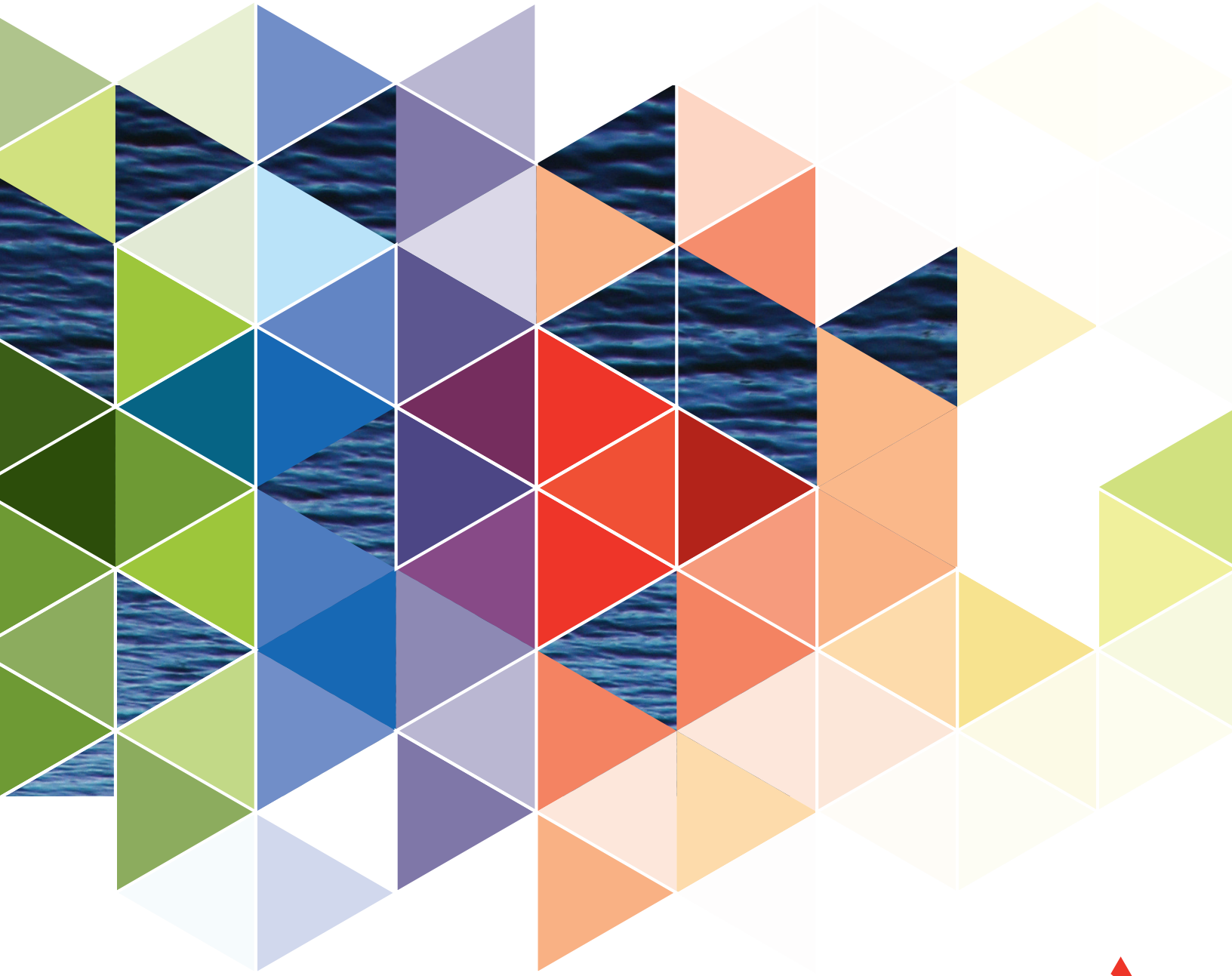
2016 WATER ACTION REPORT



SOUTHERN COMPANY

INTRODUCTION[1]

This report contains information on the management of water by Southern Company and its subsidiaries, including applicable information previously submitted through the Carbon Disclosure Project (CDP) Water Information Request. Topics include the company's water footprint, external issues affecting future water availability, risks and technological challenges and opportunities.

Information has been compiled from company regulatory filings, industry organizations, government publications and other sources. Company data is current through Dec. 31, 2015, consistent with calendar-year regulatory reporting requirements, except where noted. Industry- and government-sourced data may reflect different time periods due to limitations of available information for the topics presented.

Power plants referred to in this report as the Southern Company system are owned and/or operated by Southern Company subsidiaries Alabama Power, Georgia Power, Gulf Power, Mississippi Power, Southern Nuclear and Southern Power.

While no single document can provide all the answers, this report is presented as a factual snapshot of factors the company believes can help inform constructive efforts to address today's dynamic challenges related to energy and the environment.

A HISTORY OF RESPONSIBLE WATER MANAGEMENT

For more than a century, water has played an important role in Southern Company's development and corporate culture.

James Mitchell, the company's founder, envisioned Southern Company's future when he first saw Alabama's rivers and recognized their potential for bringing electricity to a region that had little of it. As recounted in the published history of the company, *Big Bets: Decisions and Leaders That Shaped Southern Company,* electric power was at that time a luxury enjoyed only by "the privileged few." Mitchell's plan, conceived decades before the company evolved into an entity called Southern Company, was based on developing Alabama's "vast waterpower resources to transmit power across a large southeastern market."

