86 natural gas utilities, 13 natural gas marketers, six interstate pipeline operators (natural gas, propane and refined petroleum products), 14 independent electric power producers, two federal electricity suppliers and scores of transportation fuel carriers and retail sales outlets.

Georgia's investor-owned utilities (Georgia Power[1], Atlanta Gas Light Company and Atmos Energy) forecast future demand and develop comprehensive plans for supply and demand management for their service territories under the guidance of the Georgia Public Service Commission (PSC)[2]. Oglethorpe Power Company, Georgia Transmission Corporation (GTC) and the Georgia System Operations Corporation help coordinate the electricity capacity and generation planning of Georgia's electric membership cooperatives. Similarly, the Municipal Electric Authority of Georgia (MEAG) and the Municipal Gas Authority of Georgia (MGAG) help coordinate the forecasting and planning of municipal electric and gas utilities. Finally, the Integrated Transmission System of Georgia facilitates coordination among the four utilities (Georgia Power, GTC, MEAG and Dalton Utilities) in developing new electricity transmission capacity in Georgia.

All of these efforts reflect careful forecasting and resource planning by the individual market participants and in some cases reflect coordinated planning by groups of market participants. Yet no entity in Georgia compiles a comprehensive analysis of forecasted energy demand and supply for the state. Such a forecast and resource plan would prove invaluable in developing statewide public policy, particularly on infrastructure and regulatory issues.

Policy Objective
Enhance Statewide Energy Data Analysis and Planning

In 2001, the James C. Bonbright Utilities Center at the Terry College of Business of the University of Georgia published *Reliability of Electric Supply in Georgia*. This remains the only published assessment of electricity reliability for the whole state, and underscores a broader point: no such assessment exists for all of the energy resources in Georgia. The lack of authoritative statewide energy data often complicates public policy debate. For example, 2006 debate in the Georgia General Assembly concerning HB 1325, which called for building an intrastate natural gas pipeline, drew conflicting claims about natural gas supply and demand.

Developing a statewide energy supply and demand assessment should be sensitive to the fact that utilities consider some elements of their demand forecasts and supply plans to be trade secret. Any assessment must sufficiently shield any trade secret information. Additionally, developing a statewide supply and demand assessment must not create new reporting burdens for energy

[1] Savannah Electric Power Company merged with Georgia Power effective July 2006.
[2] O.C.G.A. 46-2-26.5 details gas supply plan requirements for natural gas utilities regulated by the Georgia Public Service Commission (PSC). O.C.G.A. 46-3A-1 et seq. details integrated resource planning requirements for electric utilities regulated by the PSC.

suppliers. The agency developing the assessment would need to rely on data from current planning processes.

Despite these issues, many benefits would accrue to Georgia from having a statewide energy supply and demand assessment. An assessment would identify future reliability concerns and allow policy makers to respond creatively and constructively, avoiding the pitfalls of making policy decisions in the midst of crisis. This foresight and responsiveness would help Georgia maintain a reliable energy supply despite a constantly evolving market and regulatory climate.

Implementation Strategies

Strategy 1.1 – Develop a Statewide Energy Supply and Demand Assessment for All Fuels
The Georgia Environmental Facilities Authority, Division of Energy Resources (GEFA) should develop a centralized, statewide assessment of energy supply and demand for electricity, natural gas, propane, refined petroleum products (including gasoline, diesel fuel and distillate fuel oil) and renewable energy resources, and should update the assessment every two to three years. The assessment should forecast demand for each energy source and by end-use sectors (e.g., residential, commercial, industrial and transportation) and geographical area. The assessment should also evaluate the current energy supply and forecast supply changes. If particular issues prove contentious, the assessment should outline the range of expert opinion on those matters.

Given the complexity of assessing electricity transmission reliability and the existing regulations and federal oversight of this issue, the assessment should address electricity transmission reliability only at the highest levels.

Data from current planning processes of all utilities should be collected and used in the assessment. A methodology to shield the utilities' trade secret information should be developed.

This analysis will provide an objective, useful forecast of the energy supply/demand balance and potential problems. It will permit public policy makers to keep abreast of energy reliability issues in Georgia and to formulate targeted public policy that addresses energy reliability problems and ensures long-term energy reliability in the state.

Since O.C.G.A. 50-23-32 directs GEFA to "collect and analyze data relating to past, present, and future consumption levels for all sources of energy and report such findings…" (Georgia General Assembly, *O.C.G.A. 50-23-32*, 2005), it fits to assign the development of an energy supply and demand assessment to GEFA. To determine the appropriate scope of the assessment, data sources and data management protocol, GEFA should seek the input of natural gas and electric utilities and other interested parties through a stakeholder process. This process should highlight existing data sources that would improve the effectiveness and efficiency of data collection.

GEFA should outline any additional data and information technology needed to conduct a biannual or triennial energy supply and demand assessment.

Strategy 1.2 – Evaluate State Risk Posed by Possible Federal Carbon Regulations
American Electric Power and the Southern Company, the two largest coal-fired utilities in the United States, recently evaluated the risk posed to their operations by any future national carbon emission regulation (American Electric Power, 2004; Southern Company, 2005). As carbon regulation proposals gain momentum on Capitol Hill, it behooves utilities and states to take stock of their current electricity generation and understand what life would look like in a "carbon constrained" world. Georgia generates more than 60% of its electricity with coal, emitting high levels of carbon dioxide into the air through the combustion process. A regulatory shift at the national level would have a substantial impact on Georgia's electricity sector and Georgia ratepayers. Indeed, the Southern Company report concluded that when the potential costs for carbon emissions "…were applied to Southern Company's projected emissions, the annual cost increases to customers in 2020 range from $280 million to $1.7 billion" (Southern Company, 2005).

GEFA, the Georgia PSC and the Environmental Protection Division (EPD) of Georgia should conduct a joint study of the potential impact of proposals to regulate carbon emissions on Georgia's utilities and ratepayers. This assessment should document the current carbon dioxide emissions from Georgia electric generating units, forecast future emissions from these facilities and evaluate the economic impact on Georgia from possible carbon regulations.

Such an analysis represents prudent risk management. It helps State policy makers understand Georgia's vulnerability related to these issues and the challenges of carbon regulation.

The sponsoring State agencies should commence the study once EPD has completed an updated greenhouse gas emissions inventory for Georgia. (Strategy 6.8 related to greenhouse gas inventories is described in Section 4 of Chapter 6 of this document.) The sponsoring agencies have access to much data, but may require additional information from electric generation unit owners around the state.

Strategy 1.3 – Conduct a Thorough Analysis of Energy Efficiency and Renewable Energy Potential in Georgia
The State should conduct a comprehensive analysis of the technical, economic and achievable potential of energy saving and renewable energy technologies and programs. These assessments should outline technologies and methods that are available to consumers, determine whether they are cost effective on an individual and societal basis, and how likely they are to affect Georgia's energy consumption and overall economy. Furthermore, the analyses should evaluate how various policies and incentives, such as those proposed in the *State Energy Strategy*, will affect the adoption of energy saving and renewable energy technologies and programs.

Comprehensive studies include information from a variety of sources and identify the many benefits of energy efficiency and renewable energy technologies. Georgia can create a stronger market for efficiency and renewable technologies by further exploring their potential and prioritizing the implementation of policies and incentives that are most likely to succeed.

In May 2005, GEFA released the *Assessment of Energy Efficiency Potential in Georgia* (Jensen & Lounsbury, 2005). The study determined that consumers and businesses could save energy

and money by adopting certain cost-effective energy efficiency opportunities in lighting, heating and cooling. However, this study was completed before recent spikes in energy costs, including natural gas and gasoline. Moreover, the study relied heavily on data from the U.S. Department of Energy, much of which lacks state-level resolution. This study would greatly benefit from an update that includes more accurate, state-level data and more realistic prices and forecasts.

Finally, the *Assessment of Energy Efficiency Potential in Georgia* includes no evaluation of the technical, economic and achievable potential for renewable energy in the state. Various public and private entities agree there is great potential to develop renewable energy sources in Georgia, including the state's underutilized agricultural and forestry resources, but no comprehensive analysis exists to quantify that potential.

Based on GEFA's authority to collect and analyze data on energy consumption and to recommend energy conservation and management actions, (O.C.G.A. 50-23-32), GEFA should periodically update the *Assessment of Energy Efficiency Potential* to reflect changing energy prices and emerging technologies. GEFA should also create an *Assessment of Renewable Energy Potential in Georgia* that analyzes clean, renewable energy sources that can be harnessed to produce electricity and transportation fuels. Once complete, GEFA should work with research institutions and the private sector to increase the market penetration of technologies and practices identified by these studies.

According to the 2005 *Assessment of Energy Efficiency Potential in Georgia*, future analyses would benefit greatly from Georgia-specific data that is already collected by the state's utility companies. Some of these companies consider portions of their data to be trade secret, and do not make them available for study. GEFA should continue to collaborate with these companies to reach agreements that protect their trade secret data, yet provide useful tools for statewide analysis.

Section 2: Refined Petroleum Products

Georgia consumed 185.1 million barrels of refined petroleum products in 2004, equivalent to 976 trillion Btu of heat energy, according to the *Georgia Energy Review 2005* (GEFA, 2006). This level of consumption makes refined petroleum products the chief energy source for Georgia, outpacing energy from coal by more than 10%. The transportation sector accounted for 90% of this consumption, and motor gasoline is the single largest petroleum fuel type, accounting for 66% of transportation energy use in Georgia in 2004. Another major source of transportation energy is distillate fuel, a general classification of petroleum fuels that includes diesel fuels and other fuel oils. Distillate fuel consumption more than doubled from 1984 to 2004 and accounted for 25% of transportation energy consumption in 2004.

Georgia's petroleum consumption for the last two decades reveals a history of strong, sustained increase in demand. Consumption of refined petroleum products increased 67% from 1984 to 2004, an average annual growth rate of 2.6%. Petroleum products surpassed coal during the late 1980s and have remained Georgia's chief energy source ever since.

An obvious explanation for Georgia's increased demand for refined petroleum products lies in Georgia's population growth during the last 20 years. Yet population statistics do not tell the whole story. Georgia's rate of population growth between 1984 and 2004 (51%) lagged behind the growth rate of petroleum demand, and this discrepancy points toward other compounding factors, such as an increase in the vehicle miles traveled per capita and/or a decrease in average vehicle efficiency.

Unfortunately, Georgia produces no crude oil and has no oil wells, no proven crude oil reserves and no petroleum refining capability. Therefore, the state must rely on imports of refined petroleum products to meet its growing demand. Most refined petroleum products enter Georgia via the Colonial and the Plantation interstate pipelines that deliver products from the Gulf Coast, and some products come through Georgia's ports.

The back-to-back hurricanes that hit the Gulf Coast in 2005 underscored Georgia's dependence on Gulf Coast refineries and interstate pipelines. For the first time in recent memory, Georgia suffered fuel shortages and dramatic price spikes.

In recent years, several biofuel (ethanol and biodiesel[3]) production facilities have begun operations in Georgia. For instance, in 2004, US Biofuels opened a plant in Rome that converts chicken fat and soy oil into biodiesel. This facility produced 2.2 million gallons of biodiesel in 2005. In the same year, all biofuel facilities in Georgia produced roughly 2.8 million gallons of biodiesel and 400,000 gallons of ethanol. Yet despite this increase of in-state biofuel production, in-state consumption of biofuels has not increased proportionally. In 2005, Georgia biofuel producers exported all of their ethanol production and more than 75% of their biodiesel production to other states.

[3] Ethanol and biodiesel are fuels derived plants and animal sources that serve as alternatives or replacements for (petroleum-based) gasoline and diesel fuels.

Policy Objective
Maximize Development of In-State, Cost-Competitive Bio-Based Transportation Fuels and Expansion of the Retail Infrastructure

Given Georgia's reliance on global oil supplies, out-of-state refining capacity and vulnerable transportation fuel supply infrastructure, the increased production and use of local, bio-based transportation fuels could substantially improve Georgia's energy reliability.

Various strategies to increase production and use of local biofuels in Georgia are described in Section 1 of Chapter 2 of this document.

Policy Objective
Maximize Vehicle Fuel Efficiency in Georgia to Enhance Transportation Fuel Reliability

Georgia's demand for transportation fuels has grown strongly over the last 20 years and shows no sign of abating. Curbing this demand through greater vehicle efficiency could substantially improve Georgia's energy reliability as well as drive down costs and improve air quality.

Various strategies to increase vehicle efficiency in Georgia are described in Section 1 of Chapter 3 of this document.

Policy Objective
Enhance Petroleum Infrastructure to Minimize Vulnerability to Supply Disruptions

Enhancing the reliability of petroleum fuels is an important goal for Georgia because the state's reliance on foreign oil that is refined primarily in the Gulf Coast region and shipped through interstate pipelines leaves it vulnerable to supply disruptions. Yet progress toward that goal has been elusive because there is little consensus about the best strategies to enhance the supply of petroleum for Georgia. A comprehensive analysis of various options could help Georgia understand the advantages and limitations of each approach and determine which project is most viable in meeting the reliability goal.

In the aftermath of hurricanes Katrina and Rita in 2005, Georgia suffered transportation fuel shortages, high fuel prices and public anxiety reminiscent of the oil embargo of the early 1970s. Yet even before the hurricanes hit, gasoline prices climbed to unprecedented levels and did not come back down. Gulf Coast refinery limitations played an important role in these price increases and shortages. Also, the concentration of refining operations in the Gulf region makes Georgia acutely reliant on a single pipeline corridor served by two pipelines.

Several options have been discussed within the state. One approach is to develop local crude oil refining capacity, which would reduce reliance on Gulf Coast operations. In 1975, the Governor's Office of Planning and Budget published a study entitled *Petroleum Refinery Feasibility Study of Coastal Georgia* that examined the probable social, economic and

environmental impact of a refinery on Coastal Georgia. The study concluded that a refinery was tentatively feasible, but posed many serious risks and development challenges. While some advocate for the construction of a Georgia-based petroleum refinery today, no market player has presented a way around the inherent challenges and pursued development.

Another approach is to create reserve capacity for refined petroleum products in Georgia by developing in-state storage facilities and associated pipelines – either as centralized storage or distributed in several key locations.

A third approach is to enhance the delivery of refined petroleum products from the Gulf region. Colonial Pipeline Company, which operates the Colonial refined petroleum product pipeline that delivers nearly 70% of the refined petroleum products consumed in Georgia, has taken steps to increase the delivery capacity. Colonial has received initial approval from the Federal Energy Regulatory Commission to build 500 miles of new pipeline that would run parallel to existing pipeline, augmenting the system's capacity by nearly 30%. The State could investigate whether any impediments remain for this expansion, and if they might be removed through State action. This examination also could highlight opportunities for the State to support additional infrastructure for refined petroleum products. While a pipeline originating in the Gulf and running parallel to the existing primary pipeline provides little insurance against an event like hurricane Katrina, it substantially increases delivery capacity and alleviates constraints on the existing system.

Implementation Strategies

Strategy 1.4 – Commission Analysis of Best Projects to Enhance Georgia's Refined Petroleum Product Supply Reliability

The Georgia Department of Economic Development and the Georgia Petroleum Council should commission a comprehensive analysis of the various options to enhance Georgia's refined petroleum product reliability. The study should be completed in two sections. The first should specifically evaluate the feasibility of establishing a centralized or distributed refined petroleum product reserve. This section of the study should be completed by early summer 2007, in advance of the hurricane season. The second part of the study should evaluate the feasibility of developing a crude oil refinery off the Georgia coast and of supporting expansions of existing pipelines from the Gulf. It should also identify any other projects that may be viable in addressing petroleum reliability, and the potential role of the State in these projects. The second section of the study should be completed by late 2007.

Section 3: Natural Gas

Georgia consumed 393 billion cubic feet of natural gas in 2004, equivalent to 405 trillion Btu of heat energy. When compared to petroleum, coal and other electricity fuels[4], natural gas ranked last as a source of energy, accounting for roughly 13% of Georgia's total energy consumption. During the last twenty years, Georgia's consumption of natural gas has grown gradually, from 307 TBtu to the current level, representing a 28% overall increase (GEFA, 2006).

Yet these high-level energy consumption statistics misrepresent the significance of natural gas for Georgia. The numbers reflect the heat content of fuels that entered the state (gross energy). However, the electric power sector consumed much of this energy in the process of producing electricity. Millions of Btus of energy were "lost" in conversion and never used by an end-use consumer. These losses are substantial, accounting for 32% of industrial energy consumption, 61% of commercial consumption and 55% of residential consumption in Georgia (GEFA, 2006). Conversely, when natural gas is used directly, 93% of the original energy content is available at the end use, for instance in a hot water heater (Energy Information Administration [EIA], *Natural Gas Navigator: Natural Gas Consumption*, 2006)[5]. Recalculating energy consumption to reflect only energy consumed at the *end use* (net energy) reveals a more prominent role for natural gas in Georgia. Natural gas accounted for 18% of overall state net energy consumption in 2004, and perhaps more revealing, for roughly 27% of net energy consumed in the commercial and industrial sectors and 39% of residential net consumption.

National trends and local utility projections indicate that consumption of natural gas by electricity generators in Georgia will grow in the foreseeable future. Utilities and independent power producers in Georgia have built natural gas generating units almost exclusively since 2000, mirroring a national trend. As a result, use of natural gas by electrical generators now drives higher demand for natural gas and, some argue, has contributed substantially to the price volatility that plagued natural gas markets in recent years.

Since Georgia produces no natural gas and has no proven reserves, the state relies on imports to meet all of its demand. Natural gas imports into Georgia arrive via three interstate pipelines and a liquefied natural gas (LNG) import terminal at Elba Island, near Savannah.

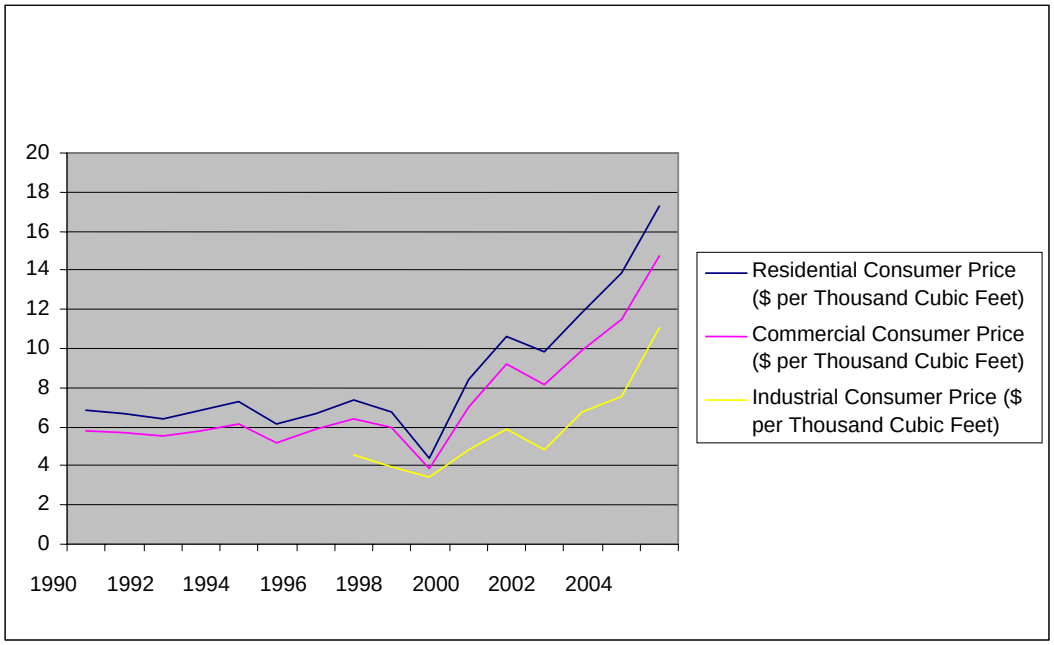
Georgia's residential, commercial and industrial natural gas prices remained stable for years, but dropped in 1999, only to climb dramatically over the next six years, as shown in Figure 1 (EIA, *Natural Gas Navigator: Natural Gas Prices*, 2006).

[4] "Other electricity fuels" refers to energy fuels that are used almost exclusively to generate electricity, including nuclear power, hydropower, and wood and wood waste.

[5] This number represents total U.S. consumption of natural gas minus all gas consumed in the extraction, processing and delivery of natural gas in 2004. EIA refers to consumption associated with extraction and processing as "lease and plant fuel" and the consumption associated with delivery as "pipeline fuel."

Figure 1

Average Natural Gas Price by End-Use Sector in Georgia 1990 - 2005 ($ per Thousand Cubic Feet)



This trend is not unique to Georgia, but reflects pricing across the United States. Most experts attribute the increase in U.S. natural gas prices over the last few years to the tightening between demand and available supply. The destructive hurricanes of 2004 and 2005 exacerbated this trend, pushing natural gas prices to record highs (GEFA, 2006).

Policy Objective

Promote Natural Gas End-Use Efficiency and Consumption Reduction Strategies

Research and policy initiatives around the country demonstrate that increasing supply or reducing demand can drive down price volatility and long-term wholesale prices. Georgia enjoys some limited opportunity to expand natural gas supply, mostly related to operation of the Elba Island LNG import facility. More opportunities exist for the state to curb demand and drive down costs. Those cost reductions occur at the customer level, when an individual residence or business reduces consumption, and in the marketplace, when demand reductions are substantial enough to improve the balance of supply and demand.

ICF Consulting's study entitled an *Assessment of Energy Efficiency Potential in Georgia* (Jensen & Lounsbury, 2005) concludes that moderately aggressive energy efficiency programming in Georgia could reduce natural gas consumption 4.4% by 2010. A more aggressive approach could increase the savings to 5.5%. That represents an annual average savings of between 0.9 and 1.1% each year. Such increases in efficiency would lower customer bills while putting downward pressure on the wholesale cost of natural gas.

It bears noting that the ICF study examined energy efficiency programs that target space heating and water heating loads, mostly in residential and commercial sectors. Yet research shows that energy efficiency or renewable energy can also displace demand for natural gas in electrical generation and reduce natural gas costs. An analysis by the U.S. Energy Information Administration (EIA) several years ago concluded that a nationwide increase in renewable energy production to 10% of U.S. generation would reduce natural gas bills by 1% for residential customers and 4% for commercial (EIA, *Impacts of a 10% Renewable*, 2002).

One important consideration is the recent dramatic increase in utilities' use of natural gas to produce electricity. While residential, commercial and industrial use of natural gas has grown modestly or leveled off, use of natural gas for electricity production has grown substantially. One approach to lowering demand from the electricity sector may be to reduce the use of electricity (and, consequently, natural gas) during times of peak power usage.

Implementation Strategies

Strategy 1.5 – Support Increased Residential and Commercial Energy Efficiency to Put Downward Pressure on Natural Gas Costs
Various strategies to increase residential and commercial energy efficiency in Georgia are described in Section 2 of Chapter 3 of this document.

Strategy 1.6 – Promote Fuel Flexibility in Georgia Industries by Removing Barriers to Industrial Fuel Switching and Fuel Back-Up Programs
In 2000, Georgia's industrial natural gas consumers paid an annual average price of $4.83 per dekatherm of natural gas. By 2004, the average annual price for Georgia industries had climbed to $7.56 per dekatherm. In 2005, this price spiked to $11.04, an increase of 129% from 2000. Given the financial blow this represents for Georgia's industries, greater fuel switching capabilities could provide valuable risk management capacity and help retain industries in Georgia. Many industries that use natural gas accept occasional curtailment of their supply for cheaper rates (interruptible service) and switch to propane or fuel oil stored on site. Yet when prices are high for natural gas, they are often high for fuel oil and propane, making it costly to replenish back-up fuels. Broader diversity of back-up fuel systems could allow industry to control costs better.

Georgia could help increase industries' use of fuel flexibility by streamlining the Georgia Environmental Protection Division's permitting process for these programs. The EPD should convene the appropriate regulated industries to discuss a more streamlined process for the State to review permits for flex-fuel programs, and follow up with changes in the regulations.

Policy Objective
Enhance Natural Gas Production and Infrastructure to Minimize Vulnerability to Supply Disruptions

Since Georgia produces no natural gas and has no proven reserves, the state relies on imports to meet all of its demand. Natural gas arrives in Georgia via three interstate pipelines and a LNG import terminal at Elba Island, near Savannah. Two of these three pipelines (the Transcontinental

Gas Pipeline and the East Tennessee Natural Gas Company) carry gas produced in the Gulf Region or the U.S. interior. The third pipeline (Southern Natural Gas Company) delivers Gulf Coast gas along with imported gas coming through Elba Island. In addition to the gas Elba Island delivers directly to the Southern Natural Gas (SNG) interstate pipeline, the LNG import facility also delivers gas to a pipeline serving South Carolina.

The Elba Island Terminal is one of four liquefied natural gas terminals operating in the United States. Elba Island receives and stores shipments of LNG from abroad, then delivers the natural gas to the interstate pipeline system. In 2005, 60-80% of monthly gas purchases from Elba Island went to some markets in Georgia and the remainder to other Southeastern states (GEFA, 2006). Yet South Georgia currently derives little benefit from Elba Island's operations in the state. That will change to some degree, however, when SNG completes construction of the new Cypress pipeline bound for Jacksonville, Florida that can deliver Elba Island gas to South Georgia and northern Florida customers. Elba Express Company LLC, a SNG subsidiary, plans to build the Elba Express Pipeline by 2010, which will travel northwest from Elba Island to connect with SNG's existing pipeline near Wrens, Georgia, as well as Transco's pipeline near the borders of Georgia and South Carolina.

These pipeline expansions are accommodating the expanded delivery capacity of Elba. One expansion of Elba completed in February 2006 increased the terminal's send-out (delivery) capacity from 446 million cubic feet (MMcf) to 806 MMcf per day. Southern LNG, a subsidiary of SNG that manages Elba Island, is planning another expansion that will more than double the capacity to over 2,000 MMcf per day by 2010.

Looking beyond imported natural gas, it is still unclear whether Georgia has natural gas reserves off the coast because all exploratory drilling has been stopped by a federal moratorium. Nationally, total dry production (overall withdrawals after processing and accounting for extraction losses) of natural gas has tapered off slightly (EIA, *Natural Gas Annual*, 2005), despite a steady increase in the number of gas and gas condensate producing wells in the United States from 2000 to 2004. United States Department of Energy (DOE) projections show U.S. natural gas production from conventional resource areas declining over the next 25 years (EIA, *Annual Energy Outlook*, 2006), forcing oil and natural gas exploration companies to go into deeper water and seek out unconventional sources of natural gas. Some natural gas market participants believe that permitting natural gas and oil exploration in currently protected areas of the United States, like the Outer Continental Shelf (OCS) off Georgia's coast, could increase production and bring down natural gas costs across the country.

Implementation Strategies

Strategy 1.7 – Evaluate Best Methods to Encourage Investment in the Natural Gas Infrastructure

Enhancing the reliability of natural gas supply is an important goal for Georgia because the state's reliance on natural gas that comes primarily through the Gulf Coast leaves it vulnerable to supply disruptions. Yet progress toward that goal has been elusive because there has been little attempt to address infrastructure issues beyond the Elba Island terminal expansion and related pipeline additions. A comprehensive analysis of options to enhance the infrastructure could help

Georgia understand the advantages and limitations of various approaches and determine which projects are most viable in meeting the reliability goal.

The Georgia Public Service Commission, in coordination with all local distribution companies, electing distribution companies, municipal gas distribution companies, interstate pipeline companies and natural gas marketers, shall conduct a comprehensive inventory to look at contractual and physical natural gas capacity and supply available to provide Georgia's natural gas requirements. This should be completed by late 2007. The study should specifically address questions by some in the natural gas and regulatory communities about the regulatory structure governing natural gas infrastructure decisions, such as whether the PSC should have additional authority to address infrastructure issues independent of their ratemaking authority.

Strategy 1.8 – Support Greater Exploration of Natural Gas Reserves on Outer Continental Shelf

In 1953, Congress enacted the Outer Continental Shelf Lands Act (OCSLA), which established federal jurisdiction over the OCS for the purpose of mineral leasing. The Act vested this authority in the Secretary of the Interior. Congress revisited the OCSLA in 1978 and, starting in the early 1980's, began restricting new leasing to only those areas of the OCS in the Gulf of Mexico and off the coast of Alaska. The first President Bush extended these drilling moratoria for a decade and President Clinton extended them until 2012. This has stopped drilling off the east coast of the United States, including Georgia's coast, since the early 1980s.

In 2006 the Georgia General Assembly considered several single-chamber resolutions focused on this issue. House Resolution 1635 requested that the Southern States Energy Board inventory and study the possibility of exploring for natural gas in the coastal areas of Georgia. House Resolution 1636 urged Congress and the President to lift the moratorium on offshore oil and gas drilling. Finally, Senate Resolution 1129 urged the Minerals Management Service (MMS) to include all OCS planning areas in its proposed five-year plan for 2007 through 2012 and to approve the broadest possible five-year plan for offshore development. The General Assembly did not pass any of these resolutions during its last session.

With the passage of the Energy Policy Act of 2005 (EPAct 2005), Congress returned to the question of OCS mineral leasing and commissioned a comprehensive inventory of oil and national gas reserves on the U.S. OCS. The MMS study said the OCS "remains a significant potential domestic source of new natural gas resources from fields yet to be discovered" (Minerals Management Service [MMS], 2006, p. ix), yet acknowledged that these resources "are in environmentally sensitive areas and the development of those resources must be balanced against potential environmental impacts" (MMS, 2006, p. xiii).

The State should continue to support prudent exploration of natural gas reserves on the Outer Continental Shelf. Better understanding the potential supply available from the OCS enhances the nation's and Georgia's ability to plan for its energy future.

Section 4: Electricity and Electricity Fuels

Georgia's demand for electricity grew 61% from 1990 to 2004 (EIA, *Retail Sales of Electricity*, 2005). In turn, this electricity demand drove construction of more than 15,000 megawatts of generating capacity in the same 14 years (EIA, *Existing Generating Units*, 2005). As expected, fuel consumption by Georgia's generating units has grown rapidly. Throughout this period of sustained demand growth, Georgia's electricity generation and transmission have performed well and the state has suffered no major electricity supply disruptions.

In the coming years, Georgia's demand for electricity will continue to grow. The 2001 study *Reliability of Electric Supply in Georgia* (Danielsen & Wright, 2001) forecast brisk annual load growth in Georgia, with a sustained annual growth rate over 3% per year from 2006 through 2010. ICF Consulting's 2005 report *Assessment of Energy Efficiency Potential in Georgia* (Jensen & Lounsbury, 2005) reflects this trend, showing strong increases in electricity sales and peak demand in Georgia from 2003 to 2015.

Currently, Georgia relies predominantly on 11 large coal plants and two nuclear power plants sited around the state to satisfy Georgians' demand for electricity; these plants produce more than 90% of Georgia's electricity (GEFA, 2006). In 2004, natural gas generation accounted for only 5% of statewide generation, although current projections indicate this share will grow. Current environmental regulations favor natural gas generation because it releases less sulfur dioxide and fewer oxides of nitrogen – precursors to smog, acid rain and secondary particulate matter.

Because of land requirements, cooling water needs and environmental constraints, locating large generating units close to major population centers proves difficult to do. Georgia's high voltage transmission grid bridges this geographic gap, linking generating units to load centers across the state and around the region. Georgia's Integrated Transmission System[6] (ITS) consists of more than 16,000 miles of transmission lines (Georgia Electric Membership Corporation [EMC], n.d.). The ITS has weathered the increased demand on the system well and suffered few disruptions. Nonetheless, any long-distance electricity transmission system suffers transmission inefficiency. According to the U.S. DOE, an average of 9.5% of electricity generated at a central power plant never reaches its destination due to line losses. These losses increase with both the distance electricity travels and the congestion on a power line (U.S. Department of Energy [DOE], Office of Electricity Delivery, 2006).

Georgia and the Southeast have recently seen greater interest in distributed generation (DG), such as combined heat and power (CHP) technologies. Distributed generation is a broad category that covers smaller electrical generation units typically located on-site or close to the point of consumption. Combined heat and power is a distributed resource that produces electricity and heating and cooling simultaneously. Five years ago, the Georgia General Assembly sought to promote DG by approving the "Georgia Cogeneration and Distributed Generation Act of 2001"

[6] The ITS is jointly owned by Georgia Power, Georgia Transmission Corporation, the Municipal Electric Authority of Georgia and Dalton Utilities.

(O.C.G.A. 46-3-50 et seq.). This law permits a residential or commercial consumer that operates a small electricity generation system on its side of the meter – such as a residential solar system – to sell electricity back to the utility when the power is not needed on-site. A couple of years later, the Southern States Energy Board (SSEB) and the Mississippi Development Authority commissioned a study of barriers to developing distributed generation in the Southeast. More recently, the Southeast Regional Office of DOE collaborated with private and public sector partners to establish the Southeast Combined Heat and Power Application Center (SCHPAC), which will explore ways to increase CHP in the Southeast and reach DOE's national goal of 92 gigawatts of CHP capacity nationally by 2010. Georgia has 1,206 MW of CHP, including 30.6 MW of wood-fired systems (Energy and Environmental Analysis, 2005).

CHP technologies are more thermally efficient than standard electricity generating units, producing useful thermal energy and electricity at the same time. Additionally, distributed forms of generation operate at the point of consumption, avoiding the "line losses" discussed above.

Greater efficiency in centralized power generation is also possible using technologies such as integrated gasification combined cycle (IGCC) power and super-critical coal-fired steam power. IGCC technology gasifies coal into synthetic gas (a medium Btu gas that can generally substitute for natural gas), which is then burned in a combustion turbine with heat recovery boilers. Plants using IGCC have achieved 42-45% thermal efficiencies (as opposed to 32-36% efficiencies for standard coal combustion technology). Super-critical coal-fired steam plants like the Lippendorf plant in Germany – which operate with higher steam temperatures and pressures than normal coal plants – have achieved similar efficiency levels. The disadvantage of these technologies is cost. IGCC is nearly four times more expensive to build than a natural gas plant. The Southern Company is now building a 285 MW IGCC pilot plant in Florida to test this technology.

Improving the efficiency of electricity generation and transmission may prove even more important in addressing environmental concerns in years to come. Tighter federal Clean Air standards are very likely, and a national limit on emissions of carbon dioxide remains possible. In response to clean air laws, U.S. and Georgia generating units have made tremendous progress cutting emissions of nitrogen oxides, sulfur dioxide and primary particulate matter using combustion and post-combustion pollution control technologies. Yet none of the technologies used today to control smog and soot will curb the emission of carbon. Only greater efficiency, switching away from carbon-based fuels or carbon sequestration (the trapping of atmospheric carbon dioxide in underground deposits, in vegetation or in the ocean) will achieve dramatic reductions in carbon emissions.

Policy Objective

Encourage Investment in Clean, Viable Next Generation Electricity Technology

Several viable emerging energy technologies are promising higher levels of generation efficiency, power reliability and improved environmental performance. As is often the case, these technologies cost more money and/or require adjustments in infrastructure or the market that are slow to occur. Throughout U.S. history, the federal and state governments have

implemented policy to stimulate the commercialization or deployment of the next generation of critical technologies.

Implementation Strategies

Strategy 1.9 – Develop Statewide Interconnection Standards That Are Consistent With Best-Of-Class National Standards

Statewide interconnection standards based on best-in-class national standards provide an early building block for the support of distributed generation, including renewable energy and CHP. While the Georgia General Assembly passed the "Georgia Cogeneration and Distributed Generation Act of 2001" (O.C.G.A. 46-3-50 et seq.), the Act does not address many aspects of interconnecting DG technologies to the grid. Georgia law leaves these details up to each individual utility, creating uncertainty and, in some cases, unnecessary burdens and delays for parties interested in interconnecting DG to the grid in Georgia.

The Federal Energy Regulatory Commission (FERC) has endeavored to harmonize state and federal practices related to interconnection. In 2003 and 2005, FERC adopted standard generator interconnection procedures and a standard agreement for large generators with capacity greater than 20 megawatts and small generators with a capacity of 20 megawatts or less (Federal Energy Regulatory Commission [FERC], 2003; FERC, 2005). A broad array of industry stakeholders participated in the process of composing these rules. Additionally, the rules incorporate many of the best practice recommendations made by the National Association of Regulatory Utility Commissioners.

While FERC's rules provide useful guidance, they specifically apply to public utilities that own, control, or operate facilities to transmit electric energy in interstate commerce, and they only pertain to the interconnection of DG with the transmission system. The rules do not apply to smaller distributors, or to the interconnection of DG with the distribution grid. In these cases, varying requirements from individual utilities can create barriers to the use of DG.

A high-quality, statewide interconnection standard in Georgia would limit uncertainty for those small distributors (facilities or homes) considering interconnected distributed generation, such as CHP units and residential solar photovoltaic systems. Implementing a standard would create a positive environment in which to expand clean distributed generation in Georgia and provide for equity by ensuring that interconnection costs are the same throughout the state.

Electric utilities, the Georgia PSC and GEFA should convene a working group to explore these issues and develop recommendations to address interconnection standards. This working group should be convened after completion of the 2007 Integrated Resource Planning process with Georgia Power so that the results of the PSC evaluation can be incorporated into the deliberations of the working group.

Other states that have developed interconnection standards can provide a rich reserve of experience with this type of policy development. As of November 2005, 14 states had adopted statewide interconnection standards and seven states were in the process of developing standards (U.S. Environmental Protection Agency [U.S. EPA], *Clean Energy-Environment*, 2006). Many

of these states have conducted stakeholder processes to arrive at their final interconnection standards. Additionally, the U.S. Environmental Protection Agency's *Clean Energy-Environment Guide to Action* includes useful guidance about key elements of interconnection standards and information about state standards around the country.

Strategy 1.10 – Develop a State Combined Heat and Power Roadmap and Supporting Policies That Encourage Deployment of Clean Distributed Generating Resources

Energy Resources International (ERI) recently analyzed the status of distributed generation in the Southeast at the request of the SSEB and the Mississippi energy office. *Distributed Generation in the Southern States: Barriers to Development and Potential Solutions* and a companion document entitled *State Policies to Encourage Development – Lessons for Consideration in Southern States* (Energy Resources International, 2003) provide important insight into policy changes that could stimulate development of distributed generation technologies in the Southeast. The subsequent creation of the SCHPAC provides a forum to address many of the issues identified in the ERI studies.

CHP can play a meaningful role in helping to meet the expected growth in peak electricity demand in Georgia over the next nine years. In 2005, Energy and Environmental Analysis (EEA) developed a combined heat and power market review for the SCHPAC. In that review, EEA estimated that Georgia has the technical potential for an additional 6,445 MW of CHP capacity (2,615 commercial and 3,830 industrial). Based on other CHP techno-economic potential studies conducted by EEA, GEFA determined that 4-14% (258-902 MW) of the technical potential identified by EEA in Georgia is economical and practical.

To achieve this potential, Georgia can do much more to promote clean distributed generation, particularly CHP. A CHP roadmap for Georgia should identify critical success factors, including but not limited to:

- Interconnection standards
- Environmental regulations
- Financing
- Rate treatment, including exit fees
- Interaction with existing infrastructure and markets
- Tax treatment of distributed generation technology.

Greater deployment of CHP would benefit Georgia because CHP technologies are more thermally efficient than standard electricity production plants. A typical fossil fuel electric generating unit converts 35% of the energy present in the fuel to electrical energy. CHP systems combine on-site electricity production with heating and cooling, achieving thermal efficiencies that can exceed 70% (United States Combined Heat and Power Association, 2006). CHP systems also operate at the point of consumption, avoiding the "line losses" associated with long-distance electricity transmission. Such line losses are significant: an average of 9.5% of electricity generated at a central power plant never reaches its destination due to line losses (U.S. Department of Energy, 2006). A CHP roadmap would clarify the challenges to deploying more CHP units in Georgia while marshalling the resources to address the obstacles.

The SSEB and the SCHPAC should lead a stakeholder process to develop a roadmap for Georgia. The Roadmap should develop a CHP target for Georgia and outline the steps the State needs to take to achieve that goal. SSEB and SCHPAC should complete this stakeholder process by late 2007.

The National CHP Roadmap (United States Combined Heat and Power Association, 2001) provides a useful framework and should serve as the basis for Georgia's Roadmap.

Strategy 1.11 – Evaluate Output-Based Environmental Regulations for Cost-Effective Opportunities to Promote More Efficient Energy Generation

Traditional air quality rules regulate boilers and power generators by measuring the units of pollutant emitted per unit of fuel input (lb/MMBtu). This approach encourages reliance on pollution control devices to reduce emissions and does not address the efficiency of the process in converting fuel into a useful output. Output-based regulation, on the other hand, regulates boiler emissions on the basis of units of pollutant emitted per unit of useful output (e.g., lbs. /MWh), encouraging fuel conversion efficiency and renewable energy as air pollution control measures.

Output-based air quality regulations encourage investment in efficient generation technology, such as IGCC, super-critical steam and CHP units. Particularly with regard to CHP, regulators can provide extra incentive by developing an output-based permitting protocol that recognizes multiple outputs from one combustion process – electricity and heat or cooling power – and the efficiency of on-site power that does not produce transmission losses. Many states use output-based formulas to regulate power plants by permit and to allocate emissions allowances under cap-and-trade programs (pollution control programs that cap total emissions of a pollutant and allow emitters to trade available allowances on an open market as part of compliance activity) (U.S. EPA, *Combined Heat and Power*, 2006).

Strategy 6.3 in Chapter 6 encourages the Georgia EPD to monitor the U.S. Environmental Protection Agency's (EPA) ongoing evaluation of output-based vs. input-based standards for larger sources of generation. EPD should also evaluate any future guidance from EPA to ensure appropriate standards are applied for all sources of generation in Georgia, and should evaluate opportunities for applying OBR to increase cost-effective energy efficient generation.

Strategy 1.12 – Encourage the Construction of Integrated Gasification Combined Cycle Coal Power Plants

Current pulverized coal-fired electricity production entails the combustion of coal to produce steam, which drives a steam turbine to generate electricity. Integrated Gasification Combined Cycle coal plants, on the other hand, gasify coal to produce a medium Btu gas that can then be used in a combined cycle power generating unit, very similar to the technology employed in a combined cycle natural gas power plant. This technology has many advantages over standard, pulverized coal combustion technology. IGCC achieves considerably better thermal efficiency, requiring less fuel to produce the same amount of electricity. Additionally, IGCC boasts much lower emissions of criteria pollutants than pulverized coal technology. Finally, IGCC permits the "segregation" of carbon dioxide emissions, a necessary technological step to enable future

carbon sequestration. However, the technology required to deploy these plants is more expensive than conventional generation, making it a risky investment for conventional investors.

In 2005, several Harvard scholars published *Deploying IGCC Technology in this Decade with 3Party Covenant Financing: Volume I*, which explores how to address the high up-front capital costs and investment risk associated with IGCC technology (Rosenberg, Alpern, & Walker, 2005). The authors describe a 3Party Covenant financing and regulatory program designed to deploy five to 10 IGCC coal generation power plants during this decade. The 3Party Covenant is an arrangement between the federal government, state Public Service Commission, and equity investor to lower IGCC capital costs by reducing the cost of debt, raising the debt/equity ratio and minimizing construction financing costs. The covenant would reduce the capital component of energy costs by 34% and the overall energy cost about 20%, making the technology cost competitive with pulverized coal and natural gas combined cycle generation.

The GPSC, the Georgia Department of Economic Development and GEFA should conduct a study evaluating the best ways to encourage the development of IGCC in Georgia. The study should examine ways to remove barriers such as cost and investment risk, and could use the 3Party Covenant approach as a starting point.

Strategy 1.13 – Support Expanded Production of Electricity From Nuclear Generation
Georgia has seen renewed interest in expanding its nuclear power capacity. The Southern Nuclear Operating Company has presented a plan to the U.S. Nuclear Regulatory Commission to bring a new reactor on line on the site of the existing Vogtle nuclear plant by 2015 (EIA, *Georgia Nuclear*, 2005). The Georgia House and the Georgia Senate also passed single-chamber resolutions in the 2006 legislative session supporting the development of new nuclear capacity in the state (HR 1365 & SR 865). With this renewed interest has come renewed debate.

Some members of the Governor's Energy Policy Council do not support the expansion of nuclear energy technologies in Georgia because of concerns about nuclear waste management and water supply constraints as well as cost overruns associated with prior nuclear power projects. However, a majority of the Council feels such technologies offer promise in meeting the state's growing energy demand while reducing air emissions. There are strong viewpoints both for and against this option both within the Council and among the public at large.

The State should evaluate options to support the expansion of nuclear energy in Georgia. This evaluation should examine all options open to the State to support already planned and future nuclear units, including an analysis of the costs to the State for emergency preparedness and environmental oversight, and identify the most cost-effective State initiatives.

Policy Objective
Improve Access to Out-of-State Renewable Electricity and Peak Power Markets

Georgia's electricity grid does not stand alone. Georgia's grid is part of the larger Southern System within the Southern Electric Reliability region, which is a component of the Eastern Interconnect that covers the eastern United States. The interconnected aspect of the nation's grid

permits individual utilities to buy and sell power with neighboring generators and electric utilities as well as with those several states away. Yet the level of interconnectivity from one regional transmission system to another is not uniform or always ideal. Some argue that interconnects between the Southern System and other sub-regions within the Southern Electric Reliability region and with Florida limit the potential for Georgia-based market participants to take full advantage of surrounding electricity markets. Improving these interconnects could permit Georgia to take better advantage of peak power supply and to import renewable electricity from other regions.

Implementation Strategies

Strategy 1.14 – Evaluate Most Cost-Effective Projects to Improve Transmission Interconnects

Interested stakeholders, such as Georgia-based utilities and renewable energy marketers, should participate in ongoing reviews to evaluate constraints in regional grid interconnection and identify high value projects that would enhance Georgia's access to regional electricity markets.

CHAPTER 2: ENERGY SUPPLY

The bulk of Georgia's energy comes today from fossil and nuclear fuels imported from other parts of the United States and abroad. Renewable sources of energy such as ethanol and biodiesel motor fuels, solar and geothermal energy, hydropower and various biomass fuels used in electricity generation play an increasingly important role in Georgia's energy industry, but currently account for less than 5% of the state's total energy consumption.

The recommended strategies in this chapter are designed to increase the contribution of renewable energy resources in all sectors. Georgia has many of the resources that can create renewable energy. Turning to technologies that use solar, wind and biomass energy sources would help the State of Georgia develop its own renewable energy supply, reduce cost and dependence on imported fossil fuels, and provide an economic development opportunity for a new industry – the renewable energy industry.

This chapter will address the production and use of alternative fuels such as biodiesel, ethanol and hydrogen for transportation, and the production and use of renewable energy sources such as biomass, low-impact hydropower, solar and wind for electricity generation and industrial processes.

Chapter 2 is organized around seven *policy objectives*, which are programs or policies intended to move Georgia toward affordable, reliable and environmentally responsible energy. Each policy objective is followed by associated *implementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Section 1: Alternative Transportation Fuels

Alternative transportation fuels are fuels that substitute for conventional gasoline and diesel, are substantially not petroleum, and provide energy security and environmental benefits. Alternative fuels include methanol; denatured ethanol and other alcohols; fuel mixtures containing 85% or more by volume of methanol, ethanol and other alcohols with gasoline or other fuels; compressed natural gas; liquefied petroleum gas (propane); diesel fuel from biomass sources (biodiesel); hydrogen; and electricity. The term "alternative fuel" usually does not include fuels that are primarily petroleum-based with alcohols or other components blended in as oxygenates or extenders, i.e., the 10% ethanol portion of gasohol (E10).

Biodiesel and ethanol are the primary fuels obtained from biomass resources, and these liquid fuels are ideal for motor vehicles and in some cases electricity generation. Biodiesel enjoys popularity as a fuel in many agriculture intensive states. Its benefits for vehicle engines include reduced exhaust emissions and reduced engine wear because biodiesel is a good lubricant. Biodiesel is produced from renewable feedstocks, such as vegetable oils and animal fats, and from waste cooking oil and grease. It is mixed with regular diesel or used as the primary fuel, and works in any diesel engine with few or no modifications to the engine or fuel system. Biodiesel provides horsepower, torque and mileage that are similar to diesel.

Ethanol is perhaps the best known alternative fuel. It is commonly produced from agricultural starch and sugar crops, and can also be produced from raw and waste cellulose. A January 2002 report completed for the U.S. Department of Energy (DOE) assessed the infrastructure requirements, including transportation, distribution and marketing issues, for an expanded ethanol industry. The report concluded that no major infrastructure barriers exist to expanding the U.S. ethanol industry production to 5 billion gallons, and that the necessary logistics modifications can be achieved cost effectively (Reynolds, 2002). The Energy Policy Act of 2005 (EPAct 2005) defined what renewable fuels are and set renewable fuel standards for the United States, which start with 4 billion gallons to be used in gasoline in 2006 and increase annually to a target of 7.5 billion gallons by 2012.

Several agriculture intensive states, primarily in the Midwest, have implemented minimum blending requirements for all motor fuels sold there, including biodiesel blended into conventional diesel, e.g., 2% (B2) or 5% (B5), and/or ethanol blended with gasoline, e.g., 5% (E5) or 10% (E10).

Greater quantities of ethanol and biodiesel may be used as motor fuels in the future. The federal renewable fuel standard referenced earlier (7.5 billion gallons by 2012) and two federal tax credits are helping to increase markets and production of these alternative fuels. The federal government has established an ethanol production tax credit ($0.51 tax credit per gallon of ethanol used as motor fuel) and a tax credit for biodiesel that allows $0.50 per gallon for recycled oil restaurant wastes and up to $1 per gallon for biodiesel produced from virgin oils. Tax credits help make the cost of biodiesel and ethanol competitive with traditional fuels. Another factor is the increasing use of ethanol as a substitute for MTBE, a fuel octane booster and oxygenate that

helps gasoline burn cleaner, but that has been found to contaminate drinking water supplies when gasoline leaks from underground storage tanks.

Another consideration in the use of ethanol is the impact on non-renewable or fossil fuel consumption. While corn or other agricultural feedstocks used to produce ethanol are renewable resources, their production requires the use of natural gas and coal as fertilizer and electricity. The question posed is "does ethanol production utilize more non-renewable energy to produce a gallon of transportation fuel than gasoline production?" A recent study by Alexander Farrell at the University of California, Berkeley looked at all of the existing studies on the subject (including two that showed a net energy loss) and compared their inputs and assumptions. The Berkeley study concludes that using current agricultural practices, factoring in the value of co-products and considering current production processes, the production and use of corn ethanol reduces non-renewable energy consumption by 5-26% (Farrell et al., 2006). Specifically, corn ethanol production reduces petroleum consumption by 95% when compared to requirements to produce a gallon of gasoline.. However, the study also notes that petroleum inputs are replaced by natural gas and coal inputs that are used in the agricultural practices that grow the corn. In comparison, ethanol produced from woody biomass such as Georgia pine (cellulosic ethanol), which requires less natural gas or coal to produce, is estimated to reduce the non-renewable energy inputs required to produce a gallon of ethanol, thereby having a much larger positive impact on non-renewable energy consumption than corn ethanol.

Alternative transportation fuels also benefit the environment by reducing emissions. With biodiesel, emissions vary with the feedstock used, the percentage of biodiesel blended, and sulfur levels of the base diesel fuel. Blends using low percentages of biodiesel – such as B2 (2% biodiesel) and B5 (5% biodiesel) – raise the lubricity and combustion quality of diesel, but do not significantly affect emissions. However, at higher levels such as B-20 (20% biodiesel), emissions are reduced. The U.S. Environmental Protection Agency (EPA) conducted the most comprehensive study of emissions from biodiesel-fueled heavy-duty diesel engines in 2002. EPA found that B-20 results in reduced engine emissions of all pollutants except nitrogen oxides (NO_x), as seen in Table 1 (U.S. EPA, *A Comprehensive Analysis*, 2002).

Table 1

Exhaust Emissions From Heavy-Duty Diesel Engines Using Soy-Based B-20 Relative to #2 Diesel

Pollutant	% Change vs. #2 Diesel
Nitrogen Oxides	+2.0%
Particulate Matter	-10.1%
Hydrocarbons	-21.1%
Carbon Monoxide	-11.0%
Total Toxics	-3.6%
Fuel Economy	-0.9 - -2.1%

While the EPA study considered a large number of fuel blends and heavy-duty on-road engines, important limitations should be noted: (1) engines from 1997 or earlier comprised 98% of all data; (2) no tests were conducted with particulate filters or other emissions control technologies;

(3) no tests were conducted with ultra-low sulfur diesel (ULSD); (4) light-duty and non-road diesel engines were not considered; and (5) no clear reason could be found for NO_x emissions increasing with biodiesel in some engines but not in others. In the absence of more specific data, the EPA study would likely serve as the basis for biodiesel emissions calculations in state implementation plans and other regulatory purposes.

Other studies have generally confirmed that biodiesel reduces emissions of particulate matter (PM), hydrocarbons (HC) and carbon monoxide (CO) in a wide variety of diesel engines, but results for NO_x are mixed. For example, Wang et al. (2000) found significant emission reductions in PM, HC and CO in heavy-duty trucks using B-35, including 25% reductions in PM. Rowan University found that B20/ULSD blends result in lower CO and HC emissions relative to ULSD in school buses (Hearne, Toback, Akers, Hesketh, & Marchese, 2005). Both studies found that NO_x could increase or decrease with biodiesel, depending on the vehicle tested.

For ethanol, the highest percentage used in spark-ignited engines is 85% because higher blends have problems starting in cold weather. Some states, such as Georgia, have a 1 pound per square inch waiver for ethanol blends between 9% and 10%. Emissions vary greatly between the 10% and 85% blends, but higher blends have greater emissions benefits. The list below shows the emission benefits associated with using E85 fuel relative to gasoline (U.S. EPA, *Clean Alternative Fuels: Ethanol*, 2002):

- 15% reduction of volatile organic compounds (VOCs)
- 40% reduction of carbon monoxide
- 20% reduction of particulate matter
- 10% reduction of nitrogen oxides
- 80% reduction of sulfates
- Lower toxics and hydrocarbons
- Increased acetaldehyde and ethanol emissions.

In response to the renewable fuel standard mandated by EPAct 2005, EPA is currently analyzing the effect of low-level blends on non-road and on-road gasoline engines.

The volatility and increase in the price of petroleum-based transportation fuels and threats to the reliability of supplies have created a significant opportunity to expand the production, delivery and consumption of alternative transportation fuels, particularly those created from agricultural and forestry feedstocks produced in Georgia. Alternative fuels like biodiesel and ethanol can play an important role in the State's future energy strategy both for their environmental impact and their economic development potential. Encouraging production, delivery infrastructure and use of these fuels in Georgia can advance all of these goals and provide many benefits for the state. Resources to initiate and sustain these strategies may include incentive programs, such as a Renewable Fuels Advancement Fund that promotes the use of biofuels in Georgia, particularly those produced with Georgia-grown forestry and agricultural resources. Additional information on incentives can be found in Chapter 5.

Policy Objective

Increase the Production of In-State Biofuels, Particularly Cellulosic Ethanol and Biodiesel

Two alternative transportation biofuels, cellulosic ethanol and biodiesel, have considerable potential for production in Georgia because the natural resources needed to produce them, such as pine trees, are plentiful in the state. With appropriate research and increased production of these fuels from the state's resources, Georgia could be a national leader in the development of biofuels.

Companies are beginning to tap Georgia's resources to produce ethanol and biodiesel. US Biofuels opened a plant in Rome in 2004 that converts chicken fat and soy oil into biodiesel. This facility produced 2.2 million gallons of biodiesel in 2005. In the same year, all biofuel facilities in the state produced roughly 2.8 million gallons of biodiesel and 400,000 gallons of ethanol.

C2 Biofuels is seeking to build a plant that would produce ethanol using a cellulosic conversion process that offers many advantages over the current practice of making ethanol from corn starch. Most importantly, the C2 Biofuel plant proposes to convert Georgia soft wood into ethanol, a technological innovation that could reap tremendous benefits for the state's forest industry. With 24 million acres of commercial forests, Georgia leads the nation in total commercial forest acreage (Georgia Traditional Industries Program, n.d.).

While these facilities represent important progress for Georgia, tremendous untapped potential remains for in-state biofuel production. For both biodiesel and ethanol, Georgia's current production capacity is less than 1/10 of 1% of the total national capacity (National Biodiesel Board, *Commercial Biodiesel*, 2006; Renewable Fuels Association, 2006).

A coordinated research effort is needed to determine which of Georgia's materials represent the best opportunities for biofuel development in the state. Analyses should look not only at the types of biomass available in Georgia, but also the costs of production, the readiness of the technology needed to convert the materials to fuels, and the energy efficiency and environmental impact of the production processes, particularly on water and air. With this information, Georgia's businesses and leadership will be better prepared to determine the best opportunities for developing the state's resources for alternative energy. Additional information on research strategies can be found in Chapter 4 of this document.

Implementation Strategies

Strategy 2.1 – Require All Ethanol Produced, Distributed and Used in Georgia to Meet the Appropriate ASTM Standards

ASTM International, originally known as the American Society for Testing and Materials (ASTM), is one of the largest voluntary standards development organizations in the world. Its standards are well recognized and provide important safety, consumer protection and quality control benefits. ASTM develops its full consensus standards with the participation of all parties that have a stake in their development and use. ASTM standards are voluntary, though

lawmakers and regulators often give voluntary standards the force of law by citing them in laws, regulations and codes.

Recent Georgia law provides an example of this practice. In order to ensure that high quality biodiesel is available in Georgia and to provide protection for consumers, the Georgia General Assembly amended the Official Code of Georgia Annotated relating to sale of petroleum products. The law requires specific ASTM standards for all biodiesel fuel produced or sold for use in a blended fuel for diesel engines.

To guarantee the same fuel quality and consumer protection for consumers of ethanol, the Georgia General Assembly should further amend the Georgia Code to require certification that all ethanol in Georgia meets one of two ASTM standards associated with ethanol. Standard D 4806 provides parameters for ethanol that is blended with gasoline to ensure it will perform satisfactorily in as wide a range of consumer engines and vehicles as possible; Standard D 5798 applies to fuel ethanol used in specially designated vehicles as a gasoline substitute. In recognition of the fact that ethanol will be produced utilizing various and changing biomass materials and that many of the ethanol manufacturing facilities will be small scale and start-up in nature, the Council recommends that all new supplies of ethanol be tested by the Georgia Department of Agriculture as to ASTM standards on an accelerated basis for the first full year of commercial operations. The State should consider initiatives that ensure accessible and affordable testing of biofuel products to assure quality.

Strategy 2.2 – Use State Purchasing Power to Support Biofuel Production in Georgia
In an effort to stimulate the market for alternative transportation fuels, State agencies should purchase ethanol and biodiesel generated from Georgia and regional renewable resources when such purchases are cost effective for the State.

In areas of Georgia that EPA has designated as non-attainment for exceeding the national particulate standard, such as the 20-county metropolitan Atlanta region, State agencies may also consider purchasing ethanol and biodiesel even if the price is not cost effective. In these areas, the use of cleaner burning fuels creates a benefit that may offset the higher price.

As a large fuel consumer, the State can effectively stimulate demand for new resources by purchasing even a modest amount of biofuels derived from renewable resources. A renewable biofuel purchase program also allows the State to lead by example while pursuing a broader statewide energy strategy.

On February 28, 2006, the Governor signed an Executive Order requiring State agencies to purchase flex-fuel vehicles and to use ethanol and biodiesel fuel blends when cost effective. Georgia should develop a program to oversee and support State agencies by assuring that these vehicles and fuels are promoted through State procurement policies and procedures and that State fueling facilities offer available Georgia biofuel blends.

Policy Objective
Enhance the Biofuel Delivery Infrastructure

While Georgia's biofuel production has grown forcefully in recent years, the number of gasoline stations selling biofuels has lagged, forcing Georgia biofuel producers to sell their product out of state. Georgia has 7,995 retail gasoline stations (EIA, *Petroleum Profile*, 2006), yet few of these sell biofuels. Only a couple of outlets in the state sell biofuels exclusively, and approximately 10 other stations have one or more biofuel pumps. A larger number of gasoline stations in Georgia sell gasoline blended with 10% ethanol (which has been added to gasoline for years to raise octane), but this product is typically not advertised specifically as a biofuel product. Without expansion of the biofuel delivery infrastructure, demand and production will lag and Georgia will forego the economic and environmental advantages of producing and burning locally-sourced transportation fuels.

Implementation Strategies

Strategy 2.3 – Conduct an Assessment of Biofuel Delivery Infrastructure Needs
An adequate biofuel delivery system consists of many elements: the transportation infrastructure necessary to get the feedstock from its source; storage facilities needed before processing the feedstock; production facilities; the infrastructure necessary to blend the biofuels; the transportation infrastructure necessary for distribution after production; and dispensing facilities to fuel the vehicles.

Efforts are under way to develop some of this infrastructure in Georgia. For instance, the Center for Transportation and the Environment (CTE) is currently managing Congestion Mitigation and Air Quality funding for the Georgia Environmental Facilities Authority (GEFA) Alternative Fuel Initiatives Project on behalf of the Georgia Department of Transportation. The project is seeking applications to improve air quality by deploying alternative fuel vehicles and related infrastructure in Atlanta's 20-county non-attainment area for ozone (Center for Transportation and the Environment, 2006).

While this is an important first step, it addresses only one small aspect of biofuel infrastructure needs and in a relatively small geographic region of the state. To fully understand the entire infrastructure needs for a vibrant and sustainable biofuels industry, GEFA's Underground Storage Tank Program should conduct a comprehensive study over the next six months and make the results available to all interested stakeholders. The study should quantify the number of suppliers delivering biofuels and the number of stations selling biofuels and pumps dedicated to biofuel sales (by fuel type). It should also assess the following: the potential for biofuel delivery infrastructure expansion; recommendations for achieving that growth; terminal capabilities to store and blend local production; and oil company policies that limit stations' ability to offer alternative fuels.

Policy Objective
Encourage the Use of Biofuels

In 2004, Georgia consumed 13 million gallons per day of motor gasoline and 5.5 million gallons per day of distillate fuel oil, the majority of which was sold for on-road diesel fuel use (EIA, *Prime Supplier Sales*, 2006). Based on these numbers, the estimated potential for ethanol use in Georgia, if all motor gasoline sold in the state contained 10% ethanol (E10), is 1.3 million gallons per day. Similarly, the potential for biodiesel use, if all diesel contained 5% biodiesel (B5), is 275,000 gallons per day. These estimates climb dramatically when using E85 and B20 blends.

Locating comprehensive statistics on biofuel consumption in Georgia is difficult. The Renewable Fuels Association found that the 2004 consumption of ethanol-blended fuel in Georgia was zero (Renewable Fuels Association, 2006). That number is sure to climb as certain retailers have since started to sell E10 gasoline. The National Biodiesel Board reports that seven retailers in Georgia sell a B20 blend of that fuel, but does not offer data concerning volume of retail sales (National Biodiesel Board, *Retail Fueling*, 2006). Despite the lack of precise sales data, it is clear that Georgia's retail sales of biofuels remain low and far behind the use potential.

Because increasing sales are important drivers of growth in production, some states across the country have implemented a range of policies designed to stimulate renewable fuel demand, including retail pump incentives (e.g., sales tax exemption), use mandates for state and local government fleets, high occupancy lane access for alternative fuel vehicles and exemptions from emission inspections. Strategies like these are discussed further in Chapters 3 and 5 of the *State Energy Strategy*. As discussed earlier in this chapter, any such policies to encourage biofuel use should be preceded by research to determine which biofuels provide the best balance of cost, available technology, energy efficiency, environmental impact and use of Georgia biomass.

Implementation Strategies

Strategy 2.4 – Track Number of Registered Flex-Fuel Vehicles in Georgia
Flex-fuel vehicles have a single fuel tank, fuel system and engine. The vehicles can run on regular unleaded gasoline and an alcohol fuel, such as ethanol or methanol, in any mixture of these fuels, e.g., E85 (85% ethanol, 15% gasoline), M85 (85% methanol, 15% gasoline) or 100% gasoline (U.S. DOE & U.S. EPA, 2006). To understand the full market potential for E-85 in Georgia, the State needs an accurate accounting of the number of vehicles in Georgia that are equipped to handle the fuel. No established data repository currently provides that information.

However, a simple modification to the Department of Revenues, Motor Vehicle Division database should accomplish this. A car or truck's VIN is required by federal regulation to contain specific information about the vehicle, such as if it is E85 compatible. The National Ethanol Vehicle Coalition reports on its web site that the eighth digit of the VIN for vehicles of a particular year, make, model and engine size identify it as E85 compatible (National Ethanol Vehicle Coalition, 2006). In Georgia, that information is in the State database because the VIN is a required field on the vehicle registration form. The Georgia Department of Revenue should be required to modify the Motor Vehicle Registration database so the number of E85 compatible

vehicles in Georgia can be readily extracted, and to make the number available to the general public. This information would be particularly useful to station owners as they consider adding alcohol fuels and blended fuels to the fuel products they sell.

Strategy 2.5 – Continue to Participate in Multi-State Efforts to Encourage Investment in Biofuels and Hydrogen Fueling Stations Throughout the Southeast

Three groups described below have formed over the last few years to work collaboratively to encourage the growth of biofuels and hydrogen industries across the Southeast. Georgia should continue to participate in these regional efforts.

Southeast Alternative Fuels Task Force

The Southeast Alternative Fuels Task Force (SEAFTF) is a broad-based partnership of stakeholders in four states committed to increasing the availability and use of alternative fuels in the Southeast. The Task Force includes representatives from state and federal environmental, energy and transportation agencies, Clean Cities coalitions, fuel suppliers and marketers, business and industry, local governments, fleet managers, universities, federal land managers, utilities, vehicle and engine manufacturers, public and private interest groups, and other interested partners. The group's primary goals are to improve air quality and decrease national reliance on imported petroleum through increased use of cleaner burning alternative fuels (Southeast Alternative Fuels Task Force, n.d.).

SEAFTF envisions that by 2025 there will be sufficient ethanol, biodiesel, compressed natural gas and propane fueling infrastructure in place to allow confident travel between major destinations across the states of Georgia, North Carolina, South Carolina and Tennessee. On a shorter time horizon, SEAFTF envisions that by 2010, there will be strategically located fueling facilities for biodiesel and ethanol fuels along major interstate highways to allow use of these fuels between major destinations in the four states.

Southeast Diesel Collaborative

The Southeast Diesel Collaborative is a voluntary, public-private partnership involving leaders from federal, state and local government, the private sector and other stakeholders in Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina and Tennessee. Its goal is to improve air quality and public health by encouraging the use of clean, renewable energy and technology and by reducing diesel emissions from existing engines and equipment from the agriculture, heavy construction and on-road sectors (Southeast Diesel Collaborative, n.d.).

The Collaborative is part of EPA's National Clean Diesel Campaign. In April 2006, EPA hosted the inaugural Southeast Diesel Collaborative Conference in Atlanta, focusing on strategies to promote clean renewable diesel and emerging technology for the agriculture, heavy construction and on-road sectors. During the conference, many of the stakeholders signed a Memorandum of Understanding that articulates the common goals of the collaborative and bolsters the relationships between the stakeholders.

Southern Fuel Cell Coalition

The Southern Fuel Cell Coalition (SFCC) is a nonprofit, member-based consortium formed to supplement initiatives of individual southern states to grow and develop hydrogen and fuel cell

technologies. The SFCC focuses on regional resources and collaborative opportunities to develop, demonstrate and commercialize these technologies, which are expected to grow to a $7.3 billion market within 15 years (Southern Fuel Cell Coalition, n.d.).

CTE and SFCC, in partnership with the University of Texas at Austin's Center for Electromechanics and the Texas Department of Transportation (TxDOT), have been selected to lead the creation of a Strategic Plan with recommendations for TxDOT's adoption of hydrogen vehicle and refueling infrastructure technologies. The Plan will address partnerships, funding, infrastructure siting, fuel transport and generation, and the costs and benefits of these technologies. The Strategic Plan is currently under development.

Section 2: Renewable Energy for Electricity and Heat

Four sources of renewable energy are available for electricity and heat in Georgia: solar, wind, biomass and hydropower. In addition to their environmental benefits, these sources have stable prices, are readily available, reduce dependence on foreign energy sources and promote local economic development. Solar, wind and hydropower energy sources do not have ongoing fuel costs. Their primary costs are the capital, construction and maintenance activities required to convert the source to usable energy. Once fixed costs are incurred, the facility can produce energy on a relatively stable basis. The price stability of these sources contrasts with prices of other energy resources such as petroleum and natural gas, which have experienced increased volatility in recent years.

Despite their benefits, renewable energy sources face challenges to widespread use and development. Resources such as hydropower, wind and biomass are often located far from major population centers. Connecting resources to load centers requires expansion of the existing transmission infrastructure. The intermittent nature of sun and wind mean they cannot provide energy around the clock, making it more difficult to respond to changing load requirements than conventional technologies using coal, natural gas or uranium. Also, without accounting for environmental and other externalities, electricity from certain renewable technologies remains more expensive than conventional electricity. While hydropower, wind and biomass technologies produce inexpensive electricity, solar photovoltaics still lag on this front because photovoltaic panels are expensive. Even with a free supply of sun, electricity produced by photovoltaic panels costs three to 10 times the electricity produced from coal or nuclear power plants (Solarbuzz, *Photovoltaic Industry*, 2006; Georgia Power, *Avoided Cost Projections*, 2005).

Renewable energy sources can play an important role in Georgia's future energy strategy given their environmental and reliability advantages and their potential use of Georgia resources. Biomass energy has the most potential because of the state's plentiful fuel sources. Other renewables such as wind, hydropower and solar energy also have potential to contribute to the diversity of Georgia's energy. Resources that can help initiate and sustain these strategies may include incentive programs, such as tax credits for purchasing qualified renewable energy technologies and a clean energy fund to support renewable energy projects. Additional information on incentives can be found in Chapter 5.

Policy Objective
Increase the Production of Renewable Energy

In 2004, non-hydropower renewables accounted for about 3% of the electricity generation in Georgia. This percentage includes the contribution of combined heat and power systems located at industrial and commercial sites around the state, which generated electricity for on-site consumption. Excluding the contribution of these units, non-hydropower accounted for less than 1/10 of 1% of electricity generated for retail sale across the grid. This compares to a national average of 1.6% (EIA, *1990 - 2004 Net Generation*, 2005).

States across the country have implemented policies to support renewable energy development in an attempt to capture its long-term economic and environmental benefits. More than 610 utilities in 45 states now offer green energy consumer choice programs, whereby customers can choose to pay more for energy from clean and renewable sources (Energy Efficiency and Renewable Energy [EERE], *Green Power*, 2006). Also, 23 states (Database of State Incentives for Renewable Energy [DSIRE], *Rules, Regulations*, 2006) require their utilities to include a certain percentage of electricity generation that comes from renewable sources (DSIRE, *Renewables*, 2006). Another four utilities or local governments have similar requirements. States also use their purchasing power to support the market for renewable energy. While these policies aim to increase production of renewable energy from the utility sector, some state policies also focus on expanding the production of renewable generation from small, distributed sources such as commercial and residential solar systems. For instance, net metering laws permit a residential or commercial consumer that operates a small electricity generation system on its side of the meter – such as a residential solar system – to sell "green" electricity back to the utility when that power is not needed on-site. States often enact a suite of such policies to create a supportive environment for the development of renewable energy sources.

Implementation Strategies

Strategy 2.6 – Use State Purchasing Power to Support Clean Electricity Production in Georgia

State government in Georgia spends approximately $140 million dollars annually for electricity and natural gas. As a large energy consumer, the State can effectively stimulate demand for new renewable energy resources by purchasing even a modest amount of energy derived from renewable resources. Purchasing electricity produced with renewable resources also allows the State to lead by example while pursuing a broader statewide energy strategy.

On February 28, 2006, the Governor signed an Executive Order requiring State agencies to purchase flex-fuel vehicles and to use ethanol and biodiesel fuel blends when cost effective. A similar initiative encouraging the State to purchase electricity derived from renewable resources when cost effective could be pursued. The State Facilities Energy Council (SFEC) should evaluate the appropriate amount of clean energy the State could purchase based on an assessment of existing State energy use and emerging sources of green power. SFEC should establish appropriate criteria to ensure that the purchased power has at a minimum either economic benefits in Georgia by stimulating projects within the state, or environmental benefits that accrue via projects located in areas that will improve Georgia's air quality.

Connecticut, Illinois, Iowa, Maine, New Jersey, New York and Pennsylvania have executive orders in place requiring the purchase of energy from renewable resources. These states have set specific goals, which range from 5% to 20% by the year 2010, for the percentage of state government electricity consumption that is derived from renewable resources. Most of the states allow agencies to offset the higher cost of renewable energy purchases by using savings from energy efficiency and conservation efforts. Each executive order specifies eligible renewable

sources of energy, and allows for a mix of on-site generation and green power purchases through green power programs or renewable energy certificates[7] (DSIRE, *Renewable Energy*, 2006).

The State of Georgia should conduct an evaluation to determine if purchasing a certain amount of electricity generated from renewable Georgia resources is cost effective. The State will need to assess and monitor both the cost and availability of renewable electricity in Georgia to determine the appropriate suppliers and amount of energy to be purchased.

Strategy 2.7 – Evaluate the Georgia Bi-Directional Metering Law to Support Renewable Energy Development

In 2001, the Georgia General Assembly passed and the Governor signed the Georgia Distributed and Cogeneration Act, which is legislation designed to "encourage private investment in renewable energy resources,…stimulate the economic growth of Georgia…and enhance the continued diversification of the energy resources used in Georgia" (Georgia General Assembly, *O.C.G.A 46-3-51*, 2005). The law ensures the practice of "net metering" in the state, whereby commercial or residential customers that operate electricity generation technology can sell electricity back to the utility when it is not needed for on-site use. Net metering can provide a clear incentive for the installation of residential solar systems, which hit their peak performance in the middle of the day when homeowners are often at work.

But some have expressed concern that the law caps the amount of electricity that utilities are required to buy back at a low level (0.2% of the utility's annual peak demand in the previous year). Also, the law does not address many aspects of interconnecting distributed generation with the grid.

The Electricity Modernization Act of 2005 (Title XII of the Energy Policy Act of 2005) includes several amendments to Title I of the Public Utility Regulatory Policies Act (PURPA). These provisions adopt new federal standards that must be considered by State regulatory authorities and large non-regulated electric utilities, including many cooperatives. The new federal standards provide that each utility shall:

- Make available net metering service to any electric consumer that the utility serves.
- Develop a plan to minimize dependence on one fuel source.
- Develop a 10-year plan to increase the efficiency of its fossil fuel generation.
- Offer a time-based rate schedule and a time-based meter for customers that request it.
- Make interconnection service available on request to any electric consumer the utility serves.

Even though the new federal standards are written in "mandatory" or "shall" language, there is no real requirement to implement them. Instead, PURPA requires State regulatory authorities (such as the Georgia Public Service Commission) and large non-regulated electric utilities to determine for themselves whether to adopt the federal standards. These authorities and utilities covered by PURPA must follow specific procedures to consider the federal standards that are outlined in the law. They must also make specific statutory determinations with respect to the

[7]Renewable energy certificates permit the market exchange of the renewable attributes of energy, separate from the exchange of the electricity generated by renewable energy projects. The electricity blends with all other electricity on the grid.

standards. If, after conducting the necessary process, a State regulatory authority determines that it is not appropriate under PURPA or State law to implement the new federal standard, it can choose not to (National Rural Electric Cooperative Association, 2005).

GEFA and the Georgia Public Service Commission (PSC) should take advantage of this requirement to evaluate through a public process the performance of the current act to support renewable energy development. In this process, GEFA and the Georgia PSC should particularly evaluate the performance of the Georgia Distributed and Cogeneration Act and recommend appropriate revisions that would enhance its ability to support renewable energy development in Georgia. This evaluation should begin after completion of the 2007 Integrated Resource Planning process with Georgia Power so that the results of the PSC evaluation can be incorporated into the deliberations.

Policy Objective
Increase the Production of Biomass Energy

Within the context of energy generation, biomass is generally defined as plant-based or plant-derived material that can be converted to a useful energy form such as a liquid fuel, biodiesel or gas fuel for electricity generation or direct heating. Most of these feedstocks are found in the agricultural sector (such as corn and corn residues) and the forestry sector (logging residues and fire prevention residues). Current research and new technologies are expanding the types of biomass feedstocks that convert efficiently to useful fuels (EERE, *Biomass Basics*, 2004).

Traditionally the pulp and paper industry within Georgia has used biomass feedstock waste generated in their processes to provide their electricity on site and reduce reliance on coal or natural gas. Opportunities to expand this model and apply it to other small-scale industrial operations, city and county governments and the agricultural industry should be pursued.

Additionally, a number of other industrial facilities burn alternative fuels in their boilers. For instance, both American Proteins and Shaw Industries have retooled their operations to burn chicken fat in their boilers. This type of industrial use of biomass feedstocks is a very efficient use of such materials, since less energy is required to process the material for use. The State can examine initiatives that would support industrial use of biofuels.

Implementation Strategies

Strategy 2.8 – Evaluate and Pursue Strategies That Convert Animal Waste Into Environmentally Sound Energy Sources, Including Use of Anaerobic Digesters
Anaerobic digester systems are special waste lagoons that permit the capture and use of biogas from animal waste at livestock and poultry confined-feed operations. Biogas recovery systems at livestock and poultry operations can be a cost-effective source of clean, renewable energy that reduces greenhouse gas emissions and helps these facilities with waste management (Newport, 2003). Because of its high energy content, biogas can be collected and burned to supply energy needs for electricity or heating on farms. Biogas is produced when the organic matter in manure decomposes anaerobically (i.e., in the absence of oxygen). Biogas typically contains 60% to 70% methane, the primary constituent of natural gas, and is a clean-burning fuel. Manure from

livestock and poultry emits 7% of annual U.S. methane emissions, and most of that 7% comes from swine and dairy operations. Biogas recovery systems capture and combust methane, reducing virtually all of the methane that otherwise would be emitted. Installing digesters at dairy and swine operations where it is economically feasible would reduce methane emissions by 1.3 million tons per year (about 66% reduction from these operations). Biogas is also a renewable form of energy. The use of biogas to generate electricity provides the added environmental benefit of reducing fossil fuel use on the electric power grid, which in turn lowers emissions of carbon dioxide, another critical greenhouse gas (AgSTAR, n.d.).

Through a program called AgSTAR – a joint effort of EPA, DOE, and the U.S. Department of Agriculture (USDA) – 31 anaerobic digester systems are in operation at U.S. commercial livestock farms. Fifteen are at swine farms, 14 at dairy farms, and two at caged-layer farms. In 23 of the 31 AgSTAR-aided systems, the captured methane is used to generate electrical power and heat. Although electrical generation has up to now required a large volume of methane to run an internal combustion engine, pending research at the USDA-ARS research station at Beltsville, Maryland, may show the value of micro-turbine engines for smaller operations.

Georgia currently has one anaerobic digester installed and operating in the City of Baxley. This system, funded in part through the Renewable Energy Systems and Energy Efficiency Improvements Program (Section 9006) of the Farm Security and Rural Investment Act of 2002 (Farm Bill), is situated on a dairy farm. With a herd of more than 1,100 cows, the system is expected to generate more than 200 kilowatts of renewable energy.

Georgia is engaged in production of beef cattle, dairy products, replacement livestock, swine, poultry and other miscellaneous livestock. The National and Georgia Agricultural Statistics Services list the following inventories (2002 data) of primary species, with poultry representing one of the most robust state agricultural industries in the United States: broilers, 1.29 billion; commercial layers, 20.4 million; cattle and calves (beef and dairy), 1.3 million; milk production, 1.4 billion pounds; and hogs, 345,000 (National Agricultural Statistics Service, n.d.). These numbers show that Georgia has tremendous potential to increase the use of anaerobic digesters as a means of energy generation. Additionally, the University of Georgia is completing a feasibility study of the potential to produce energy from methane produced in agricultural operations. This study will identify how much energy (in MW) can be produced cost effectively using commercially available technology.

The Section 9006 program of the 2002 Farm Bill offers a significant opportunity to increase the deployment of this technology. The program offers grants worth up to 25% of the total cost of installing renewable energy (and energy efficiency) systems, making this already commercially viable technology more affordable. Funding for Section 9006 is authorized and appropriated through 2006, and will be up for reauthorization in 2007.

Georgia should act quickly to ensure support for the reauthorization of the Section 9006 program as well as appropriations to support this valuable program. If reauthorized, GEFA should work with the University of Georgia, USDA and the agricultural community to increase the use of this technology by promoting grant and loan applications through Section 9006. The State of Georgia should consider supporting a part-time position to assist applicants and the engineering analyses

required by the program. By identifying and supporting projects that can be replicated at farms throughout Georgia, the State can cost effectively advance the deployment of anaerobic digesters and other renewable energy projects. Georgia should also continue to support research and development activities under way in the state to develop this technology further.

An effective application support mechanism in Iowa has increased the number of Section 9006 applications in that state from 14 in 2003 to 81 in 2006. In 2005, Iowa received more than $5.7 million in federal funding through this program.

Strategy 2.9 – Encourage the Development of Distributed Biomass-to-Energy (Electricity Plants) in Georgia

The University of Georgia released a study in 2003 on the feasibility of producing electricity from existing biomass feedstocks found in Georgia (Curtis, Ferland, McKissick, & Barnes, 2003). The study found that electricity production from existing biomass resources could support 31% of Georgia's residential electrical needs, at costs just slightly higher than 2003 residential electricity costs. The study found that gasification units (power plants that turn biomass such as peanut hulls into a gas and then burn it, similar to natural gas) could produce "green" electricity for about $0.02 per kilowatt hour more than from conventional energy resources. Current federal incentives would reduce that premium to just $0.002 per kilowatt hour, making it nearly cost competitive – although the cost effectiveness of this type of facility may have changed due to rising energy costs since the study was completed. Additional data will be available in early 2007 when Georgia's Renewable Energy Potential Study is completed (see Chapter 1 for more information).

Locally available biomass is a promising energy resource for both liquid transportation fuels as well as electricity production because it has economic and environmental advantages over conventional fossil fuels. In many cases, using the available biomass resources for energy production can help forestry and agricultural businesses either avoid the cost of disposal or earn income through sale of the by-product, supporting local economic vitality for two important Georgia industries. Biomass generally produces fewer emissions per kilowatt hour than coal. It also reduces greenhouse gas emissions because the carbon is released when burned and taken up by growing plants that will be used later for energy production, thereby closing the carbon cycle. Locally available biomass also reduces the transportation required to deliver the feedstock to the processing or generation plant, minimizing transportation costs, fuel consumption and emissions.

Georgia should support a regulatory environment favorable to the development of biomass-to-electricity power plants throughout Georgia. The Georgia PSC recently approved a new avoided cost protocol that will allow a merchant power producer to develop a 20 MW facility in Forsyth, Georgia, using 800 tons per day of construction waste from an adjacent landfill and other woody biomass in the energy production process. The PSC should help create a supportive environment that minimizes barriers for renewable energy project developers interested in this environmentally sound power source. Georgia should also consider offering incentives for biomass-to-electricity when developing incentives for biofuels.

Strategy 2.10 – Encourage the Capture of the Energy Content of Municipal Solid Waste Through Direct Combustion in Boilers for Process Heat or Electricity Generation

Another source of biomass is residential and commercial trash, also called municipal solid waste (MSW). Trash such as leaves, lawn clippings and food scraps that come from plant or animal products is biomass. It can be a source of energy by either burning MSW in waste-to-energy (WTE) plants or by capturing biogas. In waste-to-energy plants, trash is burned to produce steam that can be used either to heat buildings or generate electricity (EIA, *Biomass*, 2005).

Burning waste reduces the amount of garbage and trash sent to landfills, yet there is concern that burning garbage may harm the environment. Like coal plants, waste-to-energy plants produce air pollution when the fuel is burned to produce steam or electricity. Burning MSW produces nitrogen oxides and sulfur dioxide as well as trace amounts of toxic pollutants, such as mercury compounds and dioxins. Although MSW power plants emit carbon dioxide, the primary greenhouse gas, the biomass-derived portion is considered to be part of the Earth's natural carbon cycle. The plants and trees that make up the paper, food, and other biogenic waste remove carbon dioxide from the air while they are growing, which is returned to the air when this material is burned. In contrast, when fossil fuels (or products derived from them, such as plastics) are burned, they release carbon dioxide that has not been part of the Earth's atmosphere for a very long time, i.e., within a human time scale (U.S. EPA, *Electricity*, 2006).

EPA recommends on its web site that the most "environmentally sound" management of municipal solid waste "is achieved when these approaches are implemented according to EPA's preferred order: source reduction first, recycling and composting second, and disposal in landfills or waste combustors last" (U.S. EPA, *Municipal Solid Waste*, 2006).

EPA significantly tightened the regulation of plants using MSW to produce energy in 1995 by issuing a rule for large MSW incinerators and WTE plants to be implemented by 2000. The rule requires the maximum available pollution control technology, such as bag house particulate controls, carbon injection systems and acid control scrubbers, as well as continuous monitoring of combustion efficiency and periodic stack testing for hazardous air emissions. Small municipal waste burners are addressed in a separate similar rule. EPA studies estimate that enforcement of this rule will reduce emissions of mercury and dioxin from WTE plants by about 90% and 99%, respectively, from their 1990 levels (Power Scorecard, 2003).

In a February 14, 2003 letter to the President of the Integrated Waste Services Association, EPA applauded the Association's leadership in working to improve the performance of municipal waste combustors. EPA further stated in the letter, "The completion of retrofits of the large combustion units enables us to rely on municipal solid waste as a clean, reliable, renewable source of energy. With the capacity to handle approximately 15% of the waste generated in the U.S., these plants produce 2,800 megawatts of electricity with less environmental impact than almost any other source of electricity. With fewer and fewer new landfills being opened and capacity controls being imposed on many existing landfills, our communities greatly benefit from the dependable, sustainable capacity of municipal waste-to-energy plants" (Horinko & Holmstead, 2003).

According to the Georgia Solid Waste Management Report 2004 (Georgia Department of Community Affairs, 2004), the amount of waste sent to Georgia Municipal Solid Waste and Construction and Demolition (C&D) landfills increased during Fiscal Year 2004 to 15.9 million tons, but the State still has 26.6 years of remaining permitted MSW landfill space and 19.9 years of remaining permitted C&D landfill space. Increasingly, the private sector controls disposal capacity in the state and receives most of the waste. Larger landfills are replacing smaller facilities, and the amount of waste entering unlined landfills continues to fall. Recycling and other waste reduction efforts are reducing the amount of garbage that is generated in Georgia for burial. However, Georgia is importing more waste from other states, undercutting local and State waste disposal reduction efforts designed to meet the MSW disposal reduction goal.

With the current technology required to incinerate municipal solid waste for generating energy, and the knowledge that burning MSW can generate energy while reducing the volume of waste by up to 90%, which benefits the environment, Georgia should encourage greater use of waste-to-energy facilities to offset the demand of conventional energy sources and to extend the life of Georgia's existing landfills. However, waste-to-energy facilities should be used only after all avenues have been pursued to reduce waste through recycling and source reduction programs. MSW should not be sold at a premium price as green power.

Strategy 2.11 – Explore Permit Streamlining Opportunities to Promote Use of Biofuels in Industrial Boilers

Many types of industrial facilities in Georgia currently use natural gas and fuel oil to power boilers. An effort to support the use of alternative fuels in industrial boilers could displace the use of considerable amounts of fossil fuels and encourage efficient use of available biomass feedstocks. The implementation of this Strategy is concurrent with Strategy 1.6 – the Georgia Environmental Protection Division should convene the appropriate regulated industries to discuss a more streamlined process for the State to review permits for flexible/alternative fuel programs, and follow up with appropriate changes in the regulations.

Policy Objective
Explore Opportunities for Production of Wind, Geothermal and Hydrogen Energy

Georgia clearly has strong biomass energy potential that the State should work to expand. However, other renewable technologies can also contribute to broad energy diversification in Georgia and the State should explore opportunities to develop these energy sources. Those that hold the greatest potential include wind energy, geothermal energy (for heating) and hydrogen energy.

In the last half decade, installed wind energy generation capacity has risen dramatically in the United States – 220% annually from 1999 to 2005 (American Wind Energy Association, 2006). Unfortunately, Georgia has not shared in this growth. Historic resource assessments have put Georgia's wind energy potential below the level necessary to attract industry interest. This assessment has shifted some in the last few years. The Strategic Energy Institute (SEI) at the Georgia Institute of Technology is evaluating the wind development potential off Georgia's coast. Data culled from Navy platforms 40 miles off the coast suggest the possibility of utility-

grade wind energy potential. The Atlanta-based Southern Company has partnered with SEI to advance this research. Additionally, a new Georgia wind map produced by the National Renewable Energy Laboratory suggests potential for smaller scale wind projects across the state.

Geothermal energy is easily captured for residential and commercial heating and cooling through a technology known as a geothermal heat pump or ground source heat pump. Geothermal systems are among the most efficient heating and cooling technologies available today. These systems take advantage of the nearly constant temperatures of the earth a few feet below the surface to preheat or precool the air used to condition a home or building, dramatically reducing the need for electricity or natural gas for space conditioning.

Finally, Georgia should keep pace with the emerging and growing hydrogen and fuel cell industries in the United States. While fuel cell technology faces several core technological challenges, it holds out the promise of cars and trucks with no harmful tailpipe emissions and equally clean power generation. Implicit in this promise is a dramatic reduction in U.S. crude oil consumption and the economic and national security benefits that reduction portends. DOE maintains strong research programs focused on hydrogen production, delivery, storage, codes and standards. In the Southeast, the 23-member Southern Fuel Cell Coalition focuses on regional resources and interstate collaborative opportunities to develop, demonstrate and commercialize hydrogen technologies.

Implementation Strategies

Strategy 2.12 – Continue to Assist the Georgia Wind Working Group With Tasks in Progress Including a State Wind Guidebook and Loan Anemometer Program

Since 1999, DOE's Wind Powering America (WPA) program has emphasized a state-based approach to deploying wind energy technologies, with a focus on state wind working groups. Today WPA partners with working groups in 27 states; six other states are now forming new groups. The Georgia Wind Working Group started in spring 2005 through a partnership involving Southern Alliance for Clean Energy, Georgia Institute of Technology's SEI and GEFA. The group includes more than 20 people, representing utility companies, wind developers, government agencies, universities and other interested stakeholders.

The Georgia Wind Working Group is focusing in 2006 on generating an official wind map for Georgia, providing easy access to the map, developing a loan anemometer program, general education about wind energy, and supporting site-specific wind project development, such as the off-shore wind research project conducted by Georgia Tech and the Southern Company.

The State of Georgia should continue to support and participate in the Group's initiatives, particularly the loan anemometer program and state wind guidebook.

Strategy 2.13 – Promote the Use of Geothermal Heat Pumps in Businesses and Residences

Geothermal heat pumps use closed loop coils that circulate fluid underground to preheat or precool the air used to condition a home or building. This use of earth's near constant temperature dramatically drops the amount of natural gas or electricity required to heat and cool a home or building. EPA estimates that geothermal heat pumps can reduce energy consumption

up to 44% compared to air-source heat pumps and up to 72% compared to electric resistance heating with standard air conditioning equipment (EERE, *Benefits of Geothermal*, 2005). The State of Georgia can promote use of the pumps by considering one or more of the incentives identified in Chapter 5 for installation of this technology.

Policy Objective
Explore Opportunities for Production of Solar Energy

Converting sunlight into usable forms of energy stands out as one of the most compelling visions for a clean, zero-emission energy future. Yet realizing this vision requires sustained support to drive down the cost of these technologies – currently the most significant challenge to wider adoption. The most commonly recognized technology for solar energy use remains photovoltaic (PV) cells that convert sunlight directly into electricity. The average American regularly encounters small-scale photovoltaic applications in solar-powered calculators and roadside call boxes, but has less experience with residential, commercial and power-sector scale photovoltaic systems. The relatively high capital costs of these systems and their conversion efficiency limitations have hampered their proliferation. Electricity from a photovoltaic system can be 10 times higher than the cost of conventional electricity[8]. Industry advocates underscore that while the cost remains high, continued technological advances have lowered the price of electricity from photovoltaics an average of 4% per year over the past 15 years (Solarbuzz, *Fast Solar*, 2006). Solar systems also offer the distinct advantage of being able to displace peak demand because they produce their highest electrical output on the sunniest days, which typically correspond with high demand on the electrical system. As a result of design advances and several large government-sponsored solar promotion programs (particularly in Germany), the photovoltaic industry has enjoyed tremendous growth. Global photovoltaic installations increased 34% from 2004 to 2005 (Solarbuzz, *World PV Industry*, 2006).

Georgia enjoys moderate PV solar energy potential. The National Renewable Energy Lab's *United States Solar Atlas* (2006) shows that Georgia's potential falls in the middle range for the whole United States, ranging from 4.5-5.0 kilowatt hours per square meter per day for a horizontal flat plate collector to as high as 7.5 kilowatt hours per square meter per day for a flat plate photovoltaic array mounted on a two-axis tracking mount.

Solar hot water heating (both for residential use and swimming pool heating) is another form of solar technology that holds promise for Georgia while also facing challenges similar to photovoltaics. A residential customer can install a residential hot water system in Georgia for approximately $2,500 to $5,000. If solar hot water is installed as a retrofit on an existing home, the average customer can pay for the system with energy savings in up to 20 years depending on the cost of natural gas or electricity, with higher energy costs shortening the payback period. A more promising approach involves including the system in new homes. This allows the cost to be incorporated into the mortgage, and savings will likely outweigh costs. When the same technology is used for swimming pool heating, the payback period drops dramatically. A typical

[8] This comparison relies on Solar Buzz's estimation of 30 cents per kilowatt-hour cost for photovoltaic electricity (Solarbuzz, *Photovoltaic Industry*, 2006) and Georgia Power's published 2006 annual all-hours avoided cost of 3.5 cents per kilowatt-hour (Georgia Power, *Avoided Cost Projections*, 2005).

solar water heating system for a swimming pool can pay for itself with energy savings within two years (Southface, 2004).

Beyond water heating, Georgians can reap large benefits from using solar energy to heat and light buildings with passive solar design, daylighting and solar space heaters.

Implementation Strategies

Strategy 2.14 – Promote Development of the Solar Hot Water Heating Market in Georgia by Encouraging Installation at Large User Outlets

Although solar electricity generation remains expensive, solar hot water heating has proven cost effective in some applications. The State should explore opportunities to apply one or more of the incentives identified in Chapter 5 to encourage these cost-effective applications at facilities that have a high demand for hot water, such as the laundry industry, lodging industry, university dormitories, and State and private parks and recreational facilities. Additionally, the State should explore options for removing any regulatory or other barriers to the installation of such systems.

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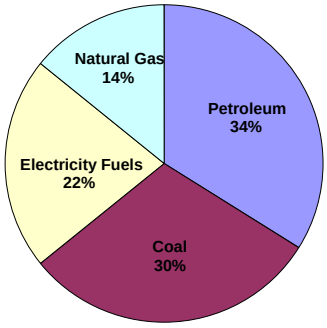
CHAPTER 3: ENERGY DEMAND

Georgia relies on a variety of energy sources. Petroleum products provide energy for transportation; natural gas, coal and other electricity fuels are used for heating, cooling, lighting and industrial production (Figure 2).

Figure 2

Georgia Energy Consumption by Fuel, 2004



This energy use affects the quality of life of all Georgians, creating jobs, providing mobility and sustaining the state's prosperity. However, by-products of energy use and high energy costs can erode this quality of life. Without adequate investment in reducing demand as the population and economic activity increase, Georgians may face more price volatility, supply constraints, security threats and health and environmental stress. This chapter explores opportunities to treat energy efficiency as a "resource" equal in value to new energy supplies. Energy efficiency is one of the most cost effective and rapidly deployable resources available to Georgians, and has the added benefit of reducing the health and environmental impact of energy consumption.

As reported in *Georgia Energy Review 2005* (GEFA, 2006), Georgia's energy use has grown 76% over the 20-year period 1984-2004, while its population has grown 51%. This indicates that Georgians were using 16% more energy per person in 2004 than they did in 1984. Yet at the same time, Georgia's overall economy has become more energy efficient. Georgia's industries and businesses used about half as much energy to produce each dollar of Gross State Product in 2004 as they used in 1984, demonstrating that the economy can function, indeed prosper, at a lower energy intensity than in the past.

The price of energy grew slowly during most of this same time period until the early 2000s, when it began to rise and fluctuate more rapidly, as seen in Figures 3 and 4. These recent energy price increases will affect consumers and businesses more if they do not reduce their energy use. This is particularly true for Georgians already receiving direct financial assistance for utility bills.

Figure 3

Georgia Natural Gas Retail Prices 1984-2004

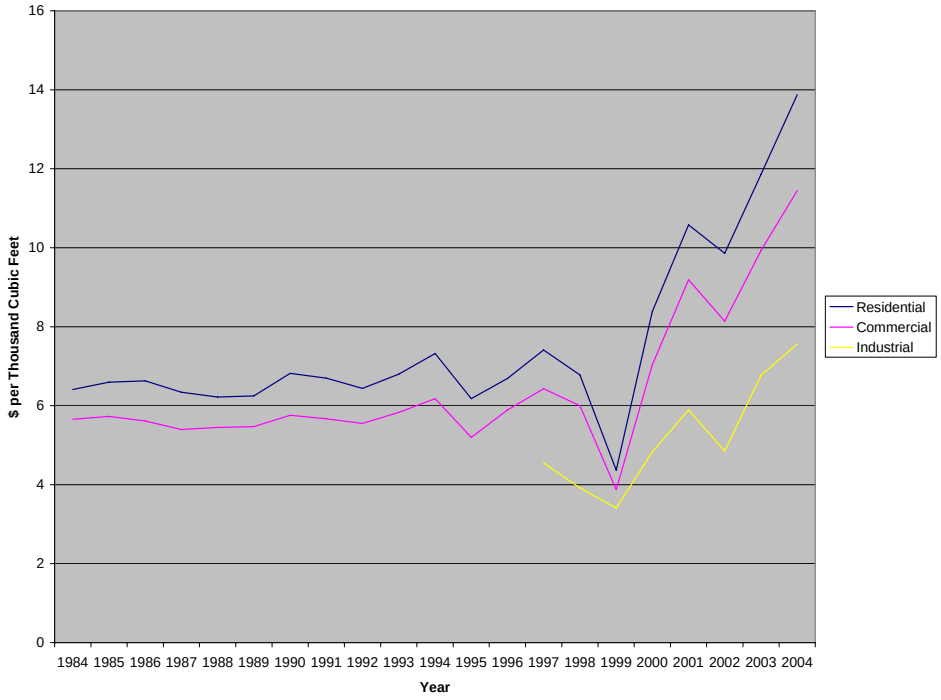
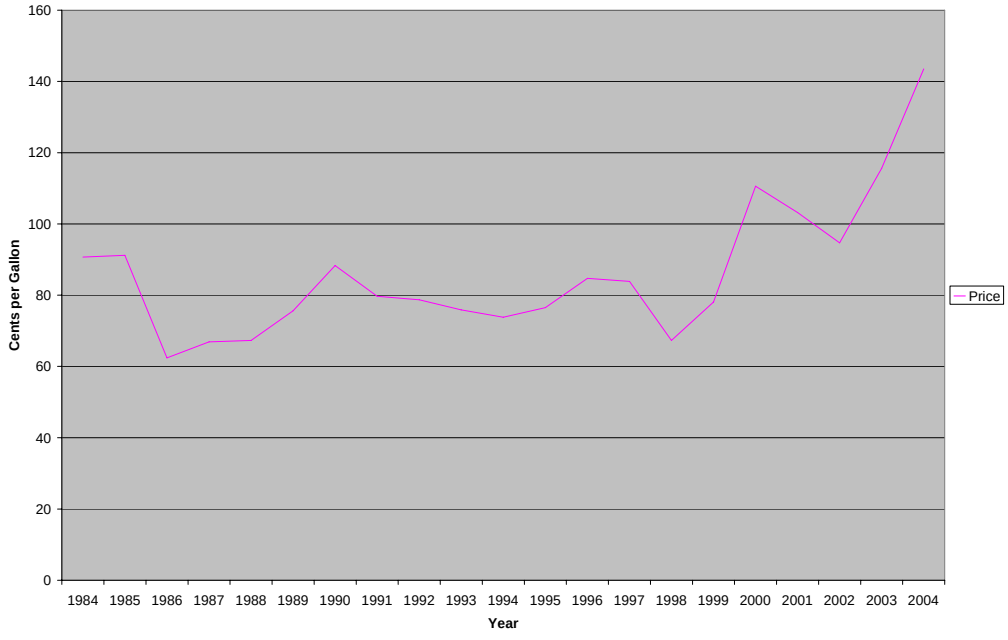


Figure 4

Georgia Retail Gasoline Prices 1984-2004



The environmental effects of energy were reduced slightly from 1985 to 2002, years for which data are currently available. The overall concentration of most air pollutants associated with energy use fell or remained relatively flat during that period due to improvements in emissions control technology implemented in response to various air quality regulations (Environmental Protection Division, 2003). Yet despite these improvements in environmental performance, 24 full or partial counties are now designated as non-attainment for the federal eight-hour ozone air quality standard, and 27 full or partial counties are designated as non-attainment for the federal fine particulate matter standard. Both standards are human health-based standards (GEFA, 2006). The number of counties that violate federal air quality standards has grown over time due to growth in population and the tightening of federal air quality standards in response to new public health research. Further reducing energy production and consumption through energy efficiency can benefit Georgia's residents and natural resources.

This chapter examines policies and strategies to sustain Georgia's quality of life and productivity while reducing the state's energy consumption through conservation and efficiency. It outlines opportunities to reduce energy demand in transportation fuels, electricity and natural gas.

Chapter 3 is organized around six *policy objectives*, which are programs or policies intended to move Georgia toward affordable, reliable and environmentally responsible energy. Each policy objective is followed by associated *implementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Section 1: Reduced Energy Demand in Transportation

Transportation was the leading energy consuming sector in Georgia in 2004, accounting for 29% of Georgia's total energy use (GEFA, 2006). Unlike other sectors that use energy, transportation is 99% dependent on a single fuel source – petroleum. In addition to contributing to a vital, agile and growing economy, transportation itself is a valued industry in Georgia and throughout the Southeast. Growth in transportation energy use is the result of at least two factors: an increase in the population (and associated number of vehicles traveling on the roads); and an increase in the distance traveled per vehicle. Between 1984 and 2004, Georgia's population grew 51%, while consumption of gasoline grew 67%. According to the Atlanta Regional Commission (ARC), the average daily vehicle miles traveled have increased every year except two during the period 1990-2004 (Atlanta Regional Commission, 2005), as seen in Table 2. This rising demand, coupled with relatively flat average vehicle fuel economy (U.S. EPA, *Light-Duty*, 2006) has created ever-rising demand for transportation fuels.

Table 2

Average Daily Vehicle Miles Traveled for 10-County Metro Atlanta Region: 1990-2004

Year	Average Daily Miles Traveled	% Change From Previous Year	VMT Per Capita
1990	77,189,265	5.93%	30.18
1991	75,159,638	-2.63%	30.09
1992	80,556,619	7.18%	30.61
1993	85,556,549	6.21%	31.78
1994	90,364,076	5.62%	32.54
1995	94,277,492	4.33%	32.71
1996	99,359,577	5.39%	33.63
1997	103,577,806	4.25%	34.15
1998	108,930,841	5.20%	35.02
1999	108,297,928	-0.58%	33.79
2000	109,895,587	1.50%	32.05
2001	112,139,004	2.00%	31.75
2002	113,035,834	0.80%	31.29
2003	113,470,169	0.38%	30.53
2004	118,133,345	4.11%	31.67

Transportation is closely tied to Georgia's economy, security and health. High prices for fuel divert household dollars from other uses, traffic congestion erodes worker productivity, and prices climb for a broad range of consumer goods, including food. In 2006, crude oil prices set a near record high (in nominal dollars) upon fears of reduced oil output due to regional instability in oil producing areas of the world (EIA, *Imported Crude Oil*, 2006).

The safety and reliability of Georgia's transportation system depend on a secure supply of energy. Yet Georgia imports all of its petroleum for transportation and other uses and is vulnerable to a wide variety of disruptions. As described in *Georgia Energy Review 2005* (2006), Georgia is primarily dependent on two pipelines that originate on the Gulf Coast to deliver

refined petroleum products such as gasoline, diesel and jet fuel. Constrained supplies could impede basic mobility and freight transport and undermine public safety.

The environmental impact of transportation demand considered in this chapter is associated with vehicle emissions[9]. The vehicle-based transportation system affects Georgia's air quality, which in turn affects both human and environmental health. Vehicle emissions include nitrogen oxides (NOx), particulate matter (PM), volatile organic compounds (VOC), carbon monoxide (CO) and greenhouse gases (GHG) (U.S. EPA, *Mobile Source*, 2006). Most visible to the public is smog, formed when NOx and VOC combine in sunlight. Smog is linked with respiratory distress and premature death (Bell, Peng, & Domenici, 2006).

The following policy objectives address these impacts by promoting ways to reduce the consumption of fuels through conservation, efficiency and alternative transportation strategies.

Policy Objective
Increase the Use of Technologies That Make the Vehicle-Based Transportation System More Fuel Efficient

Georgia's transportation system relies on passenger vehicles as the primary mode of transportation. At the time of publication, the Georgia Department of Revenue reported that of the 7,945,267 vehicles registered in Georgia, 5,016,645 are passenger vehicles (Georgia Department of Revenue, *Motor Vehicle Division*, 2006). One approach to reduce the cost, health and environmental impact of the transportation sector is to adopt technologies that make the vehicle-based transportation system more fuel efficient. Hybrid gasoline-electric vehicle (HEV) technology uses less fuel per passenger-mile or ton-mile (freight), and alternative power sources at rest stops reduce the need for truck drivers to use fuel to idle their engines during overnight stays. Other transportation technologies help traffic flow more smoothly, enabling vehicles to use fuel only when necessary. All of these measures are in use and available in Georgia, and they offer ways to reduce fuel costs and consumption.

Implementation Strategies

Strategy 3.1 – Create Incentives to Increase the Adoption of Efficient Vehicles and Vehicle Technologies

Georgia could offer incentives to increase the adoption of fuel efficient vehicles and technologies by Georgia residents and businesses. Additional information on different types of incentives can be found in Chapter 5 of the *State Energy Strategy*. To accelerate the adoption of efficient vehicle technologies, incentives could be offered on vehicles meeting certain fuel efficiency criteria. These incentives, in the form of a tax credit or rebate, could offset some or all of the higher cost of the vehicle in exchange for reduced demand on our transportation fuel infrastructure and reduced emissions, for example. Incentives should only be offered on vehicles meeting certain performance criteria. In O.C.G.A. 40-2-76, the Georgia General Assembly has

[9] The environmental impact of transportation includes elements beyond those considered in this chapter. This section addresses land use only as it affects the consumption of fuel and will not address its other environmental impact, such as increased impervious surfaces, transportation-related non-point runoff or land clearing.

adopted a definition that requires a vehicle to achieve "a composite label fuel economy greater than or equal to 1.5 times the Model Year 2002 EPA composite class average for the same vehicle class and which is made by a manufacturer," among other criteria (Georgia General Assembly, *O.C.G.A. 40-2-76*, 2005). In addition to State incentives, local governments can offer non-financial incentives (discussed below).

Incentives for fuel efficient vehicles that reduce their incremental cost can increase the market penetration of efficient vehicles, enabling Georgia to reduce its dependence on imported petroleum and reduce emissions associated with vehicle exhaust. By reducing overall fuel consumption, Georgia and its residents will minimize the impact of fuel shortages or price volatility. While the federal government retains authority to regulate average fuel economy of automobiles, states can play an important role in improving fuel economy by encouraging the adoption of advanced transportation technology.

In evaluating this public policy objective, the State should ensure that such incentives encourage Georgians to make choices they might not otherwise make and should do so in a cost-effective manner.

Any incentives considered by the State should accommodate other technologies such as high efficiency diesel vehicles, provided they meet appropriate emissions standards. Ideally, these incentives should be coordinated with federal tax incentives to minimize confusion among consumers. Additionally, local governments could consider offering non-financial incentives such as preferred or free parking for qualified vehicles. These visible benefits can increase awareness among the public about the benefits of efficient vehicles. The State should consider creating a designation or insignia (sticker, license plate, etc.) that identifies qualified vehicles to prevent confusion.

Among the federal energy-related tax incentives, the vehicle-related incentives are among the longest lasting, expiring in 2010[10]. To leverage the value of these incentives and increase the penetration of fuel efficient vehicles, Georgia could adopt incentives that last through 2010.

Twelve states currently offer incentives directly to the end user for the purchase of qualified fuel efficient vehicles (fuel efficient "definitions" vary by state). Many local governments supplement these with non-financial incentives described previously. Colorado incentives include a unique clause that offers double the standard incentive if the vehicle purchase permanently replaces a vehicle that is 10 years old or older. This provision increases the initiative's efficiency and environmental benefits.

Strategy 3.2 – Establish Purchasing Criteria for the State of Georgia to Increase the Use of Efficient Vehicles in Its Fleet

The State of Georgia should apply life cycle cost analysis to its capital investments, including its transportation needs. State purchasing criteria can use the purchasing power of government for several purposes: to expand the markets for new technologies, driving down costs; to achieve a particular policy goal such as reducing pollution; to reduce total costs of ownership, particularly

[10] Federal energy-related vehicle tax incentives for a particular model may expire before 2010 if the production of that model exceeds 60,000 vehicles.

when the first cost of a technology may be higher than conventional options; and to demonstrate the viability of a new technology that benefits the public, among others. Purchasing criteria for efficient vehicles promote the use of efficient transportation technologies, particularly for passenger cars and trucks, within the fleet of government vehicles. Purchasing guidelines encourage or require all State vehicle purchases to achieve above average fuel economy performance. Guidelines can apply to overall fleet performance, or they can directly affect new fleet purchases for greater cost impact.

By using more efficient vehicle technologies, the State will consume less fuel, spend less on fuel, emit fewer pollutants, strengthen the market for efficient vehicles, publicly demonstrate the viability of efficient vehicle technologies, and encourage others to adopt them voluntarily. Table 3 shows the cumulative five-year cost and fuel savings per vehicle by increasing the vehicle fuel economy from 21 miles per gallon (MPG) to 30 MPG. This modest performance goal allows significant flexibility and minimum incremental cost.

Table 3

Cost and Fuel Savings From Improved Fuel Economy

	Five-Year Fuel Costs					Five Year Fuel Use (Gal)
	@ $2.00/Gal	@ $2.50/Gal	@ $3.00/Gal	@ $3.50/Gal	@ $4.00/Gal	
Vehicle @ 21 MPG	$5,714.29	$7,142.86	$8,571.43	$10,000.00	$11,428.57	2857
Vehicle @ 30 MPG	$4,000.00	$5,000.00	$6,000.00	$7,000.00	$8,000.00	2000
Savings @ 30 MPG	$1,714.29	$2,142.86	$2,571.43	$3,000.00	$3,428.57	857
Payback In Years[1]	7.29	5.83	4.86	4.17	3.65	
[1] Assuming incremental cost of $2,500						

Table 3 shows that at gas prices of $3.00/gallon, a vehicle achieving 30 MPG can cost as much as $2,500 more than a vehicle achieving 21 MPG and still achieve a simple payback within five years. Paybacks may even be shorter. Of the 12 vehicles listed on the fueleconomy.gov website with a combined EPA mileage rating of 30 MPG or greater, only three are hybrid-electric vehicles. The rest are conventional gasoline vehicles with little if any incremental cost.

The State of Georgia is a significant vehicle owner with a current fleet inventory of almost 19,000 vehicles (B. Vincent, personal communication, November 21, 2005). To reduce the impact of rising prices, Governor Sonny Perdue (2006) recently issued Executive Order 02.28.06.02 that encourages efficient vehicles, stating:

> "…the agencies and departments of the State of Georgia shall prioritize the procurement of high fuel efficiency and flexible fuel vehicles in their procurement decisions when such technologies are commercially available and economically practical."

In support of this Order, the Department of Administrative Services (DOAS) and Office of Planning and Budget (OPB) should develop additional guidance, including total cost of ownership methods, to help State agencies determine which vehicles and technologies are available and practical. Total cost of ownership calculations estimate the initial (capital) costs,

operating and maintenance costs, any costs required to support the purchase over its lifetime, and any resale or residual value. DOAS should annually publish the total cost of ownership per vehicle class to inform State and local government agency decisions about vehicle options. DOAS and OPB should develop guidance so that State fleet purchases can claim federal tax credits now available for efficient vehicles[11]. Federal tax credits ultimately expire at the end of 2010, but may also be eliminated earlier as manufacturers exceed production quotas established by the Energy Policy Act of 2005.

Thirteen states currently have vehicle procurement requirements that favor alternative fueled and hybrid-electric vehicles. In addition to establishing fuel performance criteria, including overall fleet fuel economy or petroleum reduction goals, some states set minimum emissions performance standards.

Strategy 3.3 – Use and Support Idle Reduction Technologies

Idle reduction technologies reduce the fuel that idling vehicles consume and the pollutants they emit. These technologies can effectively be applied to both over-the-road freight carriers and urban transit vehicles. Long-distance truck drivers who carry freight often idle their engines at truck stops because they need power for heating, cooling or other in-truck appliances or uses. Truck Stop-Electrification (TSE) allows drivers to "plug-in" at the truck stop to a unit that provides electricity to power heating or cooling units as well as other services, such as Internet connections and cable television. Auxiliary Power Units are portable power generators that are installed in each vehicle to provide power for heating, cooling and other purposes without using the vehicle's petroleum powered engine. In the urban transit sector, hybrid-electric vehicles improve fuel efficiency and reduce idle time when the vehicle is standing still by using electric motors and batteries instead of the fossil fuel powered engine.

According to estimates by Argonne National Laboratory, truck idling consumes approximately 838 million gallons (over 19 million barrels) of fuel per year (Stodolsky, Gaines, & Vyas, 2000). Diesel engines comprise the vast majority of these engines and when compared with gasoline, diesel fuel emits considerably more particulate matter, a pollutant linked to respiratory damage, nonfatal heart attacks and premature death (U.S. EPA, *Particulate Matter*, 2006). Idle reduction technologies can provide local air quality benefits if they are available more widely along heavily traveled corridors and in dense population centers.

Broader adoption of idle reduction technologies will require participation by key players including freight carriers, truck stop owners and public transportation departments. The State of Georgia should continue to support truck stop electrification efforts through the Congestion Mitigation and Air Quality Improvement Program and two Clean Cities Coalitions, and should leverage its efforts with private partners to increase the benefits of these technologies. Transit authorities, such as the Metropolitan Atlanta Rapid Transit Authority (MARTA), should consider using more hybrid-electric vehicles to reduce idling emissions and fuel consumption, particularly as current vehicles age and need replacing. To increase use of all these technologies, the State should ensure that accurate and updated information is distributed to key stakeholders through a

[11] While the State of Georgia cannot directly claim tax credits, IRS has provided for vehicles sellers to claim the credit; the State can negotiate for a proportionally lower purchase price in exchange for the transfer of this tax credit.

collaboration of the Georgia Department of Transportation (DOT), State universities, related nonprofit organizations and private sector entities, including manufacturers.

A current collaboration among North Carolina, South Carolina and Georgia has installed TSE stations along the I-85 corridor and documented significant increases in usage over the nine months since installation. Georgia also has TSE stations in two other locations.

Strategy 3.4 – Increase the Use of "Smart" Traffic Control Technologies and Practices
"Smart" traffic control makes the flow of traffic more efficient through real time monitoring, synchronized traffic devices and other technologies that reduce stopping and idling. These technologies include traffic cameras, sensors and controls that respond to traffic activity, and synchronized traffic signals or roadway configurations (roundabouts) that reduce idling.

Governments and agencies responsible for roadways and traffic infrastructure in Georgia should study and adopt these "smart" technologies where appropriate. Through organizations such as the Georgia Partnership for Transportation Quality, the Georgia DOT should help local governments determine equipment and practices that are most likely to be effective in their jurisdictions.

DOT and Georgia Regional Transportation Authority (GRTA), in cooperation with Cobb County, the City of Marietta and the City of Atlanta, are developing a "smart corridor" pilot project along a stretch of US 41 that will integrate two types of Intelligent Traffic System technologies: adaptive traffic signal control and transit signal priority. Currently, however, Georgia does not have an ongoing smart traffic technology assessment and deployment program.

Policy Objective
Support Transportation Demand Management Efforts

Efficient transportation technologies, such as fuel efficient vehicles, significantly reduce the cost, health and environmental impact of the current transportation system. Yet recent history has taught us that reducing tailpipe emissions is not enough. While the average car in the United States emits considerably less pollution per mile than it did 30 years ago, the increase in motor vehicle use over the same timeframe has put upward pressure on total emissions from the transportation sector. Transportation demand management (TDM) addresses the increasing demand for mobility by promoting alternatives to vehicle use, particularly single-occupancy vehicle use. Carpooling, vanpooling, teleworking, public transit, walking and bicycling are TDM measures that promote conservation of transportation energy resources.

Implementation Strategies

Strategy 3.5 – Maximize the Use of Telecommunications Technology and E-Government to Provide Government Services to the Public
State and local governments can reduce travel associated with providing government services by increasing access to these services online, via telephone and through other telecommunications media ("e-government"). Using advancements in technology, Georgia residents could complete applications, request information, make payments and conduct other regular government

business electronically, reducing the need to drive to government offices. Residents save time, money and fuel, and governments reduce the cost of providing services.

The State of Georgia should continue to lead in developing and implementing telecommunications technologies that effectively and securely deliver government services. As part of the Governor's Office initiative to make customer service faster, friendlier and easier, relevant State agencies including the Georgia Technology Authority (GTA) should survey State agencies that regularly serve customers and assess new opportunities to conduct business remotely. Many government-oriented nonprofit organizations such as Public Technology Incorporated and the Council for Excellence in Government have e-government programs that can help Georgia to adopt and maintain an effective and efficient electronic presence. The State should encourage the adoption of proven technologies by local governments when appropriate.

GTA and other relevant agencies should develop and implement this survey within one year and make recommendations to the Governor's Office for new opportunities to deploy e-government systems that reduce vehicle trips to government offices.

Strategy 3.6 – Encourage Continued or Expanded Funding for Proven TDM Programs
Continued or expanded funding for TDM programs will sustain the progress Georgia has made in reducing transportation fuel consumption. Both federal and State funding should be used to support programs that have proven performance in areas that have exceeded air quality standards due to population and economic growth.

Georgia DOT collects measurement data on the effectiveness of current TDM programs. DOT should publish the data, and the State should continue or expand support for measures that reduce inefficient travel modes. DOT should also work with local governments, transit authorities and transportation management associations to assess the availability and penetration of effective TDM programs in rapidly growing areas. They should consider expanding funding, particularly in areas that exceed National Ambient Air Quality Standards due to growth in the use of transportation energy. By having access to TDM programs, cities and counties can also address rapidly growing transportation energy use before they reach non-attainment status.

Georgia DOT should conduct research on effective programs in other states that address deficiencies in Georgia's offerings. The agency should also assess the effectiveness of the recently adopted tax incentive for businesses to invest in telework capacity and recommend improvements or continuation of this incentive.

The State of Georgia has adopted measures to promote TDM practices among State employees, including:

- Executive Order 02.28.06.02 requires a 20% reduction in employee miles traveled for commuting and government business through carpooling, vanpooling, transit use and teleworking.
- Employees can use flexible work schedules, which reduce traffic congestion.
- State employees who purchase transit passes receive a pretax benefit.

The State of Georgia also offers TDM measures to the private sector, including:

- Carpools, vanpools and commuter bus service are available through GRTA.
- A tax incentive is available for employers that provide teleworking opportunities for their employees.

The State should continue to offer these programs, provide annual reports on the fuel savings and other benefits achieved, and educate public and private organizations on the benefits of TDM programs.

Policy Objective

Increase the Availability of and Access to Public Transportation and Transit Options

Intracity and intercity public transportation such as bus and rail transit are often faster and more fuel efficient than single-occupancy vehicles, particularly during peak travel hours before and after the work day. Providing public transit options to more travelers and destinations can reduce the use of less efficient vehicles as well as traffic congestion and lost productivity. According to a study of 85 urban areas conducted in 2005, public transit saved $463 million dollars in Atlanta by relieving congestion (Texas Transportation Institute, 2005).

Implementation Strategies

Strategy 3.7 – Continued Support and Funding for Public Transit Systems
State government can support public transit systems in several ways:

- Work with local governments and private investors to generate capital and maintain appropriate levels of funding for existing public transit systems throughout Georgia.
- Maintain State-provided transit options, including those operated by GRTA, and evaluate the merits of project expansions, funding projects where they will have the greatest impact.
- Seek sources of funding for new public transit options, including intercity commuter rail and intracity systems such as the proposed Beltline.

Stakeholder support of public transit will allow these systems to carry more passengers to more destinations and reduce reliance on less efficient transportation. Analyses submitted by GRTA indicate that most transit modes are more efficient than single-occupancy vehicles. Efficiency often translates into significant savings for commuters. Given available data on average fleet fuel economy, daily vehicle miles traveled, number of workdays and current gasoline prices, the average metropolitan Atlanta commuter can spend more than $1,130 per year on fuel for their commute alone. Add insurance, maintenance and other costs associated with driving and the cost can reach $4,200 or $0.531/mile (American Automobile Association, 2006). Commuters can save a significant portion of that cost by using alternative transportation options, even once a week.

Section 2: Reduced Energy Demand for Electricity and Natural Gas

In Georgia, electricity is generated by the combustion of fossil fuels such as coal or natural gas, the use of nuclear power and by hydroelectric turbines spun by falling water. Each energy source has advantages and disadvantages, but extensive use of any one resource can have economic and environmental impacts. With the exception of hydroelectric power and Georgia's small portfolio of non-hydro renewable energy resources, all of the fuels Georgia uses to produce electricity are non-renewable, produce emissions or waste, and are imported from outside the state.

The state's population and per capita energy intensity have grown substantially, as noted earlier in this chapter. This suggests that Georgia will require significant new electricity resources to serve new residents unless Georgians reduce the demand. The infrastructure needed to generate and transmit more electricity will compete with the growing population for both land and water resources. Similarly, demand for natural gas in Georgia has grown consistently over the last two decades and is projected to continue to grow, though at a slower pace than the demand for electricity.

The value of reducing energy consumption through efficiency is clear when comparing Georgia's energy use and costs to national figures. Georgia's electricity customers have experienced lower electricity rates than the national average. However, as shown in Table 4, Georgia's average residential consumer uses 25% more electricity and pays 9% more each month than the national average (EIA, *Electric Sales*, 2005). These statistics reveal that there are two components to consumer energy costs – electricity rates and end-use consumption. When combined, these result in the energy bills paid by Georgia customers each month. Georgians appear to be more dependent on electricity for residential energy needs; the climate requires greater cooling. While Georgia's electric utilities have very effectively maintained low rates for electricity, few offer comprehensive demand management services found elsewhere in the country. Low prices have dampened the financial impact of rising per capita energy use, although Georgians are now very exposed to fuel cost increases. Demand-side management (DSM) programs address the second aspect of consumer energy costs – consumption – enabling Georgians to have more control over their energy costs.

Table 4

Average Electricity Consumption and Costs: Georgia vs. United States

	Avg. Consumption Georgia (kWh)	Avg. Consumption U.S. (kWh)	Difference (%)	Avg. Monthly Cost Georgia ($)	Avg. Monthly Cost U.S. ($)	Difference (%)
Residential	1,136	908	+25.1%	89.21	81.42	+9.5%
Commercial	7,053	6,167	+14.3%	485.43	503.08	-3.6%
Industrial	233,881	113,532	+106%	10,355.88	5981	+73.1%

For natural gas, the rationale for demand management is different, although equally compelling. Georgia enjoys relatively warm winters, moderating per capita natural gas consumption in the

state. Nonetheless, Georgia consumers have felt the sting of recent high natural gas prices, as shown in Figure 5. In fact, the Southeast's recent natural gas costs have exceeded the national average, providing Georgia customers with an added incentive to manage their consumption to control costs. According to Energy Information Administration forecasts, natural gas prices in the South Atlantic Census Region will remain high, and residential consumers can expect to pay 15% to 20% more than the national average for the next two years (EIA, *Table 8c*, 2006).

Figure 5

Georgia Natural Gas Retail Prices 1984-2004

Policy Objective
Support the Use of Efficient Building Technologies and Practices

The residential and commercial sectors together account for 42% of Georgia's total energy consumption, much of which is used to heat, cool and light buildings (GEFA, 2006). The *Assessment of Energy Efficiency Potential in Georgia* (Jensen & Lounsbury, 2005) found that with a moderate level of incentive and outreach, Georgians could save about 6% of the energy they use. This energy savings would not only benefit the consumers, but also reduce costs for electric utilities. Jensen & Lounsbury conducted this analysis before Georgia's residents and businesses endured back-to-back base and fuel cost increases. At the higher prices, more energy efficiency measures become cost effective, and Georgians can save more energy and money. Most of the energy efficiency measures identified in the *Assessment* address heating, ventilation, air conditioning (HVAC) and lighting in the residential and commercial sectors. It should be

noted that other analyses of energy efficiency potential, including the *National Action Plan for Energy Efficiency*, suggest that the *Assessment of Energy Efficiency Potential in Georgia* may be a low estimate of the energy efficiency potential.

Implementation Strategies

Strategy 3.8 – Create Incentives to Increase the Adoption of Efficient Building Technologies and Practices

Georgia should offer incentives for the adoption of efficient building technologies and practices. Additional information on the definitions of different types of incentives can be found in Chapter 5 of the *State Energy Strategy*.

To accelerate the adoption of efficient building technologies and practices, incentives should be offered to projects that achieve third party performance standards, such as LEED or ENERGY STAR, and that exceed Georgia's Energy Code by an appropriate amount. In addition to financial incentives, State and local governments can offer non-financial incentives such as expedited permitting, increased density or technical assistance and training to private developers interested in high performance building.

While owners and tenants increasingly value the benefits of high performance buildings – and will pay for them – barriers still exist to increased adoption of these techniques, particularly for buildings that are not owner-occupied. These "split incentives" occur when the project developer cannot effectively price or completely recover the initial investment in high performance building technologies. Additionally, due to the competitive nature of the building market, builders are often reluctant to incorporate features that might increase first costs, even if they can recover these through a higher sale price, for fear of a competitive disadvantage. Incentives can increase the efficiency of Georgia's buildings, which can be in place for decades.

In evaluating this public policy objective, the State should ensure that such incentives encourage Georgians to make choices they might not otherwise make and should do so in a cost-effective manner. Any incentives considered by the State should be coordinated with federal tax incentives to minimize confusion among building owners. Finally, State and local governments should consider offering non-financial incentives such as expedited permitting, density bonuses or training and technical assistance for the private sector.

Due to the relatively short window of opportunity (through December 31, 2007), the federal tax credits for efficient buildings are difficult for many building owners to claim. Most commercial buildings of substantial size take more than two years from conception through 'substantial completion' – the state a building must achieve by the deadline to claim credits. Georgia should consider offering incentives that effectively extend the federal credits through 2010 to allow projects to be designed and built according to efficiency standards.

Strategy 3.9 – Establish Energy Reduction Goals for Public Facilities

Specific, measurable, achievable, realistic and time bound energy reduction goals could provide the State with a clear and manageable roadmap to reduce the expense of operating its public facilities. Energy reduction goals are built around a baseline from which reductions can be

achieved and measured. Governments must first understand the complete scope of their energy consumption and be able to access data from their utilities. Reduction goals are then established based on the condition of the public facilities, current technology, available financial resources and other considerations.

The State of Georgia operates more than 15,000 buildings and spends approximately $140 million annually to power those facilities. Realizing opportunities to increase the buildings' energy efficiency could provide substantial savings to the State while increasing energy reliability and clean air in Georgia. Many energy efficiency practices used in new construction, such as daylighting and air sealing, also have a positive effect on employee productivity. Other practices, such as building commissioning, can reduce operating costs by detecting and fixing potential problems before they become costly malfunctions or legal liabilities.

Governments can create energy management teams and plans that establish baselines, audit buildings, implement energy efficiency measures and monitor performance. The State of Georgia should continue to support the State Facilities Energy Advisory Council created by Executive Order 02.28.06.01 and ensure that it has the resources to improve energy efficiency of State-owned buildings. The State of Georgia should apply life cycle cost analysis to its capital investments, including the facilities it builds and owns, and should ensure that all of its new facilities meet or exceed requirements established by Georgia's Energy Code. State agencies such as the Georgia Building Authority and Georgia Environmental Facilities Authority (GEFA) should offer technical assistance and other resources to help local governments develop and implement energy management plans.

Strategy 3.10 – Encourage the Use of Energy Savings Performance Contracting to Finance Energy Efficiency Projects

Energy savings performance contracting (ESPC) is another method of financing energy efficiency projects, particularly in buildings. The first step is an energy audit to determine the appropriate energy efficiency measures. Then a third party arranges financing and installs these measures. The building owner pays back costs over a term (10-15 years) through the energy and cost savings, then keeps the equipment and continues to enjoy the savings. Unlike a revolving loan fund that may have limited capital and qualifying criteria, ESPC is available to all public and private entities that have the potential for cost-effective energy efficiency improvements.

Performance contracting was developed to overcome the lack of capital and technical expertise that many building owners encounter when considering energy efficiency improvements. However, performance contracting can be a technically and financially complex undertaking, particularly for smaller entities, and technical assistance can facilitate increased use of this cost-effective, energy-saving service. The most significant benefits of performance contracting are the energy efficiency projects that otherwise would not happen.

The State of Georgia should support the use of performance contracting in public and private buildings where other methods of financing energy efficiency improvements are not available. GEFA should coordinate with relevant agencies and organizations to provide education, training and information resources to ensure that the public sector has technical assistance and other resources to increase its use of performance contracting.

Strategy 3.11 – Develop More Effective Building Energy Code Enforcement Strategies
The State of Georgia has adopted an energy code for residential and commercial buildings that establishes minimum criteria for the energy performance of buildings and requires builders to certify compliance through one of several mechanisms (Georgia Department of Community Affairs, 2006). The State regularly updates the code, and the current code is effective. However, local governments that are responsible for enforcing the code lack the resources and training to ensure compliance.

The building energy code is an effective way to save energy in Georgia because it costs less to make buildings energy efficient during construction than to retrofit them with energy efficiency measures. Enforcing the energy code may help mitigate the trend of higher energy use per person in Georgia. Enforcing code compliance is particularly important as Georgia continues to attract new residents and remains one of the states with the most rapidly growing populations.

The Department of Community Affairs (DCA) and local governments should collaborate to provide resources and training to local building code officials so they can properly inspect and verify energy code compliance. DCA should continue to support the adoption of "best-in-class" energy codes.

Policy Objective
Increase the Use of Efficient Appliances and Equipment

Like buildings, appliances consume significant amounts of electricity and natural gas. For purposes of the *State Energy Strategy*, the term 'appliances' includes all commonly found devices that consume energy, including basic industrial equipment such as motors, pumps, process heating and other technologies that have been identified (i.e., by the U.S. Department of Energy, Industrial Technologies Program).

Efficient appliances can reduce energy consumption and demand and save consumers money while providing equal or better services and requiring little change in behavior. Appliance standards currently in place are estimated to save approximately 27,000 MW nationwide by 2015, and the Appliance Standards Awareness Project estimates that new standards could save at least that much again (Appliance Standards Awareness Project, n.d.).

Implementation Strategies

Strategy 3.12– Continue Incentives to Increase the Adoption of Efficient Appliances and Products
Georgia should continue to offer incentives to increase the adoption of efficient products and appliances by Georgia residents and businesses, such as tax incentives, direct financial incentives and non-financial incentives. Additional information on the definitions of these incentives can be found in Chapter 5. To accelerate the adoption of efficient products and appliances, tax incentives and direct financial incentives should be offered on select models meeting certain criteria, such as the ENERGY STAR standard or the Consortium for Energy Efficiency's appliance standards.

While many ENERGY STAR appliances are cost effective, i.e., they reduce energy bills by an amount more than the higher first cost of the product, more efficient products are emerging every day in this dynamic market. Given the relatively long life of some appliances, the State should consider promoting appliances that have longer than average payback periods.

The Georgia General Assembly could consider a combination of tax incentives and rebates for efficient appliances and products as part of the comprehensive Clean Energy Income Tax Program described in Chapter 5. Tax incentives can either be a capped percentage (i.e., 20% of the appliance cost up to $500), or an amount that grows in relation to the energy performance of the product. Ideally, these incentives should be coordinated with federal tax incentives to minimize confusion among consumers. Rebates that are equivalent to the amount of the associated tax incentive should be considered for nonprofit and tax-exempt organizations. These rebates could be supported from the Clean Energy Fund also described in Chapter 5.

Strategy 3.13 – Establish Minimum Energy Performance Criteria (i.e., ENERGY STAR) for All Appliance and Equipment Purchases by the State of Georgia

Energy efficient purchasing preferences guide State agencies when they buy appliances or equipment, and they ensure that all equipment uses less energy than standard models of the same device without reducing service. These provisions may include tests for life cycle cost effectiveness to ensure that the energy and cost savings over the appliance's life exceed the purchase cost, which may be higher. The State can use its purchasing power to increase the penetration of energy efficient goods in the marketplace and to provide access for local governments to these goods through State contracts.

With over 120,000 employees, the State uses a significant number of appliances and equipment. The State can help to establish Georgia as a leader in energy efficient technologies and reduce taxpayers' exposure to energy price increases. Promoting energy efficient technologies that are commonly used throughout the private sector also provides significant opportunities for education and leadership by example.

Additionally, State and local governments are responsible for a variety of unique energy consuming equipment including traffic signals and street lights, water and wastewater plants and other facilities. Ensuring that the technologies achieve high levels of energy efficiency will save energy, lower operating costs that must ultimately be paid by taxpayers, reduce emissions, and reduce taxpayer and agency exposure to rising energy prices.

The Office of Planning and Budget and the Department of Administrative Service should convene a working group to develop life cycle cost tools that determine the total cost of ownership for common energy consuming purchases. These tools should consider the current and expected near-term cost of energy, enabling the State to estimate the likely energy costs over the lifetime of the purchase. In addition, OPB and DOAS could use existing standards, such as ENERGY STAR, to identify preferable purchases. OPB and DOAS should educate agencies on these tools and eventually adopt policies requiring their use, or provide incentives to use them by limiting budget requests that increase energy costs.

The working group should also evaluate best practices in government procurement of unique energy consuming devices such as traffic signals, street lights, electric motors, and equipment for wastewater and drinking water facilities. The State should consider incorporating language that encourages use of high efficiency equipment and products into contracts and other agreements with any entity that receives State monies or financing. For example, GEFA should promote energy efficient options through its water, wastewater and sewer loan programs for local governments and offer loans to improve their energy efficiency.

OPB and DOAS should convene a working group within six months of the adoption of this strategy and develop basic protocols for life cycle cost assessment within 12 months.

While many states have various energy and environmentally preferable purchasing programs or mandates, the federal government has the most comprehensive life cycle cost assessment program and an extensive library of energy and environmentally preferable projects managed by the General Services Administration and supported by the Environmental Protection Agency. The federal government offers tools to calculate the life cycle cost of a variety of products and methodologies.

Policy Objective
Support the Increased Involvement of Electric and Natural Gas Utilities in Promoting and Implementing Energy Efficiency

Electric and natural gas utilities have the opportunity to play a significant role in diversifying Georgia's energy supply. All electric and natural gas utilities in Georgia are governed by an oversight agency[12] that establishes incentives and deterrents to certain actions. According to the National Action Plan for Energy Efficiency, utilities have sought to expand their retail sales with support of their respective oversight agency. Yet economic, environmental and security issues are arising that suggest the need to reconsider the value of reducing energy demand instead of expanding supply. Within the current framework of existing regulatory authorities, the State should encourage utilities to expand the resources they provide consumers to meet the economic, environmental and security challenges facing Georgia.

Implementation Strategies

Strategy 3.14 – Encourage Achievement of a Voluntary Energy Efficiency Target for Electric and Natural Gas Utilities

An Energy Efficiency Target (EET) is a voluntary goal designed to address the impacts of expected growth in electricity and natural gas consumption in Georgia. An EET is a voluntary approach in which a certain percentage of energy load growth is targeted to be met through energy efficiency measures instead of new power production. As proposed here, an EET relies on a careful analysis that will identify levels of energy efficiency that can be achieved through market-based mechanisms. While some states have successfully implemented mandatory targets for introducing efficiency and renewable energy into their energy portfolios, utilities and large

[12] Electric membership cooperatives are governed by a board of directors and municipal electric utilities are ultimately governed by elected officials. The term 'oversight agency' is used here inclusive of these two groups.

energy consumers in Georgia do not favor a mandatory approach. The EET alternative achieves agreement among utilities, customers and other stakeholders throughout the state about the levels of energy load that can be served by energy efficiency. Due to its voluntary nature, there would be no requirement for participation and no penalty for non-participation.

As reflected in the Executive Summary, stakeholders in Georgia have agreed that the pursuit of all cost-effective energy efficiency measures should be the State's highest priority as it develops a diversified portfolio to meet future demands. Given the varied regulatory regimes of different utilities in Georgia, an EET would provide an overarching, statewide public policy target that can be met by different utilities in their own ways.

In order to focus this energy efficiency effort, the Governor should consider, after a thorough cost-benefit analysis and jointly with the General Assembly, an energy efficiency goal to significantly reduce the forecast load growth over the next 10 years. For purposes of scope only, other states have set goals from 20 to 30 percent. Once established, Georgia utilities would report annually on their progress toward meeting this goal.

Georgia already has one comprehensive analysis of cost-effective energy efficiency potential available in the state. This study, while not reflecting consensus about the level of cost-effective energy efficiency, could serve as a starting point for the decision-making process.

At least seven states around the country have established energy efficiency portfolio standards or incorporated energy efficiency into their renewable energy portfolio standards (American Council for an Energy-Efficient Economy, 2005). These efforts might provide useful guidance to Georgia in establishing an appropriate level for its EET.

Strategy 3.15 – Consider Alternative Utility Regulation Strategies That Allow Utilities to Recover Investments in Energy Efficiency

Alternative utility regulation reduces or eliminates penalties and thereby encourages utilities to pursue all resources that might satisfy the energy demand, including energy efficiency. Alternative utility regulation can provide Georgia with significant new energy efficiency resources, creating a new and stable market for energy efficiency services that will generate jobs and businesses while ensuring a financially viable utility and providing value to shareholders. Utilities can better use energy efficiency as an enhanced customer service tool to help customers manage their energy use and lower their bills.

The Georgia Public Service Commission's (PSC) current electricity ratemaking protocol ties utility revenues directly to energy sales, creating a disincentive (lost revenue) for the electric utility to implement demand-side management programs. The protocol also permits the electric utility to earn a return on investments in infrastructure (such as power plants, transmission lines and pollution control measures), some of which could be deferred or displaced by more aggressive DSM. These structural incentives for increased energy sales and capital investment put DSM at a relative disadvantage compared to investments in infrastructure, such as generation, electricity transmission, and pollution control equipment.

The EPA recently released the *National Action Plan for Energy Efficiency*. The report was produced with participation by more than 50 leading energy stakeholders, including Southern Company, the parent company of Georgia's largest investor-owned utility, Georgia Power. This Leadership Group provided five recommendations "to overcome many of the barriers that have limited greater investment in programs to deliver energy efficiency to customers of electric and gas utilities" (U.S. EPA, *National Action Plan*, 2006), including considering alternative utility ratemaking and revenue requirements.

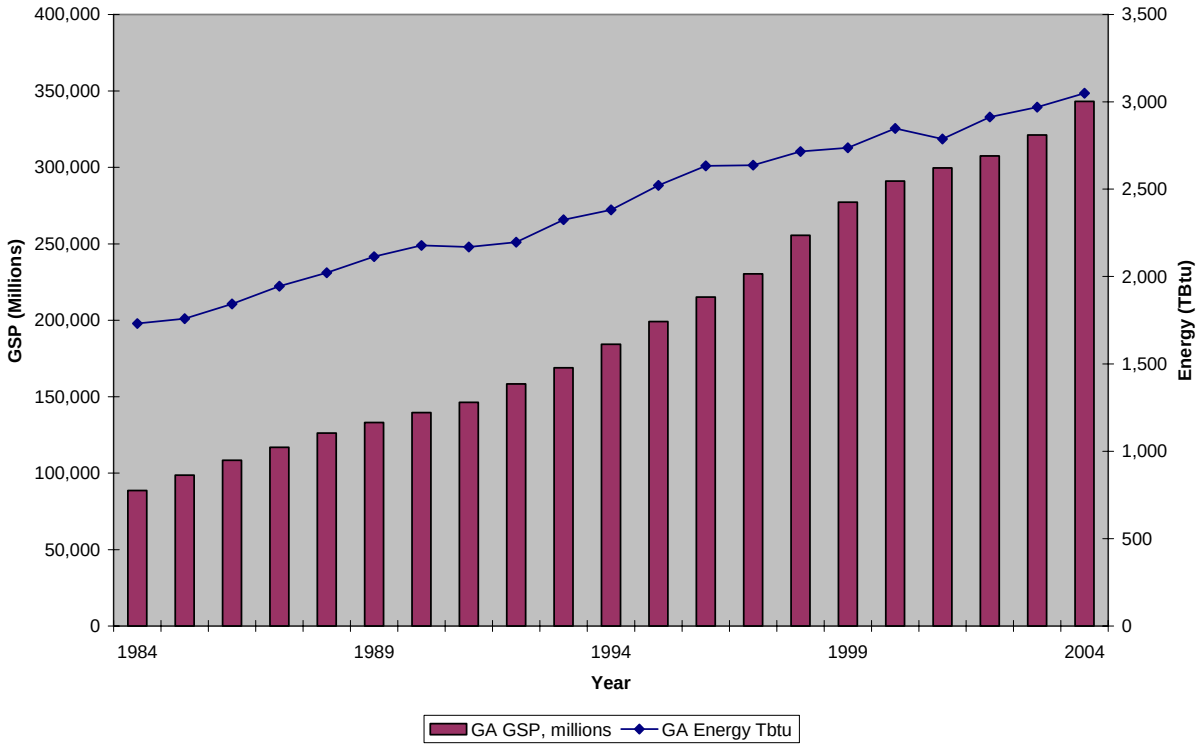
The Georgia PSC should review current earnings mechanisms and determine whether additional measures need to be taken to appropriately allow utilities to earn on energy efficiency options. This review should take place during the existing supply and ratemaking proceedings. While natural gas revenues are already decoupled from sales, the Georgia PSC should ensure that the electricity and natural gas utilities are given equal consideration with respect to any new earnings mechanisms or measures that promote energy efficiency.

CHAPTER 4: ECONOMIC DEVELOPMENT

Over the last two decades, Georgia has prospered from exceptional population and economic growth. From 1984 to 2004, the state's population grew from 5.8 million to 8.8 million people, and the gross state product (GSP) nearly quadrupled from $88.6 billion to $343.1 billion, as shown in Figure 6. Population forecasts suggest that Georgia will grow to over 12 million residents by 2030 (U.S. Census Bureau, 2005). Not surprisingly, Georgia's overall energy consumption mirrors this demographic and economic growth. The state's total energy consumption grew 76% between 1984 and 2004, from 1,731 Trillion British Thermal Units (TBtu) in 1984 to 3,050 TBtu in 2004. In 2001, the most recent year for which state-level energy data are available, Georgia ranked ninth in total population and 10th in total energy consumption (GEFA, 2006).

Figure 6

Georgia GSP and Energy Consumption



Improvements in energy efficiency and a shift of Georgia's economy away from heavy industry during this time allowed economic growth to outpace the growth in energy consumption by more than 5-to-1. Nonetheless, as these data clearly illustrate, Georgia's consumption of energy and economic growth are still closely related. While a rapidly growing economy provides employment opportunities and enhances quality of life, the growth in energy demand that accompanies economic expansion can also have undesirable economic and environmental

consequences. In Georgia's case, most of the rising energy demand over the past 20 years was met by increasing the consumption of fossil fuels. Georgia currently has no in-state sources of fossil fuels and must therefore import its energy from other states and countries. In 2001, the most recent year for which data are available, Georgia residents and businesses spent over $19 billion on primary energy fuels, nearly all of which left the state (EIA, *Table S1b*, 2005). In addition, the combustion of fossil fuels in Georgia creates environmental costs, including adverse impacts on air and water quality that in turn can affect citizens' health and well-being.

Encouraging the development of Georgia's native energy resources can mitigate the negative effects of fossil fuel importation and combustion, while enhancing Georgia's economic expansion. This can be done by supporting the development and commercialization of new energy technologies and processes that use in-state renewable fuel sources or otherwise reduce the need for fossil fuels through efficiency. The State can also encourage non-energy businesses to purchase renewable fuels and reduce energy consumption by adapting Georgia's current industrial recruitment and training efforts.

This chapter addresses energy-related economic development, including how the State can encourage the development of clean energy technologies, attract new and innovative businesses to Georgia, and support the continued growth of Georgia's economy by ensuring affordable and reliable energy supplies.

Chapter 4 is organized around four *policy objectives*, which are programs or policies intended to move Georgia toward affordable, reliable and environmentally responsible energy. Each policy objective is followed by associated *implementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Section 1: Research and Development

State-specific energy-related research and development (R&D) can contribute greatly to the effective deployment of technologies that are tailored to Georgia's specific needs and challenges while benefiting local businesses that commercialize these innovations. State-specific R&D can also capitalize more effectively on resources found in Georgia and reduce reliance on imported resources.

Energy-related research and development activities find a welcome environment in Georgia. The state has many R&D assets, including a strong and diverse research capacity within the University System of Georgia and private universities; access to a variety of federal agency central or regional offices; 15 Fortune 500 companies including Southern Company, one of the nation's largest electric utilities, and UPS, a leader in the transportation field; accessibility through a variety of transportation modes; and a favorable climate and geography.

These strengths provide a variety of opportunities for Georgia's businesses by creating products, systems and services that can be delivered to the market. Yet businesses have faced obstacles in identifying and pursuing these potentially profitable opportunities. In 2004 the Commission for a New Georgia (CNG) released a report assessing the business climate for its most valued industries, which included the energy and environmental sectors (Commission for a New Georgia [CNG], *Strategic Industries*, 2004). As CNG explained, Georgia can benefit from more access to research and development resources, particularly those at universities. CNG noted that Georgia does not offer a university-affiliated research and development park, an asset found in all neighboring states.

Policy Objective
Support Development of a Comprehensive Energy Research Agenda and Program

Georgia has sizeable research capacity and assets, significant and distinct industry bases and a growing population. A coordinated energy-related research agenda and program can integrate the strengths of these areas and increase the return on investment as well as the benefit to Georgia's residents, businesses, environment and economy.

Georgia has significant R&D opportunities in areas such as biomass for transportation fuels, electricity and chemicals production, but further coordination is needed with the agricultural and forestry sectors, which could develop new crops or forestry products as feedstock for these systems. A coordinated R&D program could examine the entire product value chain in key energy-related areas, identify opportunities and needs, and disseminate this information to key partners in the research, academic, industry and government arenas. These stakeholders could coordinate their work to accelerate the development of products, services and systems that achieve the goals described in the *State Energy Strategy*.

Implementation Strategies

Strategy 4.1 – Support Public-Private Partnerships to Coordinate Research and Development Efforts of Universities and Industries

Various public-private research partnerships and other working groups in Georgia are focused on developing clean energy. The State should investigate ways to strengthen these processes, such as helping to coordinate and prioritize promising fields of study, evaluate the costs and benefits of additional State incentives for research, and develop a university-affiliated research park.

Public-private partnerships can develop and implement research and development agendas for energy-related issues, such as efficiency, supply, renewable, transportation and other areas that leverage Georgia's competitive strengths. This strategy echoes the CNG recommendations, which identified the need for Georgia to develop university-affiliated research parks to support and attract new and growing industries (CNG, *Strategic Industries*, 2004).

A coordinated approach will strengthen efforts to secure funding for research, reduce duplicative work and accelerate Georgia's ability to apply research findings to products and practices with commercial energy applications. According to the CNG, supporting R&D within the state can accelerate innovations by Georgia-based businesses and industries and enhance their competitiveness.

State agencies associated with energy use, including the Georgia Environmental Facilities Authority (GEFA), the Department of Transportation, the Department of Agriculture and Georgia's research universities, should work with industry and nonprofit organizations to identify and prioritize the most promising or valuable R&D opportunities. The U.S. Department of Energy's Industries of the Future initiative provides a template to develop and implement a unified vision for research and development. Collaborative efforts should leverage regional, private and federal research organizations, such as the Electric Power Research Institute, the U.S. Department of Energy National Laboratories and the Georgia Research Alliance.

The State could also evaluate resources that may aid public-private clean energy partnerships in Georgia, such as new incentives that draw on Georgia's natural resources and benefit local industry, other resources to develop a university-affiliated research park, and a cost-share pool created by private industry and foundations. The Georgia Research Alliance provides one model for cost-share pools, which can provide a coordinated approach to research spending and leverage federal and State resources that require matching funds.

Strategy 4.2 – Create a 'Clean Fuels Research and Development Fund' to Match Federal Grants

Funding for many of the projects and incentives described throughout the *State Energy Strategy* is already available to Georgia research institutions and businesses through federal grant programs. However, most of these grants require that at least a portion of the federal funds be "matched" by other sources. According to the U.S. Department of Energy's Alternative Fuels Data Center, there are 20 federal grant programs specifically related to the development of clean fuels and transportation vehicles (EERE, *United States (Federal) Grants*, 2006). These grants can fund between 25% and 80% of a project's total cost. The requirement for applicants to meet

the remainder of a project's costs often prohibits small businesses and others from applying for federal grants when additional matching funds cannot be raised.

The State should create a fund to provide matching dollars to leverage federal grant funds for research institutions and businesses. Funding would be contingent upon those organizations successfully applying for federal grants, and could be generated by one or more of the options described in Chapter 5 of the *State Energy Strategy*.

Section 2: Commercialization

For new and advanced technologies to improve the economy, environment and quality of life in Georgia, they must become commercially viable. Commercialization programs and policies can benefit Georgians when they effectively combine research, local economic development and environmental improvement, while strengthening Georgia's competitiveness in a national and global economy.

In 2004, the Commission for a New Georgia's Strategic Industries Task Force released a report assessing the climate for Georgia's most valued industries, including those in the energy and environmental sectors. Among the findings, CNG reported that Georgia has significant opportunities to commercialize technologies developed by its research community. In fact, CNG estimated that "over 50% of Georgia's university-based research goes out of state for commercialization" (CNG, *Strategic Industries*, 2004). Effective commercialization can stimulate R&D and benefit businesses that add value to these innovations.

Policy Objective

Establish a Comprehensive Statewide Technology Transfer Program That Incorporates Energy Technologies

Georgia is home to major research universities involved in clean energy technology research and development, and only a few hours from the U.S. Department of Energy's Oak Ridge National Laboratory in Tennessee. Georgia can simultaneously achieve energy and economic development goals by strengthening connections between research institutions and Georgia's businesses. The CNG reported that Georgia's business community does not take advantage of commercialization opportunities because prospects are difficult to identify (CNG, *Strategic Industries*, 2004). A comprehensive technology transfer program could improve consumers' and businesses' access to energy saving technologies that contribute to a more sustainable energy future for Georgia while benefiting local companies that deliver them to these markets.

Implementation Strategies

Strategy 4.3 – Support and Coordinate Energy-Related Business Development Centers
Georgia's universities have a long tradition of transforming research into practical and profitable ventures. Centers such as the Georgia Institute of Technology's Enterprise Innovation Institute and the University of Georgia's Center for Agribusiness and Economic Development provide a variety of services and expertise to help individuals and businesses develop, evaluate and market energy-related technologies. These include technical evaluation of new energy-related products and inventions, proof of concept and moving a product or service to market.

The market for increasingly efficient and clean energy technologies is growing rapidly. In response to pressures on the conventional energy system, utilities, industries and businesses are seeking cleaner, more efficient and more reliable energy systems to reduce their exposure to price volatility and improve their competitiveness. The new emphasis on domestically available

energy resources, such as renewable and non-conventional fossil fuels, requires new technologies to convert these resources into useful forms of energy, including liquid fuels and electricity. Finally, conventional manufacturing businesses can benefit from growth in these markets by promoting their products in new ways if they are aware of the opportunities.

Existing energy-related business development centers should create a customer service process that provides prospective clients with seamless assistance, and analyze their services to identify gaps or duplication in the energy technology commercialization process by the end of 2007. These centers should also propose recommendations to streamline and expand energy business development in Georgia; coordinate with the Georgia Department of Economic Development to market their services to existing businesses and attract other companies interested in commercializing new energy technologies; inventory existing and emerging licensing opportunities available to businesses in Georgia; and assess emerging energy technologies and trends in order to focus research efforts on opportunities or sectors that address energy challenges in Georgia or that use Georgia resources, such as biomass feedstocks.

The Northwest Energy Technology Collaborative (NWETC) is an example of an aggressive regional effort to develop energy-related business opportunities in the Pacific Northwest. The NWETC benefits members by finding and exploiting shared opportunities to compete in a global market. The NWETC creates synergies among businesses, nonprofits, governments and universities by identifying funding and market opportunities throughout the world, coordinating technology resources, assisting regional businesses to market themselves and promoting a regional identity.

Section 3: Industrial Recruitment

The State of Georgia currently sponsors activities and incentives to encourage businesses to locate and expand in Georgia. State agency and university-affiliated programs, such as those offered by the Georgia Department of Economic Development, the University of Georgia's Small Business Center, and Georgia Tech's Advanced Technology Development Center, provide strategic business advice and other consulting for upstart companies in Georgia. The OneGeorgia Authority uses one-third of Georgia's tobacco settlement funds to assist economic development in the state's most economically challenged areas. OneGeorgia investments, which are typically targeted towards rural communities, could total $1.6 billion over the 25-year term of the settlement (OneGeorgia Authority, n.d.). In addition to these programs, the State also offers tax credits for qualified businesses based on job creation and other factors.

To encourage the development of Georgia's native energy resources, the State can capitalize on many of these existing programs and incentives, as well as other efforts such as education and workforce development. The State should also recognize that continued economic growth in Georgia is predicated on reliable and affordable energy resources as discussed in Chapter 1 of the *State Energy Strategy*. Moreover, the State should consider establishing new programs and incentives, such as those discussed in Chapters 2 and 3 of the *State Energy Strategy*. These activities can stimulate investment, create jobs and encourage the development of renewable resources in Georgia by attracting businesses that are good stewards of Georgia's long-term economy and environment.

Policy Objective
Encourage Development of Emerging Clean Energy Industries

The development of renewable energy resources is a local endeavor, and money spent for fuel and job opportunities created by energy producers remains within the state. In addition, the production and use of renewable energy resources generally have less impact on the environment compared to fossil fuels. The Commission for a New Georgia recently identified businesses that focus on the "Energy and Environmental" field as a strategic industry, or one in which Georgia maintains a competitive advantage (CNG, *Task Force*, 2004). An effective energy strategy should leverage the abundance of homegrown renewable energy resources to develop these clean energy businesses in Georgia.

Given the prospects for the clean energy industry in the United States, promoting Georgia as a leader in this field could provide substantial benefit for the state. According to research conducted by Clean Edge, a research and publishing firm that helps companies and investors understand the clean energy industry, the four top clean energy technologies (biofuels, wind power, solar photovoltaics [PV] and fuel cells) will grow four-fold within the coming decade. Specifically, Clean Edge forecasts the following trends (Makower, Pernick, & Wilder, 2006):

- Biofuels (global manufacturing and wholesale pricing of ethanol and biodiesel) will grow from $15.7 billion in 2005 to $52.5 billion by 2015.

- Wind power (new installation capital costs) will expand from $11.8 billion in 2005 to $48.5 billion in 2015.
- Solar PV (including modules, system components and installation) will grow from an $11.2 billion industry in 2005 to $51.1 billion by 2015.
- The fuel cell and distributed hydrogen market will grow from $1.2 billion last year (primarily for research contracts and demonstration/test units) to $15.1 billion by 2015.

Implementation Strategies

Strategy 4.4 – Support Development of the Biomass Fuel Industry, With Particular Emphasis on Georgia's Agricultural and Forestry Resources

The State should pursue innovative means, including program coordination, financial incentives and market transformation, to encourage the growth of one of Georgia's most promising new energy solutions – biomass. State policies should target all portions of the biomass production chain, including feedstock, production, delivery and distribution. In addition, the State should pursue demand-side efforts to increase the adoption of biofuels, including incentives to purchase biofuels and technology that uses biofuels, and State government purchases of biofuels.

Less than 5% of Georgia's total energy consumption now comes from renewable resources such as biomass, solar and wind (GEFA, 2006). Yet Georgia's forest products industry and related industries have experienced a net loss of $7 billion and 60,000 jobs within the last five years (Riall, 2002 & Riall, 2006), and this decline has created a glut of forestry products with limited potential markets. Supporting the development of woody cellulose-to-ethanol and biodiesel industries would help rural regions of Georgia economically by stimulating demand for forest products and by-products and by encouraging ethanol producers to locate in Georgia. Similarly, a 2003 University of Georgia study identified substantial potential for electricity production from in-state forestry and agricultural biomass resources and documented significant financial benefit that would accrue to forestry and agriculture industries (Curtis, Ferland, McKissick, & Barnes, 2003).

Chapter 2 of the *State Energy Strategy* provides specific strategies to support the development of a biomass fuel industry.

Policy Objective
Incorporate Energy Issues Into Industrial Recruitment Plans

In addition to supporting development of the clean energy industry in Georgia directly, the State can tailor its industrial recruiting efforts to improve energy efficiency, increase the demand for renewable resources, and encourage growth in underserved markets. The State can target renewable energy providers with a recruitment strategy that emphasizes the availability of natural, technical and educational resources to develop Georgia's clean energy industry. Moreover, if the State successfully recruits businesses that use renewable energy or produce products that use it, Georgia will benefit from the increased demand for renewable energy that these businesses generate and a reduced demand for fossil fuels.

Implementation Strategies

Strategy 4.5 – Develop an Industrial Recruitment Strategy to Target Mature and Emerging Industries Focused on Producing Clean Energy

A company's decision to locate in Georgia is often influenced by encouragement it receives from coordinated, statewide recruitment efforts. To this end, recruitment efforts should specifically target industries that intend to develop Georgia's clean energy industry by producing and/or using the state's clean energy resources. If successful, such efforts will directly increase the production of renewable energy in Georgia and yield economic benefits.

Recruiters of new industry for Georgia should seek companies that will be good stewards of the state's resources, including energy, air, water and land. Manufacturers of energy efficiency and renewable energy products, waste recyclers, and producers of innovative or practical products that are environmentally responsible should be the subject of special recruiting attention.

GEFA, in conjunction with partners such as the Georgia Department of Economic Development, the Georgia Allies, the Georgia Industrial Technology Partnership and the Georgia Chamber of Commerce, should develop an industrial recruitment strategy to target appropriate industries and hold periodic workshops to discuss pertinent issues with business leaders. In addition, these partners should communicate to existing and potential new industries the research on emerging energy technologies conducted at Georgia's universities and the energy research performed for the State's economic development strategy.

Strategy 4.6 – Ensure That Energy Is a Consideration in the Recruitment Process of Non-Energy Related Industries

When recruiting new industries to Georgia, the State should give preference to industries that implement energy-related best practices. Additionally, energy management should be a consideration in the recruitment process of non-energy related industries when public funds are used to attract such new businesses to Georgia. For example, the State could encourage businesses receiving public funds to purchase green power or meet certain energy efficiency standards, such as ANSI/MSE 2000. Programs should focus on providing incentives for best practices without penalizing large energy consumers. These strategies are discussed in greater detail in Chapter 3 of the *State Energy Strategy*.

Georgia already offers a number of financial incentives, such as loan and grant programs, to attract new businesses and expand existing businesses in underdeveloped areas of the state. Such programs require entrepreneurs or communities to apply for funds, and often applicants compete against one another for limited financial resources. Incorporating sound energy management principles, such as demand-side management and energy efficiency, and/or a commitment to purchase renewable energy into the evaluation process will enable Georgia to attract good stewards of the state's natural resources without requiring the creation of new programs or funding sources.

The OneGeorgia Authority and the Department of Community Affairs should work with GEFA to determine the most effective way to integrate energy issues into the application evaluation process for relevant grant and loan programs.

CHAPTER 5: INCENTIVES AND PROGRAM RESOURCES

The *State Energy Strategy for Georgia* enumerates a series of policy goals designed to move Georgia toward greater energy efficiency, deeper reliance on native energy resources, enhanced energy reliability and improved environmental performance. The realization of these individual goals, and the broader vision they support, will require Georgians to employ new technologies and adopt new practices. Georgia, like most of the states in the nation, already provides financial and non-financial incentives to guide citizens toward optimal energy choices. For instance, Georgia supports a three-day sales tax holiday to increase the use of energy efficient ENERGY STAR appliances. Likewise, the State permits single-occupancy alternative fuel vehicles to drive in High Occupancy Vehicle lanes to create an incentive for the use of advanced transportation technologies. This *State Energy Strategy* development process represents an opportunity to consider a broader range of incentives to promote clean, reliable energy in Georgia.

This chapter describes tax incentives, direct financial incentives, non-financial incentives and program resources – four broad categories of resources that can support the policies described throughout the *State Energy Strategy*. The following list provides an introduction to these incentive programs, while the subsequent implementation strategies go into greater detail.

Tax Incentives – Common tax incentive strategies to promote clean energy technologies include income tax credits and deductions as well as sales tax exemptions for specific products. Income tax incentives can be "investment" tax credits, triggered by the purchase of a product or piece of equipment, or "production" tax credits, which provide tax relief based on the production of a particular good, such as a gallon of ethanol or a megawatt-hour of wind energy.

Direct Financial Incentives – Direct financial incentives include rebates, grants and loans. Such programs typically require a dedicated and sustainable source of funding, such as a public benefits fund (in the case of government programs) or the procurement budget of an electric or gas utility (in the case of utility programs).

> **Rebates –** Rebates are direct cash incentives to consumers who purchase a specific item, such as an energy efficient air conditioner. Government, public-private partnerships and businesses offer rebates to encourage the use of a particular technology.
>
> **Grants and loans –** Grants and low-interest loans from the public and private sectors provide financing support for larger projects, such as the development of a renewable energy project or the implementation of large energy efficiency projects by local governments and/or businesses. Grants are direct financial awards that do not require repayment, while low-interest loans reduce the cost of financing a project by allowing the managing organization to borrow money at a lower interest rate.

Non-Financial Incentives – Non-financial incentives represent creative ways to promote the adoption of certain advanced clean energy technologies or recognize superior energy and/or environmental performance.

> **Public recognition –** Recognizing exemplary energy performance in a public forum is a valued yet low-cost way to encourage continued achievement and motivate others to action.
>
> **Legislative and regulatory incentives –** Legislative and regulatory incentives include variances or exemptions in laws and rules to individuals that make specific optimal energy choices. As stated above, Georgia allows single-occupancy alternative fuel vehicles to drive in the High Occupancy Vehicle lanes of the interstate. This incentive does not involve a direct financial benefit but provides preferred treatment to those who invest in advanced transportation technology. Regulatory incentives can include fewer inspections or expedited permitting for organizations that achieve exemplary energy or environmental performance. These incentives may require some funding to administer, but typically cost little to implement.

Program Resources – Program resources include providing high-quality energy information to the public and targeted energy research and data collection. For instance, the federal ENERGY STAR website provides consumers with easy to understand information about energy efficient appliances, including online calculators to estimate savings and payback periods. Similarly, the Georgia Public Service Commission (PSC) publishes a monthly guide to natural gas marketer rates, providing the public with a clear "apples-to-apples" comparison of natural gas rates.

As an example of research and data collection, the Georgia Environmental Facilities Authority (GEFA) Division of Energy Resources commissioned *An Assessment of Energy Efficiency Potential in Georgia*, which examined the energy efficiency potential in Georgia and evaluated the potential of different policy options to achieve that efficiency. This research is helping to guide energy efficiency investments in the state today.

A full accounting of the costs involved in the incentives outlined in this chapter is to be determined. Such an accounting may affect the viability of the options.

Chapter 5 is organized around one *policy objective*, which is a program or policy intended to move Georgia toward affordable, reliable and environmentally responsible energy. This policy objective is followed by associated *implementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Policy Objective
Provide Resources to Achieve State Energy Strategy Goals

Funding is critical to the success of the *State Energy Strategy for Georgia*. The implementation strategies below represent a range of incentive options for Georgia to consider, each using a unique incentive mechanism and/or addressing a particular audience or particular energy sector.

In this regard, none of these strategies should be considered as the single funding strategy. The State should consider implementing several or all of the strategies listed below to reach the greatest number of Georgians.

The Governor's Energy Policy Council strongly debated funding options for advancing the policy objectives and implementation strategies recommended in the document. While Council members agreed on the importance of funding and the usefulness of creating a Clean Energy Fund to support the various elements of the Strategy, they did not reach consensus on how to generate revenue for such a fund.

Implementation Strategies

Strategy 5.1 – Create Georgia Renewable Transportation Fuels Advancement Fund

The development of a Georgia Renewable Fuels Advancement Fund could advance many of the renewable fuel policies outlined in Chapter 2 of the *State Energy Strategy*. In developing such a fund, it would be important to adhere to an approach wherein the users of motor fuels would directly contribute to the improved energy and environmental performance of the transportation sector and help alleviate some of the economic and political difficulties associated with reliance on the global oil market. Georgia's current motor fuel tax structure offers an important opportunity for developing such funding.

Georgia's taxation of on-road motor fuels consists of two separate tax components: the Motor Fuel Tax and the State Prepaid Tax. The Motor Fuel Tax is an excise tax that collects 7½ cents for each gallon of motor fuel sold in Georgia. The State Prepaid Tax, alternately, collects 4% of the pre-tax sales price of gasoline or other motor fuels. One effect of this tax structure is that revenue to the State increases as the cost of motor fuels increases (assuming demand does not drop off sharply). The Georgia General Assembly appropriates all of the revenue generated by the Motor Fuel Tax and ¾ of the revenue generated by the State Prepaid Tax to the Georgia Department of Transportation. The remaining ¼ of the State Prepaid Tax goes to the State Treasury.

An examination of the revenue generated by the State Prepaid Tax for motor gasoline and diesel fuel highlights an opportunity to fund renewable fuels programs without raising taxes. Georgia took in approximately $53 million more from the State Prepaid Tax (for gasoline and diesel) in fiscal year 2006 than it did in fiscal year 2005 (Office of Communications for Governor Sonny Perdue, 2006). Approximately $13 million of this incremental revenue went into the State general fund. Additionally, more recent fuel cost increases have pushed the State Prepaid Tax funds collected up 30%[13] (Georgia Department of Revenue, *Motor Fuel Tax Bulletin*, 2006). This increase heralds more fuel-related revenues to the Georgia general fund in the absence of any tax increases.

[13] On July 1, 2006 the Department of Revenue adjusted the State Prepaid Tax rates on gasoline and diesel to 10.2¢ per gallon, a 30% increase over the motor gasoline rate and a 13% increase over the diesel rate set at the beginning of the year. It is coincidental that the gasoline and diesel rates were calculated to be the same for this adjustment period.

The State could set aside a portion of this new motor fuel-related revenue to develop a Georgia Renewable Fuels Advancement Fund. This fund could help Georgia reap its wealth of biomass resources and stimulate the development of a robust biofuel industry. Expediting the development of Georgia's biofuel industry brings the added advantage of keeping Georgia in step with the federal Renewable Fuel Standard recently enacted as part of the Energy Policy Act of 2005. A funding program through which the State could make grants or low-interest loans to support renewable fuel research and commercialization, renewable fuel production and/or the expansion of biofuel fueling facilities would provide an important stimulus for developing a strong biofuel industry in Georgia.

Strategy 5.2 – Implement Comprehensive Clean Energy Income Tax Credit Program for Georgia

Forty-six states in the nation offer tax incentives to individuals and/or businesses that invest in clean energy fuels or technologies (DSIRE, *Financial*, 2006; U.S. DOE & U.S. EPA, *Alternative Fuel*, 2006). These programs range from narrowly targeted tax incentives, such as a personal income tax credit for alternative fuel and high-efficiency hybrid electric cars (Louisiana and Colorado), to comprehensive energy efficiency and renewable energy tax packages, which provide tax credits for energy efficient businesses, homes, cars and appliances and for investment in a broad range of renewable energy technologies, from residential solar systems to biofuel refineries (Oregon).

Clean energy tax bills entail four key elements:

- A ***definition of the eligible investments***, (for investment-style tax credits) such as the purchase of a residential solar hot water system, a biofuel or flex-fuel vehicle, a piece of biofuel refinery equipment or a biofuel retail gas pump.
- A ***credit amount*** that a residential or business taxpayer is permitted to take for investments in specific technologies.
- A ***credit limit*** on the amount of tax liability that a taxpayer is able to offset.
- The ***duration*** of the tax credit.

If incorporated into a fiscally responsible package, a comprehensive clean energy tax incentive package in Georgia could advance many of the key policy objectives supported in the *State Energy Strategy*. In its evaluation of this public policy option, the Council should ensure that such incentives encourage Georgians to make choices they might not otherwise make and should do so in a cost-effective manner.

The process of developing a comprehensive clean energy tax package in Georgia should begin with a careful review of comparative tax incentives in other states that evaluates the optimal eligible technologies, credit amount, credit cap and quality assurance mechanisms. The analysis should also consider the available federal tax incentives supported in the Energy Policy Act of 2005 and evaluate if Georgia policy would benefit by dovetailing with the federal programs.

The clean energy tax incentive programs in North Carolina and Oregon provide examples of the types of technologies that a clean energy tax credit program can support. Both of these states have provided tax credits for clean energy technologies since the late 1970s. While North

Carolina's is a single tax credit program available to residential and business taxpayers, Oregon offers separate residential and business tax credit programs.

Both states' tax incentives cover a range of similar renewable energy technologies, including:

- Solar energy equipment for domestic water and pool water heating
- Solar energy equipment for active space heating
- Solar energy equipment for electricity generation
- Wind energy equipment
- Hydroelectric equipment
- Biomass equipment for electricity generation.

Oregon's tax credit programs also address energy efficiency (in homes, buildings and transportation), providing incentives to:

- Purchase premium efficiency appliances and heating/cooling equipment (residential).
- Purchase hybrid and alternative fuel vehicles (residential & business).
- Invest in conservation projects, such as lighting improvements, heating and cooling controls, etc. (business).
- Invest in programs to reduce employee vehicles miles traveled, such as teleworking programs (including necessary equipment), and carpooling and vanpooling programs, etc. (business).
- Construct fueling stations that offer alternative fuels.

Strategy 5.3 – Create a Georgia Clean Energy Fund

Direct financial incentives such as rebates, grants and low-interest loans are powerful tools to advance energy efficiency and renewable energy development, but successful, sustained incentive-based public policy requires sustainable funding. Rebate and grant programs require sufficient ongoing funding to ensure their success; loan programs require initial start-up funds that can be recouped (and often reused) over time; and information and research programs require personnel and administrative support to achieve their aims.

The Georgia Clean Energy Fund could be funded through various approaches, including but not limited to state taxes, reallocation of existing funds, a public benefits fund or other appropriate measures.

A public benefits fund typically receives funding through a system benefits charge, which is a small, per unit-of-energy (e.g., per kilowatt-hour) surcharge on the retail sale of electricity, natural gas and/or propane. In this way, public benefits funds derive funding from the users of energy fuels to provide a public good, such as improved environmental performance of the energy sector.

Funding levels and the appropriate funding mechanisms for these initiatives should be determined by the Governor and the Georgia General Assembly once final decisions are made on which initiatives should be implemented.

In the implementation of this funding option, the State should ensure that such incentives encourage Georgians to make choices they might not otherwise make and should do so in a cost-

effective manner. Such a fund could be used to advance many of the key policies outlined in the *State Energy Strategy*. Specific programming goals and ideas to consider include:

Developing Native Energy Supplies

- A revolving loan fund that owners of single- or multi-family dwellings could access for new renewable energy systems.
- A green energy sales rebate for electrical utilities that allows them to lower the incremental cost of Georgia green energy.
- Grants or low-interest loans for renewable energy producers.
- Matching funds for Special Purpose Local Option Sales Tax monies that are used for renewable energy projects.
- Grants or low-interest loans for industrial energy consumers, such as manufacturing firms, that install a biomass boiler and related equipment.

Managing Energy Demand

- Rebates for energy efficient products, including ENERGY STAR appliances and geothermal heat pump systems.
- Low-interest loans to cover incremental costs of building energy efficient buildings meeting third party performance standards.

Integrating Energy Into Economic Development

- Awards, recognition and other incentives (including cash prizes) for industries that reduce their energy use and emphasize sustainable practices.
- Grants for energy-related research and development.

Ensuring Energy Affordability

- Additional funding for the Low Income Home Energy Assistance Program.
- Expansion of the low-income Weatherization Assistance Program across the state.

Strategy 5.4 – Establish an Energy Improvement Revolving Loan Fund for Public Facilities
An energy improvement revolving loan fund is a mechanism to finance energy improvements for State agencies, local governments and school districts that may not otherwise be able to secure low-cost financing for projects that reduce energy consumption. Loans can be extended for capital-based energy improvements that are cost effective when considered on a lifecycle basis. They can be designed to achieve specific savings that pay the project costs, eliminating the need to raise taxes or user fees to repay the loan. After the loan is repaid (usually within ten years), the savings will continue to accrue directly to the public entity.

Many public entities lack the capital funds to make cost-effective energy improvements. A State-supported revolving loan fund can increase the number of energy improvement projects and ensure that projects are cost effective and beneficial. Public entities will enjoy the savings due directly to the energy saving project, lower exposure to rate and fuel price fluctuations, and reduced emissions from energy production.

The State should fund a six-year pilot energy savings revolving loan fund targeted to a specific user base (i.e., State agencies, school districts, local governments). The State should appoint a

selection committee with representatives from relevant State agencies and stakeholders to develop criteria for the characteristics and performance of eligible energy savings projects. The Georgia Environmental Facilities Authority (GEFA) is a potential administrator of the fund, based on its expertise in finance and energy, and its experience administering loans for water and wastewater improvements. Implementation of the fund will require careful consideration of State agency borrowing limitations.

The State could appropriate the initial funding for a pilot revolving loan fund for the FY2008 budget, and appoint a selection committee to develop eligibility criteria.

At least five states that offer revolving loan funds for energy improvements, including North Carolina and Tennessee, include local governments as applicants. Other states have funds that support renewable energy and other energy-related purposes. Funding sources range from systems benefit charges to general obligation bonds. Terms and conditions vary, depending on the percentage of the project that is financed with the loan, the minimum and maximum loan amounts, the loan period and other factors.

Strategy 5.5 – Develop Program Resources Necessary to Support the Goals of the State Energy Strategy

Program resources indirectly support the strategies described in this document through education, information and training programs. Programs are often necessary to educate the public or particular sectors about the availability and benefits of a specific energy-related technology or practice, even if it is already cost effective to employ. Information and data collection programs that monitor the status and health of the energy infrastructure and potential vulnerabilities help ensure that Georgians continue to enjoy a reliable energy system. Training is often needed to support education efforts, particularly to help industries adopt new technologies or practices. Costs include administration of the programs and operating supplies. Like incentives, program resources should focus on measurable results and be consistently evaluated for their effectiveness.

Strong energy programs in Georgia would support many of the key policies outlined in the *State Energy Strategy*. Specific programming goals and ideas to consider include:

Developing Native Energy Supplies

- A renewable energy potential study that details the most promising areas for expanded renewable fuels development in Georgia.
- One-stop State resource center for biofuels to provide technical assistance for biofuel production or retail sales operations.
- Solar energy technical assistance center to assist residential and commercial customers considering the installation of a solar system.

Managing Energy Demand

- Transportation technology evaluation programs that provide information on the benefits of commercially available advanced and efficient transportation technologies.

- Technical assistance and training on sustainable and efficient building practices for public and private construction.
- Technical assistance and training on sustainable and efficient practices for industry and agriculture.
- Creation of a State Energy Efficient/Environmentally Preferable Purchasing Group.

Developing and Commercializing Advanced Energy Technologies

- Creation of a university-affiliated research park.
- Location of an advanced energy commercialization center.
- Delivery of energy education programs, including energy education publications, information resources and training programs through relevant State agencies, universities and nonprofit organizations.

CHAPTER 6: ENERGY AND THE ENVIRONMENT

Energy production and consumption often have adverse environmental effects on air, water and land. Energy consumed for power generation and transportation, for instance, has a direct impact on Georgia's air quality, creating emissions of fine particulate matter (PM), oxides of nitrogen (NO_x), volatile organic compounds (VOCs), sulfur dioxide (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), mercury and other metals, as well as benzene, formaldehyde and other toxic compounds. Emissions of NO_x and VOCs lead to the formation of ozone (smog), and SO_2 and NO_x create additional fine particulate matter. Mercury emissions move into rivers and streams when it rains, and ultimately accumulate in fish living there. These air pollutants have important human and environmental health implications for Georgia and its citizens.

Energy use also contributes significantly to water supply challenges in Georgia, where population and economic growth are stressing a finite fresh water supply. Steam generation and cooling processes in power plants take billions of gallons of water each year from Georgia's surface waters and groundwater. While most of this water is returned, a significant portion is lost to evaporation.

Land availability is becoming a greater challenge as the growing demand for power requires new generation facilities. These operations require large land blocks as well as access to rail, barge or pipeline for fuel delivery. Power generation facilities also need to be near transmission lines, and these facilities in turn require significant amounts of land.

The State of Georgia has many options to address these energy and environmental issues, but each choice has trade-offs. For example, heavy reliance on coal to generate energy will have significant impact on air quality, while natural gas-fired generation will require expanded natural gas infrastructure and drive up electricity prices. Finite water supplies will set limits on the future siting of these facilities.

Economic development, reliable and affordable energy, and a healthy environment have been essential to Georgia's tremendous growth and prosperity. Georgia's need to transport people and freight as well as its electrical energy consumption and peak demand are projected to continue brisk growth for the next decade. This increased demand will require new power plants and the delivery and use of more motor vehicle fuels. Yet growth and prosperity have already brought Georgia significant air quality and water supply challenges. Georgia's ability to chart a positive environmental future is intricately linked with the development of a comprehensive energy strategy that not only meets current and future energy demand, but also improves energy efficiency, diversifies fuel sources and minimizes environmental effects.

This chapter addresses the environmental impact of energy production and consumption, and opportunities to reduce these effects on air quality, water quality and supply, land use and waste management, and climate.

Chapter 6 is organized around six *policy objectives*, which are programs or policies intended to move Georgia toward affordable, reliable and environmentally responsible energy. Each policy objective is followed by associated i*mplementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Section 1: Air Quality

Energy use, whether for electricity or for transportation, is a principal factor in Georgia's air quality challenges. Energy consumption in 2002, the most recent year for which complete air quality data are available, produced statewide emissions of more than 510,000 tons of SO_2, nearly 475,000 tons of NO_x (69% of the state total) and 1.4 tons of air-borne mercury (75% of stationary source emissions statewide) (GEFA, 2006). Each year these emissions form ground-level ozone, fine particulate matter and haze across the state, and add mercury to rivers, lakes and streams.

As a result, 24 full or partial counties are now designated as non-attainment for the federal eight-hour ozone air quality standard and 27 full or partial counties are designated as non-attainment for the federal fine particulate matter standard (GEFA, 2006). The Georgia Environmental Protection Division (EPD) has issued mercury-based fish consumption advisories for all 14 of Georgia's river basins, and two Class I natural areas – the Cohutta Wilderness and Okefenokee Swamp – suffer from reduced visibility because of regional haze.

Stricter federal clean air standards have forced states and utilities to examine their dependence on fossil fuels. Current and projected population growth and industry expansion in Georgia suggest that the state may face future environmental challenges in providing the required energy. Alternative approaches such as clean energy, energy efficiency and conservation could play a role in balancing energy and environmental concerns for air quality.

Policy Objective
Incorporate Energy Strategies Into Air Quality Plans

While air quality planning in Georgia has historically addressed specific control measures such as the installation of pollution control equipment at power plants and vehicle emissions inspections, the State has not incorporated broad energy strategies such as energy efficiency, renewable energy and transportation demand management programs. As air quality attainment becomes increasingly difficult, the State should closely evaluate all energy programs for their potential air quality benefits.

Implementation Strategies

Strategy 6.1 – Identify and Consider Energy Efficiency and Renewable Energy, and Continue to Include Transportation Demand Management Programs in the State Implementation Plan

Energy efficiency, renewable energy and transportation demand management programs result in small incremental reductions in emissions. However, the administrative burden to quantify, verify and enforce these programs has been a disincentive for states to invest resources for such minor reductions. Nevertheless, as states continue to develop plans to address their air quality challenges, many are finding that large reductions are not readily available and that these programs are an important part of effective strategies. To assist and encourage states to consider these programs, the U.S. Environmental Protection Agency (EPA) offers several guidance

documents that allow states to incorporate emission reductions from these programs into the State Implementation Plan (SIP)[14].

Historically, mobile source control strategies have focused primarily on reducing emissions per mile through vehicle and fuel technology improvements. However, transportation emissions continue to be a significant cause of air pollution due to significant increases in vehicle miles traveled (VMT). Additional approaches are needed to reduce mobile source air pollution, due to the increasing cost of technological improvements that produce incrementally smaller reductions in grams per mile or grams per kilowatt hour emissions, and the time it takes for technological improvements to penetrate existing fleets.

With the adoption of new national ambient air quality standards (NAAQS) for ozone and particulate matter, EPA recognized that many areas around the country had implemented most of the traditional emission control strategies and wanted to try new types of pollutant reduction strategies to meet the NAAQS. Nationally, EPA was focused on reducing dependence on foreign sources of fuel, increasing the reliability of the electricity grid, enhancing energy security and helping states address the new air quality challenges. The agency began to support and promote tests of promising new pollution reduction strategies, such as energy efficiency and renewable energy measures, within the air quality planning process.

While this was an important first step, EPA realized that the quantification of emission reductions for SIP purposes from energy efficiency or renewable energy measures presents some unique challenges. Since electricity from numerous generators is fed into an electrical grid that serves many consumers at various locations, there typically is no direct connection between a specific facility generating electricity and the end user of that electricity. Also, the air quality benefit of a very small energy efficiency or renewable energy measure may be indeterminable or insignificant, and therefore may not be worth pursuing for a single user.

However, the combined effect of multiple small measures may provide a substantial air quality benefit. Therefore, in an effort to encourage states to voluntarily incorporate innovative programs, EPA has issued guidance documents[15] that help states quantify the cumulative effect these programs could achieve and count them toward the emission reduction goals in their SIPs.

As the Georgia EPD develops the next round of SIPs, it should encourage and support transportation demand management, energy efficiency and renewable energy programs by including these programs in the SIP, and should work with EPA to ensure that it grants emission reduction credit to the fullest extent possible. Any concerns about compatibility with already established programs, such as those of the Georgia Public Service Commission, can be addressed during the development of the SIP, which is an open public process.

[14] A State Implementation Plan is an enforceable plan developed at the state level that explains how a state will comply with air quality standards according to the federal Clean Air Act.

[15] Guidance documents include: *Guidance on Incorporating Voluntary Mobile Source Emission Reduction Programs in State Implementation Plans* (10/24/97); *Guidance on State Implementation Plan Credits for Emission Reductions from Electric-Sector Energy Efficiency or Renewable Energy Measures* (August 2004); *Incorporating Emerging And Voluntary Measures In A State Implementation Plan* (September 2004); *Incorporating Bundled Measures In A State Implementation Plan* (August 2005).

Policy Objective
Develop Innovative Approaches to Deliver Air Quality Improvements

As environmental issues grow more complex and natural resources become less abundant, many states and the EPA are looking for creative ways to meet these challenges, including both regulatory and non-regulatory tools. Georgia is one of 12 participants in the EPA's Clean Energy Environment State Partnership (CEESP) that has emerged from the recognition that clean energy and energy efficiency have a positive effect on environmental quality. The CEESP promotes programs and policies that increase the use of clean energy resources and energy efficiency and that better integrate these efforts with environmental planning and regulation.

Implementation Strategies

Strategy 6.2 – Consider Supplemental Environmental Projects to Support Energy Efficiency and Renewable Energy Measures

A Supplemental Environmental Project (SEP) is an environmentally beneficial project implemented through an environmental enforcement settlement. Under a settlement, a violator voluntarily agrees to undertake a SEP as a way to offset a portion of its monetary penalty. SEPs are commonly implemented through both federal and state enforcement actions. State SEPs can be a significant source of funding for new clean energy projects. There are many opportunities for states to implement clean energy SEPs through large and small enforcement settlements. Depending on state and local needs, SEPs can involve the violator's facilities or can be a project that provides other local benefits. For example, in response to a violation of air quality standards, a Colorado manufacturer agreed to fund an energy efficiency assessment at its facility and implement some of the assessment recommendations. In Maryland, in response to a violation of visible emissions standards, a utility installed photovoltaic systems on three public buildings in the county (U.S. EPA, *Clean Energy-Environment*, 2006).

SEP policies and practices differ between the federal government and the states and from state to state. For settlements involving violations of federal laws or regulations in which EPA is a party, the SEP must follow policy and guidance established by EPA. For violations of state or local laws or regulations, the applicable state policy should be followed. State and local SEP policies generally contain concepts consistent with the federal SEP guidance, but they vary and are not required to match EPA's SEP policy. Some state policies are more flexible than EPA policy, while some are more restrictive (U.S. EPA, *A Toolkit*, 2005).

Because SEPs are negotiated on a case-by-case basis, legal and technical issues can be addressed during the negotiation process. To streamline that process, EPD should develop guidance and a database of acceptable projects with an emphasis on clean energy and energy efficiency projects for use in appropriate environmental enforcement settlements.

Strategy 6.3 – Evaluate Output-Based Environmental Regulations for Cost-Effective Opportunities to Promote More Efficient Energy Generation

Output-based environmental regulations (OBR) establish emissions limits per unit of productive energy output of a process (such as electricity, thermal energy or shaft power) as opposed to

traditional input-based limits. OBRs encourage fuel conversion efficiency and renewable energy as air pollution control measures.

Most environmental regulations for power generators and boilers have historically established emission limits based on heat input or exhaust concentration, measuring emissions in pounds per million British thermal units (lb/MMBtu) of heat input or in parts per million (ppm) of pollutant in the exhaust stream. These traditional input-based limits do not account for the pollution prevention benefits of process efficiency in ways that encourage the application of more efficient generation approaches. For example, a facility that improves the fuel conversion efficiency can achieve the same level of output while burning less fuel and emitting less pollution. But with an input-based emission limit, the reduced emissions from improved energy efficiency are not counted toward compliance. By not accounting for these emission reductions, input-based emission limits can be a barrier to adopting energy efficiency improvements in some cases (U.S. EPA, *Clean Energy-Environment*, 2006). Particular care must be taken when evaluating a shift to OBR for existing sources that currently apply input-based limits. This is particularly true for large utility sources since the nature of their design and operation is to maximize efficiency based on economic incentives.

Output-based emission limits are particularly important in promoting the significant energy and environmental benefits of combined heat and power (CHP). CHP units produce both electrical and thermal output. Output-based limits can be designed to explicitly account for both types of output in the compliance computation. Traditional input-based limits, on the other hand, can present a barrier to selecting CHP technologies because they do not account for the emission reductions achieved through increased generation efficiency. This application is explored more fully in Section 4 of Chapter 1 of the *State Energy Strategy*.

U.S. EPA is continuing to evaluate output-based vs. input-based standards for larger sources of generation. EPD should continue to monitor these activities. EPD should also evaluate any future guidance from EPA to ensure appropriate standards are applied for all sources of generation in Georgia, and should evaluate opportunities for applying OBR to increase cost-effective energy efficient generation.

Section 2: Water Quality and Water Supply

Energy production can affect water quality throughout Georgia, which in turn affects environmental and human health. The three impacts of greatest concern are mercury deposition, thermal pollution, and eutrophication and acidification of water bodies through deposition.

Mercury emissions can deposit into rivers and streams when it rains, and ultimately accumulate in fish living there. Exposure to mercury, a toxic element, can impair the developing nervous systems of unborn or young children and lead to developmental disabilities depending on the level of exposure (U.S. EPA, *Mercury: Health Effects*, 2006). Mercury accounts for approximately 80% of all State advisories on reduced fish consumption, and most of the mercury originates from power plants, according to *Georgia's Environment*, a report from Georgia's EPD (2003). All of the officially listed impaired waters for mercury have undergone an analysis that determined a federally required Total Maximum Daily Load (TMDL), which reflects the amount of mercury loading that must be reduced to achieve water quality standards. The TMDLs for mercury indicate that coal-fired electric generating facilities need to make substantial reductions. EPA has also recognized that mercury emissions are transported long distances, and has issued the Clean Air Mercury Rule to reduce emissions from coal-fired utilities and help states meet their water quality goals. States must submit a rule to implement the federal reductions by fall 2006.

Conventional power plants can create significant thermal pollution when discharging excess waste heat. Georgia Department of Natural Resource's *Rules and Regulations for Water Quality Control* (2004) provides use classifications and quality standards for all surface waters in Georgia. Specific standards for water temperature limit the absolute temperature of a water body and the increase above intake or natural temperature for the receiving water.

Only one area of Georgia – a nine-mile section of the Chattahoochee – is in violation of the temperature standard, primarily from waste heat of two power plants. EPD has established a TMDL for this body of water and is working with the plants to lower the heat discharge.

The energy sector may also affect the levels of acid and excess nutrients in Georgia's waters. In the preamble to the Clean Air Interstate Rule in the *Federal Register* (2005), EPA stated that activities to reduce SO_2 and NO_x emissions from coal-fired utilities will result in environmental benefits, such as reducing the eutrophication that stimulates excessive plant growth and reducing acidification of lakes, streams and forests.

The use of energy contributes significantly to water supply challenges in Georgia, where population and economic growth are stressing a finite fresh water supply. Steam generation and cooling processes in power plants take billions of gallons of water each year from Georgia's surface waters and groundwater. While most of this water is returned, a significant portion is lost to evaporation. Water resources are very limited in most of the state for any type of intensive water-consuming project. The pressures of a growing population and industries will tighten water supplies in more regions of Georgia, making even less water available for energy production.

In addition, the production of hydroelectricity requires significant water volume to meet seasonal and peak demands of late spring, summer and early fall. Most of this water is released from large federal reservoirs, and once released is not available for other uses. As the population and the demand for other uses grow, competition will create challenges to hydropower generation.

Policy Objective
Reduce the Impact of Atmospheric Deposition Resulting From Energy Production on Water Quality

According to the U.S. EPA's report, *Frequently Asked Questions About Atmospheric Deposition: A Handbook for Watershed Managers* (2001), atmospheric deposition is now recognized in many areas as a significant cause of water quality problems, acidification of streams and lakes, and toxic contamination of fish and the birds and mammals that eat them. Yet it is a difficult challenge to manage. Because atmospheric deposition involves pollutants traveling from land through air to water, it does not fit neatly into government agency classifications that typically separate air and water legislation and programs. Also, the sources of air pollution may be near the water body or distant, such as in another state or perhaps even another country.

Atmospheric deposition comes from emissions of air pollutants from natural and human-made (anthropogenic) sources. Some pollutants in the atmosphere occur naturally, including nitrogen, sulfur, mercury, lead, cadmium, copper and zinc. These pollutants also have significant anthropogenic sources, which can rival or exceed emissions from natural sources.

Nitrogen is the product of burning fossil fuels (e.g., in power plants, industries and vehicles) and agricultural activities (including fertilizer application, animal feedlots and waste lagoons). The primary anthropogenic sources of mercury emissions are waste incinerators and combustion of material containing mercury, such as coal-burning utilities and boilers. Emissions also come from industrial processes, such as chloralkali plants and gold-mining operations.

Implementation Strategies

Strategy 6.4 – Implement Air Quality Regulations to Reduce Atmospheric Deposition and Help Meet Water Quality Goals of the TMDLs

The Clean Water Act requires Georgia's EPD to develop TMDLs for water bodies that do not meet federal water quality standards. Once a TMDL is established, the State allocates the allowable load to point sources and to non-point sources. Under the Clean Water Act, point sources are defined as those sources regulated under the National Pollutant Discharge Elimination System permitting program. Non-point sources are all other sources that contribute to the impairment. Therefore, while electric generating utilities emit significant amounts of pollutants into the atmosphere, which then deposit into water sheds and water bodies, they are not considered point sources under the Clean Water Act. Consequently, the TMDL program does not currently have a direct regulatory mechanism to address them.

However, in developing the Clean Air Mercury Rule (CAMR), EPD established at the outset the overarching objective of reducing air emissions of mercury deposition based in part on results of the 26 TMDLs EPD has developed to address mercury in fish tissue. Of those, nine suggest that

a significant amount, as high as 72%, of the mercury comes from coal-fired power plants in Georgia. By evaluating the conclusions reached by the TMDLs, EPD has used an open stakeholder process to develop a regulation that ensures significant reductions of mercury deposition within the state on the most aggressive schedule technically feasible.

Georgia EPD should continue to evaluate appropriate opportunities to use this regulatory process as it develops implementation plans to address Georgia water bodies that are impaired by atmospheric deposition. This methodology permits the State to more comprehensively address all the sources of pollution that affect water quality and better attribute the costs associated with improving Georgia's water quality to the appropriate emission sources. Any concerns about compatibility with already established programs can be addressed during the development of the SIP or specific TMDLs, both of which are open public processes.

Policy Objective
Minimize Water Supply and Water Quality Impacts of Energy Production in the State

Energy and water use are interrelated to a significant degree. Reducing use of one resource often reduces use of the other. Energy is used to pump, treat and heat water, and water is used to cool electricity generation equipment. The *Assessment of Energy Efficiency Potential in Georgia* (Jensen & Lounsbury, 2005) determined that cost-effective energy efficiency measures could save 159 million gallons per day by 2015 in addition to saving consumers energy and money[16]. The transportation energy system also affects water quality, as recently demonstrated by the rapid shift away from the motor fuel additive methyl tertiary butyl ether, which is a carcinogen, due to its role in contaminating drinking water supplies.

Strategies that integrate water and energy planning can manage both resources more cost effectively than if addressed alone.

Implementation Strategies

Strategy 6.5 – Incorporate Energy-Related Recommendations Developed as Part of the Statewide Water Planning Process Into the State Energy Strategy
A 2004 Georgia law gave EPD a mandate to develop a statewide water management plan with oversight from a Water Council. This plan will be written in accordance with the following policy: "Georgia manages water resources in a sustainable manner to support the state's economy, to protect public health and natural systems, and to enhance the quality of life for all citizens" (Georgia General Assembly, *O.C.G.A. 12-5-522*, 2005). The plan will address water use permitting decisions in the context of river basin and aquifer management, as well as hydropower and electricity generation.

[16] To put this number in context, the Metropolitan North Georgia Water Planning District adopted a comprehensive Water Supply and Water Conservation Management Plan that outlined water conservation measures that would save approximately 219 million gallons per day by 2030 (Metropolitan North Georgia Water Planning District, 2003).

EPD has proposed to the Water Council a policy framework for the first iteration of the comprehensive water plan,[17] which addresses management of individual sources of water supply and can be applied to both surface water and groundwater sources. The framework is designed to support the management objectives adopted by the Water Council with a particular focus on the first and second objectives: 1) minimize withdrawals of water by increasing water conservation and reuse; and 2) maximize returns to the basin of origin by managing inter-basin transfers, on-site sewage disposal systems and land application of wastewater.

Water conservation practices can be implemented by different sectors and users to decrease the amount of water that is withdrawn for off-stream use, while other practices can be implemented to increase the amount of water returned. Some examples of standard water conservation practices being considered for industries and power providers include: adopting a maintenance and repair program, conducting regular water audits, conducting reuse feasibility studies, decreasing down-time, maximizing reuse/recycled water, and updating conservation plans regularly. These practices may be supplemented by a broader suite of additional water conservation and water return practices in sub-basins where water use is nearing its consumptive use budget[18].

EPD will submit a draft plan to the Water Council by July of 2007. The Water Council is required by statute to transmit the plan to the General Assembly by January of 2008. The 2008 plan will include two major components: 1) a State policy framework addressing the four management objectives, and 2) guidance for sub-state planning. After the General Assembly acts on the plan, additional planning will commence at the sub-state level to address specific regional needs.

Since the timeline to develop the State Water Plan is longer than the *State Energy Strategy*'s timeline, it is unlikely that specific recommendations associated with the Water Plan will be developed concurrent with the *State Energy Strategy*. The Georgia Environmental Facilities Authority (GEFA) should be prepared to provide expert advice on the impact of the energy sector on consumptive use in the state as the plan is developed. When specific recommendations are adopted, they should be incorporated into future *State Energy Strategy* revisions.

Strategy 6.6 – Evaluate the Results of Planned Studies on How the Increase in Energy Supply and Demand Will Affect Water Quality and Quantity

Energy production requires a reliable, abundant and predictable source of fresh water, a resource that is already in short supply in Georgia and throughout much of the United States. In fact, the electricity industry is the largest user of water in the state (Hutson, et al., 2004). According to Sandia National Laboratory, coal generation requires 25 gallons of water for each kilowatt-hour of generation (Sandia National Laboratories, 2005). This is an important consideration for Georgia, which relies on coal-fired generation to produce more than 60% of the state's electricity (GEFA, 2006). Sandia's examination of this issue concludes that consumers may indirectly consume as much water turning on the lights and running appliances as they directly use taking showers and watering lawns. (Sandia National Laboratories, 2005).

[17] The Water Council has not formally acted on the proposed framework.

[18] Consumptive use budgets are defined as the water available from that source in a dry year, beyond the quantity needed to meet in-stream or in-aquifer needs and the needs of downstream users.

Organizations like the U.S. Geological Survey and the U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) have tracked the amount of water used to generate energy, and estimated the amount of water that will be needed for energy generation in the future on a national basis. Looking at various regions, there are significant differences in projected electricity growth and freshwater demand and availability. As such, future analyses are planned that will focus on these regional differences. The Southern States Energy Board, in conjunction with NETL, is conducting a regional review of the status of water supply in the Southeast, and some information for Georgia should be available through that review. This study may include the geographic scope and time scale of the cumulative impact of current and projected energy supplies on water quality and water quantity parameters.

Section 979 of the Energy Policy Act of 2005 also speaks to the importance of water and energy issues and instructs the Secretary of DOE to address issues related to adequate water supplies, including the planning, analysis and modeling of energy and water supply and demand. Sandia National Laboratories has been charged with leading a national Energy-Water Roadmap Program to help identify major regional and national issues and needs that must be addressed to support a long-term sustainable supply of water for electric power generation and energy production in the United States. A report will be completed in the near future identifying the data and technology needs for future research and development activities at DOE. The project will also develop tools (primarily computer models) that predict the impact of energy on water quantity and quality, forecast regional energy and water supply and demand, and identify trouble spots by analyzing "what if" scenarios (Sandia National Laboratories, 2005).

The State's energy and water planners should pay close attention to the results of these studies and the development of additional data and tools, and should incorporate them into future planning efforts.

Section 3: Land Use and Waste Management

Land availability is becoming a greater challenge as the growing demand for power requires new generation facilities. These operations require large tracts of land as well as access to rail, barge or pipeline for fuel delivery. Power generation facilities also need access to transmission lines, waste storage and disposal facilities, which require land.

As described in *Georgia Energy Review 2005* (GEFA, 2006), the transportation sector was the largest energy consuming sector in 2004, barely edging out the industrial sector and accounting for 29% of Georgia's total energy consumption. Georgia's demand for transportation of people and freight is projected to grow at a brisk pace for the next decade at least. This increased demand will require construction of new transportation infrastructure and acquisition of additional land.

Policy Objective
Increase the Role of the State in Managing Natural Resources

Economic development, reliable and affordable energy, a multi-modal transportation system and a healthy environment have been essential parts of Georgia's tremendous growth and prosperity. The demand for transportation to move people and freight as well as electrical energy consumption and peak demand are projected to grow quickly over the next decade. This increased demand will require construction of new power plants and the delivery and use of more motor vehicle fuels. Yet growth and prosperity have already brought significant environmental challenges to Georgia.

Implementation Strategies

Strategy 6.7 – Incorporate Energy-Related Considerations Into the Development of Comprehensive Solid Waste Management Plans and Regional and Local Land Use Plans
In 1990, the Georgia General Assembly passed the Georgia Comprehensive Solid Waste Management Act (O.C.G.A. 12-8-20) that requires solid waste management planning at the State and local levels. Four State agencies are directly involved with Georgia's solid waste management programs and activities:

- Georgia's Environmental Protection Division is responsible for permitting and enforcement of solid waste handling facilities as well as administering the solid waste trust fund.
- Georgia Department of Community Affairs (DCA) is the lead agency for municipal solid waste recycling, waste reduction and public education efforts.
- Pollution Prevention Assistance Division of the Georgia Department of Natural Resources is responsible for developing programs to encourage commercial, industrial and institutional solid waste generators to implement waste reduction measures.
- GEFA acts as a conduit through which the State provides financial assistance to local governments for solid waste management efforts.

These agencies signed a formal memorandum of understanding (MOU) in 1997 to further define their roles and responsibilities and formed a MOU team, which recently updated the Solid Waste Management Plan for the State of Georgia that was adopted by the DCA board in 2006.

In that plan, the MOU team identified several needs that have the potential to divert waste from a landfill and support the development of clean energy and fuel industries. For example, one need is to divert vegetative debris from lined and unlined disposal facilities for beneficial use. As the technology emerges to convert cellulosic biomass to ethanol, the vegetative debris could prove to be a valuable feedstock.

As the MOU team develops a plan to implement recommendations of the State Solid Waste Management Plan, they should consider identifying alternative forms of fuel and energy as added markets for diverting the biomass currently landfilled, and provide information to the landfill owners about the economic benefits this could reap. The State plan should at a minimum encourage recycled content products and salvaged materials, increase efforts to recycle solid waste as a method both to conserve energy and recover material values, and maximize the use of coal combustion ash and other fossil fuel waste for road and building construction and other beneficial purposes.

State law (O.C.G.A. 50-8-1) requires that local governments develop a local solid waste plan and a comprehensive plan that details how the jurisdiction will meet its future land use and infrastructure needs. DCA has adopted minimum standards to guide local governments in developing these plans, and the agency can provide technical guidance to communities in the planning process. These processes provide DCA with an excellent opportunity to educate and guide local governments on the importance of local land use decisions in ensuring that efforts to meet future economic, energy and environmental needs will not be fragmented and inconsistent. For example, DCA should support mechanisms that encourage trading of development rights to help retain agricultural and forestry production lands that could be used for biomass energy, and mechanisms that promote adherence to smart growth strategies, which reduce transportation demand and consumption of transportation fuels.

Section 4: Climate

Strong scientific evidence exists that increasing emissions of carbon dioxide and other greenhouse gases (GHG) are affecting Earth's climate. The current science suggests that many changes can be expected due to the cumulative effects of man-made emissions of CO_2 and other GHG. These include:

- Rising ocean levels that threaten and gradually cover most barrier islands and coastal areas.
- Changes in growth rates and population migration of several notable species of vegetation.
- Changes in climate that make it difficult to grow current primary agricultural crops.
- Increases in extreme weather events and storms and their impact upon the region.
- Greater water loss due to increased evaporation, resulting in desertification and reductions and shifts of water supplies.
- Increase in number of wildfires.
- Higher energy costs for cooling in the summer, and greater risk of heat-related illnesses and deaths.
- Disruptions to natural habitats and ecosystems (e.g., bark beetle infestation, changes in natural food web dynamics, disruption of plant pollination by insects).
- Higher incidence of insect-borne diseases (e.g., mosquito-transmitted encephalitis, West Nile disease).

Climate change could affect the economy through rising shoreline levels and resulting damage to coastal development, disruption of growing seasons for agriculture and forestry, and reduced tourist trade. The only viable options available now to reduce CO_2 emissions are increasing efficiency and using more energy from sources that generate considerably less CO_2, such as nuclear energy, hydropower, solar energy, wind energy, and biomass energy sources that promote a closed carbon cycle. In the future, technology may permit the cost-effective sequestration of carbon, but such advances are still years from commercial deployment.

Policy Objective
Prepare for Potential Federal Climate Change Policies

Recent activities in Congress indicate that the national debate about mandatory control of greenhouse gas emissions is still alive and under consideration. The State can begin to take steps now to ensure it is better prepared for any federal programs and to minimize efforts to react or catch up.

Given that the most likely type of federal program to be implemented is a greenhouse gas emissions trading program, it makes sense for Georgia to be proactive to allow participate by interested organizations. From a planning perspective, the following basic steps will enable Georgia organizations to participate in any greenhouse gas emissions trading scenario:

- Establish current baseline measures of emissions for the State.
- Establish a protocol that allows organizations to account for reductions.

- Support any current ongoing efforts at emissions reductions.

Implementation Strategies

Strategy 6.8 – Develop And Publish a Greenhouse Gas Inventory for the State Every Three Years

Greenhouse gas inventories identify the major sources of GHG emissions and present annual emissions by sector (e.g., energy, agriculture, waste), by source (e.g., transportation emissions, manure management), and by gas (e.g., carbon dioxide, methane). EPA helps states prepare GHG inventories by providing a spreadsheet-based analytical tool, technical assistance, and state inventory summaries that reflect recent inventory guidance. States use their inventories to quantify their emissions, measure changes in GHG emissions, and identify potential GHG reduction opportunities. Forty-one states have developed their own GHG inventories in partnership with EPA (U.S. EPA, *Global Warming*, 2005). Georgia developed an inventory in 1999, and EPD has indicated its intent to update that inventory within the next year.

EPD is currently required to develop and submit a statewide emissions inventory to EPA every three years for a number of pollutants. EPD should begin to require, as part of that inventory, the reporting and development of greenhouse gas emissions. This information will facilitate the implementation of a greenhouse gas registry (Strategy 6.9), and assist those local governments that have voluntarily committed to reductions under the U.S. Mayors Climate Protection Agreement in tracking their progress (Strategy 6.10). EPD should work with EPA and use the tools available, such as the Clean Air and Climate Protection Software, to develop a comprehensive inventory. The software – developed by the State and Territorial Air Pollution Program Administrators (STAPPA), the Association of Local Air Pollution Control Officials (ALAPCO) and the International Council for Local Environmental Initiatives (ICLEI) – is a user friendly Windows-based software that helps state and local officials create an inventory and forecast emissions of GHGs (STAPPA/ALAPCO, 2003).

EPD should also use the definition "CO_2 "to mean "equivalent CO_2 (CO_2e)", and thus include other greenhouse gases and their Global Warming Potential value[19]. EPD should evaluate whether it is feasible to credit biomass energy systems by looking at their net emissions instead of direct stack emissions.

Strategy 6.9 – Consider a Greenhouse Gas Registry

A greenhouse gas registry is a database where companies, states and other entities that emit greenhouse gases can register and record their respective emissions and reductions of greenhouse gases, such as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride.

[19] Each greenhouse gas differs in its ability to absorb heat in the atmosphere. Methane traps over 21 times more heat per molecule than carbon dioxide, and nitrous oxide absorbs 270 times more heat per molecule than carbon dioxide. Often, estimates of greenhouse gas emissions are presented in units of millions of metric tons of carbon equivalents (MMTCE), which weights each gas by its Global Warming Potential.

There are existing and emerging GHG registries and programs in the United States, such as the California Registry, the Eastern Climate Registry (involving 10 Northeast and Mid-Atlantic states), the Chicago Climate Exchange (CCX), the U.S. EPA Climate Leaders Program (Climate Leaders), and the U.S. Department of Energy's 1605(b) voluntary GHG reporting program. Six Midwestern states have recently formed a stakeholder process to evaluate the development of a Midwest Climate Registry for their region.

In developing their registries, states have found that the national registries (CCX, Climate Leaders and DOE's 1605(b)) were designed with a specific policy goal in mind or were not designed to be publicly available. For example, the goal of the Eastern Climate Registry is to provide a GHG emissions platform for state voluntary and mandatory GHG reporting programs and for state and regional climate change initiatives. One goal was to ensure consistent data reporting and accounting methodologies regardless of differences in greenhouse gas policies and programs. Similarly, the Midwest Registry is designed not to interfere with or pre-determine climate policies, which acknowledges the reality that multiple policies may be necessary to address climate change in the future.

Recent discussions among the registries have led to an agreement that state and multi-state registries need to work toward consistent GHG accounting and reporting standards across the United States through a multi-state collaboration called the Registry Alliance. Its goals are to increase participation, standardize best practice, create a common currency, leverage resources, facilitate the development of innovative state programs, and reduce the proliferation of independent registries and reporting initiatives that would pose a risk to the registries' success.

The State should monitor the efforts of the Registry Alliance and consider creating a greenhouse gas registry, possibly in conjunction with other states in the Southeast. The registry could demonstrate reductions in greenhouse gas emissions in Georgia for potential greenhouse gas trading systems, depending on the availability of funding. The State should also explore ways for private individuals, small businesses, nonprofit groups, faith-based organizations and others to register savings in the GHG registry. As part of its analysis, the State should ensure that the potential benefits of creating the registry outweigh its associated costs.

As required by SB 356 (OCGA 12-6-220), the Georgia Forestry Commission (GFC) and the University of Georgia's Warnell School of Forest Resources are cooperating to develop a Carbon Sequestration Registry for Georgia. Carbon sequestration is the process that removes carbon from the atmosphere. EPD should work with the GFC and build on the Carbon Sequestration Registry to establish a comprehensive robust greenhouse gas registry in anticipation of a potential federal program.

Strategy 6.10 – Work With Georgia Local Governments That Choose to Set Voluntary Targets to Reduce Carbon Emissions

On February 16, 2005, Seattle Mayor Greg Nickels challenged mayors across the country to join Seattle in taking local action to reduce global warming pollution. On March 30, 2005**,** 10 mayors representing more than 3 million Americans joined together to invite other cities to take additional actions to significantly reduce global warming pollution. On June 13, 2005, the U.S. Conference of Mayors passed the Mayors Climate Protection Agreement unanimously.

Under the Agreement, participating cities commit to the following three actions: 1) strive to meet or surpass the Kyoto Protocol targets in their own communities, through actions ranging from anti-sprawl land-use policies to urban forest restoration projects and public information campaigns; 2) urge their state governments and the federal government to enact policies and programs to meet or exceed the greenhouse gas emission reduction target suggested for the United States in the Kyoto Protocol (7% reduction from 1990 levels by 2012); and 3) urge the U.S. Congress to pass the bipartisan greenhouse gas reduction legislation, which would establish a national emission trading system.

As of August 16, 2006, 282 mayors representing more than 48.8 million Americans have accepted the challenge, including Shirley Franklin of Atlanta, Heidi Davison of Athens, Patsy Jo Hilliard of East Point, C. Jack Thomas of Macon and Jason Buelterman of Tybee Island.

The State should provide support for any voluntary efforts to reduce greenhouse gas emissions and provide technical and policy support for local governments, including the development of a GHG inventory (Strategy 6.8) and a GHG registry (Strategy 6.9).

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CHAPTER 7: ENERGY EDUCATION

Programs designed to shift markets to clean, advanced energy technologies and efficiency practices are most effective among educated consumers. Ensuring that all levels of Georgia's population, from grade-school students to homeowners and industry professionals, are effectively educated on energy issues can increase the adoption and implementation of these technologies and practices on a large scale. A highly trained and motivated workforce is also necessary to develop local energy resources and attract new businesses in the clean energy field. Finally, an understanding of the full costs and benefits of various energy options helps overcome the "not in my backyard" response to energy developments that benefit the public-at-large. The success of the *State Energy Strategy* therefore depends in part on whether Georgia has the appropriate tools and knowledge to manage its energy use effectively and in accordance with its public policy goals.

Educational institutions, energy providers, interest groups and government agencies offer various educational resources, ranging from consumer brochures to K-12 school demonstration projects. An effective energy strategy must build on these efforts to provide the most accurate, effective and far reaching public education initiatives possible.

In addition to active efforts to educate the public, the State can also increase the effectiveness of energy policies by gathering, analyzing and reporting energy data and other related research. Individuals and businesses in Georgia have not typically considered reducing energy use in their personal or business decisions due to historically low energy prices and a reliable energy supply in the state. Yet awareness increased significantly after hurricanes Katrina and Rita reduced the supply of natural gas and petroleum products to Georgia. Individuals faced intermittent gasoline shortages and higher commuting costs, while industries coped with natural gas prices that increased by 67% over a span of just four months (EIA, *Natural Gas Navigator: Natural Gas Prices*, 2006). Consumers of all types began making adjustments to manage costs after these events. Policymakers responded with a variety of legislative proposals designed to lower costs for energy consumers. In addition to temporary shocks such as this, environmental impacts, reliance on potentially unstable global energy supplies, and regular market fluctuations are ongoing issues that Georgia energy consumers and policy makers must be prepared to address. Ensuring that all stakeholders have access to relevant, accurate and useful information is essential to charting a sustainable energy future for Georgia.

This chapter addresses methods to leverage State government resources and expertise to track and distribute important energy information to Georgia residents and businesses.

Chapter 7 is organized around three *policy objectives*, which are programs or policies intended to move Georgia toward affordable, reliable and environmentally responsible energy. Each policy objective is followed by associated *implementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Policy Objective
Enhance Public Awareness of Energy Issues

Energy consumers across Georgia's economy can benefit from adopting energy efficient and renewable energy technologies and practices, even with no additional incentives provided. Yet widespread adoption of many of these options has not taken place. Many cost-effective energy efficient products have a higher initial price compared to standard models, and many consumers are wary of the quality and performance of certain renewable fuels. One way to overcome these hurdles is to provide Georgians with ample information on the costs and benefits of energy practices and purchases.

O.C.G.A. 50-23-32 directs the Georgia Environmental Facilities Authority (GEFA) to educate the public on energy, the impact of energy consumption, conservation, energy efficiency and alternative energy technologies. GEFA, along with public and private stakeholders, should therefore take the lead role in enhancing public awareness of energy issues.

Implementation Strategies

Strategy 7.1 – Develop a Public Awareness Campaign That Educates Georgians on How to Achieve the Benefits of Wise Energy Use

The State should work with stakeholders to develop a sustained and consistent message regarding the adoption of cost-effective energy saving measures. The message should be delivered using one or more forms of media, including television, radio, and print advertisements and the internet, depending on which are deemed the most likely to be effective.

There are many readily available, easy to implement, cost-effective methods and products that Georgia residents and businesses could use to save energy and lower expenses. For some of the measures that are not currently cost effective, or that are more expensive to purchase upfront, the federal government may offer additional incentives. And in some cases, certain energy efficiency measures are required by law, as in the case of the Georgia Energy Code, which requires certain standards be incorporated into building practices. Still, many of these methods and products are not widely adopted in Georgia. A multi-faceted and wide-ranging public information campaign could increase the knowledge of energy consumers and help them make more educated decisions about energy consumption and equipment purchases.

GEFA should evaluate energy-related public awareness efforts that exist nationally and in Georgia to determine which methods have proven successful and yielded measurable results and to identify where gaps exist. To design a program specifically for Georgia, GEFA should coordinate with public and private stakeholders including the Pollution Prevention Assistance Division, the Environmental Protection Division, the ENERGY STAR program of the U.S. Department of Energy and U.S. Environmental Protection Agency, Georgia energy providers, appliance manufacturers and retailers, and others by 2008 to determine the most appropriate message and the best way to deliver it.

The exact resources that will be required to implement a statewide energy efficiency campaign will depend on the medium that is used and how effectively existing campaigns can be adapted

to meet Georgia's needs. In any case, it is very likely that funding will be required to purchase ads or develop a website. Furthermore, advertising, marketing and web development expertise beyond the current capacity of GEFA or its stakeholders may be necessary.

Many organizations in the nation and Georgia conduct energy awareness campaigns regarding various energy issues. For instance, the U.S. Department of Transportation's Federal Highway Administration sponsors a program called "It All Adds Up to Cleaner Air," which emphasizes simple, convenient actions that people can take to improve air quality and reduce traffic congestion. Georgia Power Company, in cooperation with the Georgia Public Service Commission, conducts an advertising program designed to raise awareness and encourage the efficient use of energy. In September 2005, Governor Sonny Perdue appeared in public service announcements to publicize the creation of an ENERGY STAR sales tax holiday in Georgia. Finally, a statewide anti-littering campaign in Georgia led by the Pollution Prevention Assistance Division and the Department of Community Affairs was so successful that next year a similar campaign to encourage recycling will be launched. GEFA should study these efforts and leverage these resources to create a comprehensive campaign for energy efficiency.

Periodic surveys can also help determine where educational efforts should focus and can track the results of programs that exist or are put into place. Surveys also ensure that funding for education, programming and incentives goes to the most cost-effective activities.

Many organizations, both national and local, already conduct surveys that could help design education programs and other policies for Georgia. The Energy Information Administration (EIA) conducts surveys on residential, commercial and manufacturing energy consumption and the federally sponsored ENERGY STAR program collects data on energy efficient product purchases. In Georgia, organizations such as the Clean Air Campaign and the Center for Transportation and the Environment conduct surveys to track the results of commuter reward programs and other alternative transportation incentives.

As part of any comprehensive energy awareness campaign, consideration should be given to establishing an energy education workgroup that would evaluate survey results and design new surveys where data gaps exist. This workgroup could also evaluate the progress of existing programs, revise educational messages and plans as needed, develop new educational materials and programs, and use collected data to seek financial support when needed.

Policy Objective
Streamline Energy Data Collection and Dissemination

Georgia's energy planning process should be founded on accurate, timely and comprehensive data. In the past, Georgia has relied on data collected by the federal government to meet its information needs. Over time the resources needed for this effort have declined, and the federal government updates the information less frequently and thoroughly. If Georgia is to chart its own energy future effectively and base decisions on high quality information, it is important to develop an effective and coordinated energy data collection process without imposing unnecessary burdens on energy providers.

As indicated in previous chapters, many stakeholders are directly involved in the production and distribution of energy in Georgia. These stakeholders operate within different jurisdictions and are governed by a variety of entities, including State agencies, municipalities, owners, shareholders and the federal government. While each stakeholder or stakeholder group has its own planning process to ensure that Georgians have a reliable energy supply, much of this information is considered proprietary or trade secret by the utilities that develop it. To ensure that Georgia has an accurate, comprehensive assessment of energy production, distribution and consumption now and in the future, the State should develop a streamlined energy data collection and dissemination process.

Because of GEFA's statutory responsibility to collect and analyze data about energy consumption (O.C.G.A. 50-23-32), the Authority is a logical choice to lead such an effort. However, to avoid duplicating data collection efforts, GEFA should work closely with other stakeholders, including utility companies and public agencies.

Implementation Strategies

Strategy 7.2 – Improve the Quality and Availability of Georgia Energy Data Products

The *Georgia Energy Review* is an overview of energy production, consumption, prices and markets in Georgia produced by GEFA's Division of Energy Resources. Updating the *Georgia Energy Review* annually will ensure that the most accurate information is available to policymakers, businesses and residents to help make energy management and policy decisions. GEFA can improve the document by identifying and incorporating new state-level data sources, reporting on energy consumption trends in State government, and including a summary of the statewide reliability assessment described in Chapter 1 (Strategy 1.1) of this Strategy document.

Georgia Energy Review 2005 relies heavily on state-level data that is collected and published by federal government agencies, including the U.S. Department of Energy and the U.S. Environmental Protection Agency. Unfortunately, much of this information is not updated frequently enough to yield relevant reports – in some cases the most recent state-level data are more than 3 years old. Also, federal data are mostly summary information, limiting GEFA's ability to analyze differences in energy trends within the state- and micro-level data, such as energy consumption by end use.

Beyond data collection issues, the *Georgia Energy Review* does not report any information on energy consumption by State government, a large sub-sector of Georgia's commercial energy economy and perhaps the largest single energy consumer in Georgia. Reliable baseline data are necessary for the State to lead by example in applying best practices in energy management, and the impact of new programs and policies should be reported to the public and policymakers.

GEFA most recently updated the *Georgia Energy Review* with 2005 data and should be the primary agency responsible for improving the document and updating it annually. GEFA is now launching a program to identify total State government energy consumption and spending by tracking utility bills paid with State funds. Any data collected during this process should be used in the *Georgia Energy Review*.

To acquire more refined state-level data than is offered by federal databases, GEFA should work with energy stakeholders, including utility companies and other interested parties. In some cases, data that GEFA needs to improve the *Georgia Energy Review* are already tracked by these organizations and every effort should be made to avoid duplicating tasks. Moreover, GEFA must work with stakeholders to ensure that confidential information is protected.

In addition, the State should create a comprehensive website for finding publicly available, Georgia-specific energy information, including current and historical consumption data, generation data, prices, comparative state and national data, original publications, fact sheets, energy saving tips, news and policy updates, and incentives for businesses and individuals.

Georgia currently lacks a single, authoritative resource where the public can locate state-level energy information. Having quick and easy access to such a tool can help businesses and residents perform cost comparisons between different fuels, equipment and appliances and make cost-effective decisions about how to build and operate buildings efficiently, the potential benefits of using alternative fuels, easy steps to curb energy consumption, the environmental impact of their energy use and other topics.

GEFA should work with State and federal agencies, private sector allies, and other organizations in 2008 to determine the information that would be most useful on such a website. GEFA should also identify successful efforts by other states and organizations to distribute energy information via the web and emulate the most effective models.

In addition to aggregating information from numerous sources, GEFA should update much of the information that the Authority currently distributes, including energy saving tips for builders and homeowners. Creating the website will require expertise in web design and marketing that is currently beyond GEFA's capacity, and other technical needs should be evaluated as well.

Policy Objective

Develop Formal Energy Education Curricula and Demonstration Projects for K-12 Schools, Colleges and Universities in Georgia

Education that provides students with a thorough understanding of the relationship between energy, economics and the environment can help ensure that Georgia's energy future is guided by the informed choices of its citizens. Both public and private sector programs have developed energy education curricula that focus on a broad spectrum of energy issues for all levels of education. The State can enhance these efforts by reviewing existing programs and measuring their results. The State should leverage the most successful programs and provide additional support where gaps exist.

Implementation Strategies

Strategy 7.3 – Coordinate Efforts to Incorporate Energy Lessons Into Traditional Coursework

The State should seek ways to incorporate energy issues into classroom lessons, including the natural sciences, mathematics, economics, engineering and others. Lesson plans should provide

relevant, real-world discussion topics and should meet state and national learning standards in their respective fields. The State should also define best practices among the energy education programs offered by private, nonprofit and governmental organizations, and seek input from these stakeholders in adopting and developing an energy lesson toolkit specifically for Georgia educators.

Ensuring an economically and environmentally sustainable energy future for Georgia will depend largely on how well Georgia's future leaders can create and adapt to new technologies and understand the costs and benefits of energy-related decisions. Numerous energy stakeholders, both public and private, have developed lesson plans for use in classroom study. However, many of these programs are only regional in their reach, and many of the national programs could benefit by being tailored to Georgia's specific issues.

In 2008, GEFA should work closely with the Georgia Department of Education, the University System of Georgia and the Georgia Department of Technical and Adult Education to coordinate the development of energy lesson plans for statewide adoption. To this end, GEFA and its State partners should convene a group of interested parties – especially those who already offer some type of energy education – to determine best practices and develop a Georgia-specific, statewide toolkit.

Public and private organizations, such as the Southern States Energy Board, the Southeast Carbon Sequestration Partnership and Southern Company offer or are developing energy-related lesson plans that meet National Science Education Standards. In addition to in-class components, some organizations offer student activities, such as the Clean Air Campaign's "Better Air Schools" program, which features a 40-minute interactive and educational assembly.

Strategy 7.4 – Support the Development and Implementation of Alternative Energy Demonstration Projects in Schools

The State should provide material and organizational support, including financial resources, if necessary, to encourage the widespread adoption of alternative energy projects at Georgia's schools.

A good way to expose students to meaningful energy education is by providing hands-on learning experiences that relate clean energy technologies to course curricula. The installation of technologies such as photovoltaic solar panels also helps to reduce pollution, preserve natural resources and reduce Georgia's reliance on traditional energy sources. In turn, schools using these demonstration projects can provide the State and other interested parties with valuable information on the performance and cost effectiveness of the technologies. Focusing on magnet schools that emphasize math and science may enhance the value of these investments.

GEFA has statutory authority to help advance alternative energy projects, and to this end, GEFA should work with Georgia utility companies and other private entities offering demonstration projects to expand the scope and reach of these programs by 2008.

For instance, Green Power EMC sponsors the Sun Power for Schools program, and has added photovoltaic installations to six schools, with another 10 installations scheduled through the end

of 2006. Georgia Power Company operates a similar program and has purchased two solar demonstration systems to deploy at middle schools later this year. Depending on the type of system installed, a monitoring device could permit students to see the amount of energy produced each day or in real-time, and the data could be used in math and science classes. GEFA should coordinate with these companies to determine how best to expand the programs, and which schools might benefit the most from new demonstration projects. Providing State matching funds where feasible could increase the potential reach of these programs. GEFA could also work with the Georgia Department of Education to develop math and science curricula that correspond to such demonstration projects, which may also stimulate demand from schools.

Beyond renewable electricity, many schools might also benefit from the application of biodiesel demonstration projects. Public school cafeterias produce a by-product of food preparation known as "yellow grease" or waste vegetable oil. Although typically considered a waste product, it can instead be converted into biodiesel which, in turn, can be used to power diesel school buses. GEFA should help Georgia schools identify the potential for implementing such a "closed-loop" demonstration project by identifying markets for waste grease and determining the need, if any, to retrofit school buses that will use biodiesel.

In addition to coordination efforts led by GEFA, a source of State matching funds may be necessary to expand the use of more expensive alternative energy demonstration projects in Georgia schools, such as photovoltaic installations.

Strategy 7.5 – Create Awards and Publicity for Students, Schools and Campuses That Exemplify Wise Energy Practices or Creative Energy Solutions

The State should offer special recognition to schools and students that excel at reducing energy consumption or using alternative energy. Individual awards to students who demonstrate expert energy awareness, or scholarships to students presenting an outstanding energy-related science project at the Georgia Science and Engineering Fair, should also be considered.

Awarding schools and campuses for their energy management excellence encourages them to educate students by example and, in turn, encourages students to get involved in energy saving practices. As part of the public awareness efforts described in Strategy 7.1, the State could consider establishing a workgroup to determine how to advance this recognition program.

Existing recognition programs offer models that the State could evaluate. The Georgia Green and Healthy Schools program incorporates awards for various levels of achievement, including banners, patches, awards ceremonies and grant eligibility. The Alliance to Save Energy supports a program called Green Schools, which encourages teachers, students, custodial staff and administrators to change their behaviors and use energy more efficiently, and asks the school to change operational and maintenance routines. Green Campuses is a similar program at the college level. The State could enhance publicity for the awards with a presentation to the top performing schools by the Governor or other public officials.

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CHAPTER 8: FUTURE STATE ENERGY PLANNING AND TRACKING

This *State Energy Strategy* is the first comprehensive energy strategy ever developed for Georgia. It heralds a new era of intentional planning for the State. The analysis and policy objectives contained in the Strategy reflect Georgia's current energy industry and markets. Given the rapidly changing world of energy supply and demand, the State anticipates the need for a planning process that continuously optimizes this Strategy to meet Georgia's future energy needs.

Chapter 8 proposes a continuous planning process to update the *State Energy Strategy* on a periodic basis. Under this process, the State should review the implementation of this Strategy regularly and update the analysis and policy objectives contained herein to reflect changing energy trends.

Chapter 8 is organized around one *policy objective*, which is a program or policy intended to move Georgia toward affordable, reliable and environmentally responsible energy. This policy objective is followed by associated *implementation strategies*, which are activities designed to achieve or implement the policy. These strategies are believed to be feasible and could move forward if desired.

Policy Objective
Support Ongoing Energy Planning for Georgia

Best practice in the field of energy planning across the United States includes a continuous improvement cycle of program implementation, evaluation and plan revision every three to four years. The development of Georgia's *State Energy Strategy* also generated numerous ideas for further consideration that merit additional research and thought. That research may demonstrate these ideas are ripe for inclusion in future iterations of the *State Energy Strategy*, or it may determine they should not be considered further.

Implementation Strategies

Strategy 8.1 – Establish Schedule and Protocol to Update the State Energy Strategy for Georgia

The Governor's Energy Policy Council urges the Governor to develop a schedule for updating the *State Energy Strategy* at a regular interval, such as every three to four years, and establish the protocol for handling revisions. For example, New York statute requires a state energy planning process every four years, incorporating public comment and advisory council input. It is one of the most respected plans in the nation because part of the updating protocol includes provisions that the New York State Energy Research and Development Authority must regularly monitor, verify and report on the implementation of the plan. The State of Georgia could also routinely review the energy plans of other states within the region and identify opportunities for pursuit of

common energy conservation goals. Also, the State should consider aligning the schedule for updating the Strategy with the planning processes of the Georgia Public Service Commission and Georgia's energy providers. Finally, the Strategy revision protocol should include a process to evaluate further the technical feasibility, costs, scientific basis and legality of ideas considered during the development of the *State Energy Strategy* that were not included in the final version of the document.

Continual improvement in Georgia's energy planning will ensure that State energy policy makers always have an up-to-date road map for Georgia's energy future. Public participants, members of the Governor's Energy Policy Council and State energy and environment staff will have invested thousands of hours of work into producing the *State Energy Strategy for Georgia*, crafting a useful guide for policy makers. None of these planning participants, however, can confidently predict the future. Near- and long-term developments in energy supply, demand and market dynamics require that Georgia revisit and revitalize its *State Energy Strategy* to ensure its continued relevance.

Strategy 8.2 – Track Implementation of the State Energy Strategy and Analyze the Impact of Implementation Strategies

The Georgia Environmental Facilities Authority (GEFA) should review the implementation of the plan and publish an annual analysis that describes implementation status and the Strategy's impact on providing affordable, reliable and environmentally responsible energy in Georgia. Such a review will provide the State with real world data to continuously improve the current Strategy and the policies implemented in support of the Strategy.

GEFA should publish its first evaluation in December 2007, one year after the Strategy has been submitted to the Governor.

To prepare for this review, GEFA should determine the data that are needed to comprehensively track implementation of the *State Energy Strategy*. GEFA must assess availability of relevant data, coordinate with energy suppliers and determine how it will access all data necessary to adequately track implementation of the plan and its attendant policies.

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APPENDIX A: LIST OF FIGURES

APPENDIX B: LIST OF TABLES

APPENDIX C: ABBREVIATIONS

ASTM	American Society for Testing and Materials
BACT	Best Achievable Control Technology
Btu	British thermal unit
CAMR	Clear Air Mercury Rule
C&D	Construction and demolition
CEESP	Clean Energy Environment State Partnership
CHP	Combined heat and power
CNG	Commission for a New Georgia
CO	Carbon monoxide
CO_2	Carbon dioxide
CTE	Center for Transportation and the Environment
DCA	Department of Community Affairs (Georgia)
DG	Distributed generation
DOAS	Department of Administrative Services (Georgia)
DOE	Department of Energy (U.S.)
DOT	Department of Transportation (Georgia)
DSM	Demand-side management
EEPS	Energy efficiency portfolio standard
EET	Energy efficiency target
EPA	Environmental Protection Agency (U.S.)
EPAct	Energy Policy Act
EPD	Environmental Protection Division (Georgia)
ERI	Energy Resources International
FERC	Federal Energy Regulatory Commission
GEFA	Georgia Environmental Facilities Authority
GFC	Georgia Forestry Commission
GHG	Greenhouse gases
GRTA	Georgia Regional Transportation Authority
GSP	Gross state product
GTA	Georgia Technology Authority
GTC	Georgia Transmission Corporation
GWh	Gigawatt-hour
HC	Hydrocarbon
HEV	Hybrid gasoline-electric vehicle
IGCC	Integrated gasification combined cycle
ITS	Integrated Transmission System
KW	Kilowatt
kWh	Kilowatt hours
LNG	Liquefied natural gas
MEAG	Municipal Electric Authority of Georgia
MGAG	Municipal Gas Authority of Georgia
MMcf	Million cubic feet

MOU	Memorandum of understanding
MPG	Miles per gallon
MSW	Municipal solid waste
MW	Megawatt
MWh	Megawatt-hour
NAAQS	National Ambient Air Quality Standards
NETL	National Energy Technology Laboratory
NO_x	Nitrogen oxides
NWETC	Northwest Energy Technology Collaborative
OBR	Output-based environmental regulations
OPB	Office of Planning and Budget (Georgia)
PBF	Public benefits fund
PM	Particulate matter
PSC	Public Service Commission (Georgia)
PURPA	Public Utility Regulatory Policies Act
PV	Photovoltaics
R&D	Research and development
RFS	Renewable fuel standard
RPS	Renewable portfolio standard
SCHPAC	Southeast Combined Heat and Power Application Center
SEAFTF	Southeast Alternative Fuels Task Force
SEI	Strategic Energy Institute
SEP	Supplemental environmental project
SFCC	Southern Fuel Cell Coalition
SFEC	State Facilities Energy Council (Georgia)
SIP	State implementation plan
SMD	Standard market design
SNG	Southern Natural Gas
SO_2	Sulfur dioxide
SSEB	Southern States Energy Board
TBtu	Trillion British thermal unit
TDM	Transportation demand management
TMDL	Total maximum daily load
TSE	Truck stop electrification
TxDOT	Texas Department of Transportation
ULSD	Ultra-low sulfur diesel
USDA	United States Department of Agriculture
USF	Universal Service Fund
VIN	Vehicle Identification Number
VMT	Vehicle miles traveled
VOC	Volatile organic compound
WPA	Wind Powering America
WTE	Waste to energy

APPENDIX D: GLOSSARY

ACIDIFICATION
A process whereby air pollution – mainly ammonia, sulfur dioxide and nitrogen oxides – is converted into acid substances

AIRSHED
An area or region defined by geology or settlement patterns that result in discrete atmospheric conditions

ALTERNATIVE FUEL VEHICLE
A vehicle that operates on fuels other than gasoline and diesel

ANTHROPOGENIC
Made or generated by a human or caused by human activity

ATMOSPHERIC DEPOSITION
The contribution of atmospheric pollutants or chemical constituents to land or water ecosystems, resulting from materials in rain or snowfall and combined with dry dust fallout

BIODIESEL
Any liquid biofuel suitable as a diesel fuel substitute or diesel fuel additive or extender

BIOFUELS
Liquid fuels and blending components produced from biomass (plant) feedstocks, used primarily for transportation

BIOMASS
Organic non-fossil material of biological origin constituting a renewable energy source

BRITISH THERMAL UNIT (Btu)
A British Thermal Unit equals the amount of energy needed to raise a pound of water one degree Fahrenheit at constant pressure of one atmosphere.

CAP-AND-TRADE PROGRAM
A pollution control program that caps total emissions of certain pollutants, and allows emitters to trade available allowances on an open market as part of compliance activity

CARBON SEQUESTRATION
The biological or physical process of capturing CO_2 emissions, which would otherwise be released into the atmosphere, and permanently storing them in geologic formations, including oil and gas reservoirs, unmined coal seams, saline reservoirs or oceans

CLOSED CARBON CYCLE

The process in which CO2, released into the atmosphere from the burning of biodiesel, is absorbed by growing plants, which are later processed into fuel

COMBINED HEAT AND POWER
A technology designed to produce both heat (and/or cooling) and electricity from a single heat source

CONSUMPTIVE USE
The difference between the amount of water that is withdrawn by an industrial user (such as electricity generating unit) and the amount discharged back to the stream that becomes available for use downstream

DEMAND-SIDE MANAGEMENT
The planning, implementation and monitoring of utility programs and pricing designed to encourage consumers to reduce electricity consumption or to modify patterns of electricity usage, including the timing and level of electricity demand

DISTILLATE FUEL
A general classification for a petroleum fraction produced in conventional distillation operations, which includes diesel fuels and fuel oils

DISTRIBUTED GENERATION
Electricity production by small generators typically located onsite at the point of consumption as opposed to large central power plant generation.

ELECTRICITY FUELS
A category of fuels tracked by the Energy Information Administration. These fuels are used almost exclusively to generate electricity, including nuclear power, hydropower, wood and wood waste

ENERGY EFFICIENCY MEASURES
Activities designed to reduce electricity loads by improving end-use equipment and systems to get the same service (i.e., lighting, heating, cooling, etc) while using less energy input

ETHANOL
A clear, colorless, flammable oxygenated hydrocarbon produced chemically or biologically that can be used for gasoline blending or as a gasoline octane enhancer

EUTROPHICATION
A process whereby water bodies, such as lakes, estuaries, or slow-moving streams, receive excess nutrients that stimulate excessive plant growth such as algae and nuisance plant weeds

GAS CONDENSATE
Hydrocarbon liquid dissolved in saturated natural gas that comes out of solution when the pressure drops below the dew point

GEOTHERMAL ENERGY
There are two typical technologies for converting geothermal energy into useful energy. In areas where there is volcanic activity, technology can produce steam from geothermal reservoirs in the earth's crust to be used for electricity production. In geothermal heating and cooling applications, geothermal heat pumps take advantage of the near-constant temperature of the earth by circulating fluid though buried piping to be used for pre-heating (in winter) and pre-cooling (in summer) air used for space heating and cooling, thereby reducing the need to use other forms of energy.

HEAT CONTENT
The amount of heat energy available to be released by the transformation or use of a specified physical unit of an energy form (e.g., a ton of coal, barrel of oil, kilowatt hour of electricity, cubic foot of natural gas, or pound of steam). Heat content is typically described in British Thermal Units (see definition above) per unit of fuel.

HYDROGEN
The lightest of all gases, occurring chiefly in combination with oxygen in water

INTAKE TEMPERATURE
The natural or background temperature of water in a particular water body unaffected by any man-made discharge or thermal input

INTEGRATED GASIFICATION COMBINED CYCLE TECHNOLOGY
A process that produces electricity in the following sequence: coal, water, and oxygen are fed to gasifier; the resulting gas is cleaned and fed to a gas turbine; the hot exhaust and the heat recovered from the gasification process are routed through a heat-recovery boiler to produce steam, which drives a steam turbine to produce electricity

LINE LOSS
Electric energy lost because of the transmission of electricity

LIQUEFIED NATURAL GAS
Natural gas cooled to roughly -260° F at normal air pressure, at which point the gas converts to a liquid state roughly 1/600 the volume of the gas at normal atmospheric temperatures.

RENEWABLE ENERGY RESOURCES
Energy resources that derive from existing flows of energy, from on-going natural processes, such as sunshine, wind, flowing water (hydropower, wave action & tidal flows), biological processes, and geothermal heat flows. Renewable energy resources are replaced rapidly by a natural process such as power generated from the sun or from the wind.

SILVICULTURAL
The agriculture of trees, including how to grow them, maximize growth and return, and manipulate species compositions to meet landowner objectives

SOLAR POWER
The radiant energy of the sun, which can be converted into other forms of energy, such as heat or electricity

STACK EMISSIONS
The particulate matter and vapors released to the atmosphere through a stack, chimney, or flue

STATE IMPLEMENTATION PLAN
An enforceable plan developed at the state level that explains how the state will comply with air quality standards according to the federal Clean Air Act

STATIONARY SOURCE
A place or object from which pollutants are released and that does not move around, including power plants, incinerators and other emitting industries

TOTAL MAXIMUM DAILY LOAD
A calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

WIND ENERGY
Kinetic energy present in wind motion that can be converted to mechanical energy for driving pumps, mills, and electric power generators

SOURCES
Many of the definitions in this Glossary were drawn from the Energy Information Administration's Energy Glossary at http://www.eia.doe.gov/glossary/index.html.

Additional web sites used in developing the Glossary include:

- http://themes.eea.europa.eu/Environmental_issues/acidification
- http://www.afvi.org/
- http://www.biodiesel.org/resources/faqs/
- http://www.eere.energy.gov/de/ee_measures.html
- http://www.eia.doe.gov/oiaf/1605/95report/glossary.html
- http://www.epa.gov/oar/oaqps/peg_caa/pegcaa10.html
- http://www.epa.gov.owow/oceans/airdep/air5.html
- http://www.epa.gov/owow/tmdl/intro.html
- http://www.fossil.energy.gov
- http://www.neo.state.ne.us/statshtml/glossaryd.htm
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