James Mitchell

Although Mitchell did not live to see how his vision would ultimately energize the South, he set in motion a business that would continue to rely on water even as other forms of generation became necessary to provide power for the growing region. It was only after World War II that thermoelectric generation – first with coal, then with other fossil fuels and nuclear – exceeded hydro power in use. And those other fuels that came to dominate the generation mix also needed water to operate.

Even today, with a diverse mix of electric generating resources being used in the course of providing power to more than 4.5 million customers in the Southeast (see Figure 1), the original source of Southern Company's electricity continues to play an important role as one of the cleanest, environmentally safe and affordable sources of renewable energy. With 33 hydro generating facilities and a combined nameplate generating capacity of approximately 2,800 megawatts (MW), the Southern Company system has ranked as high as seventh among U.S. utilities in terms of hydroelectric generation.

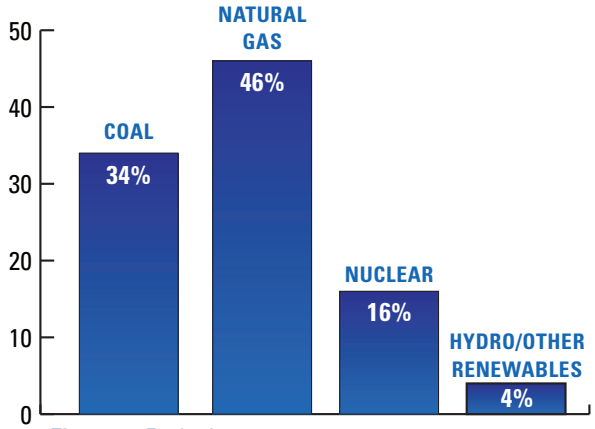


Figure 1, Fuel mix
Electricity generated and purchased in 2015 (percent)

[1] *Information in this report that corresponds to the CDP's 2016 Water Information Request is footnoted throughout the report.*

Lay Dam in Alabama

WATER GOVERNANCE[2]

The Southern Company system's commitment to the environment, including responsible water management, starts with top executives and extends throughout the company.

Overall leadership is provided by the Southern Company management council, a team of senior officers responsible for establishing corporate policies, reviewing key strategies and evaluating the company's performance.

The environmental management council (EMC) is led by the chief environmental officer and consists of officers and senior management from Southern Company subsidiaries Southern Company Services, Alabama Power, Georgia Power, Gulf Power, Mississippi Power, Southern Nuclear and Southern Power.

The primary functions of the EMC are to provide leadership, direction and coordination of environmental matters throughout the company. Specifically, the EMC ensures key objectives, policies, processes, programs and resources are in place to support an effective environmental management system and ensure all employees and business units understand and meet the requirements of the company's environmental policies, standards and goals.

The Southern Company system's commitment to the environment is expressed in its environmental policy and transitioned into practice through the environmental management system. The priorities of the environmental policy include:

- Management and employee commitment
- Compliance
- Continuous improvement
- Research and innovation
- Environmental stewardship
- Public policy
- Accountability
- Transparency

Water, air and land environmental governance teams provide support so that all elements of the environmental management system work effectively throughout the company.

WATER PHILOSOPHY

As part of our general water philosophy, Southern Company is committed to responsible use and protection of all natural resources, including water, by meeting or surpassing all environmental laws and regulations. We consider the impact of our current and future operations on water quality and availability, focusing on researching, developing and evaluating innovative technologies that address industry needs, while providing benefits to our customers and the environment. We engage communities and relevant stakeholders to address specific water challenges at local levels and practice water stewardship beyond our facilities.

[2] *CDP section W6, Governance and Strategy*

WATER IN POWER PRODUCTION

While there are several ways water is involved in the production of electricity, it is essential for cooling systems in all thermoelectric, or steam-driven, power plants, where most electricity is produced by burning fossil fuels in a boiler to turn water into steam. Under high pressure, the steam turns the blades of a turbine that spins a generator, producing electricity.

Figure 2 illustrates some ways water is involved in power production. The Southern Company system's thermoelectric power plants withdraw cooling water to condense the steam that exits the turbine generators back into water. Some plants use once-through cooling; others have a closed-cycle cooling process.

At plants with once-through cooling, water is withdrawn from a source such as a river or lake, passes through the condenser and returns immediately back to the source. Power plants with a once-through cooling design can withdraw hundreds of millions of gallons a day but return almost all water that has been withdrawn. At plants with closed-cycle cooling, water recirculates continuously between the condenser and a cooling tower. Compared with a once-through system, only a small amount of water is withdrawn from the source to make up for evaporation and other losses. Plants with cooling towers typically withdraw about 95 to 98 percent less water than those with a once-through design. Depending on cooling tower water chemistry, the tower typically returns only about 25 percent back to the source, with the remainder lost to evaporation.

Newer plants with natural gas- or oil-fired combined-cycle technology generally withdraw and consume less water. Integrated gasification combined-cycle (IGCC) plants, which gasify coal, generally consume less water than a traditional coal plant with closed-cycle cooling but slightly more than a natural gas combined-cycle plant with closed-cycle cooling. IGCC plants with carbon capture technology are expected to consume more water (50 to 60 percent more) than a natural gas combined-cycle plant but less than a traditional pulverized coal plant. While currently under development and operating on natural gas, Mississippi Power's Kemper

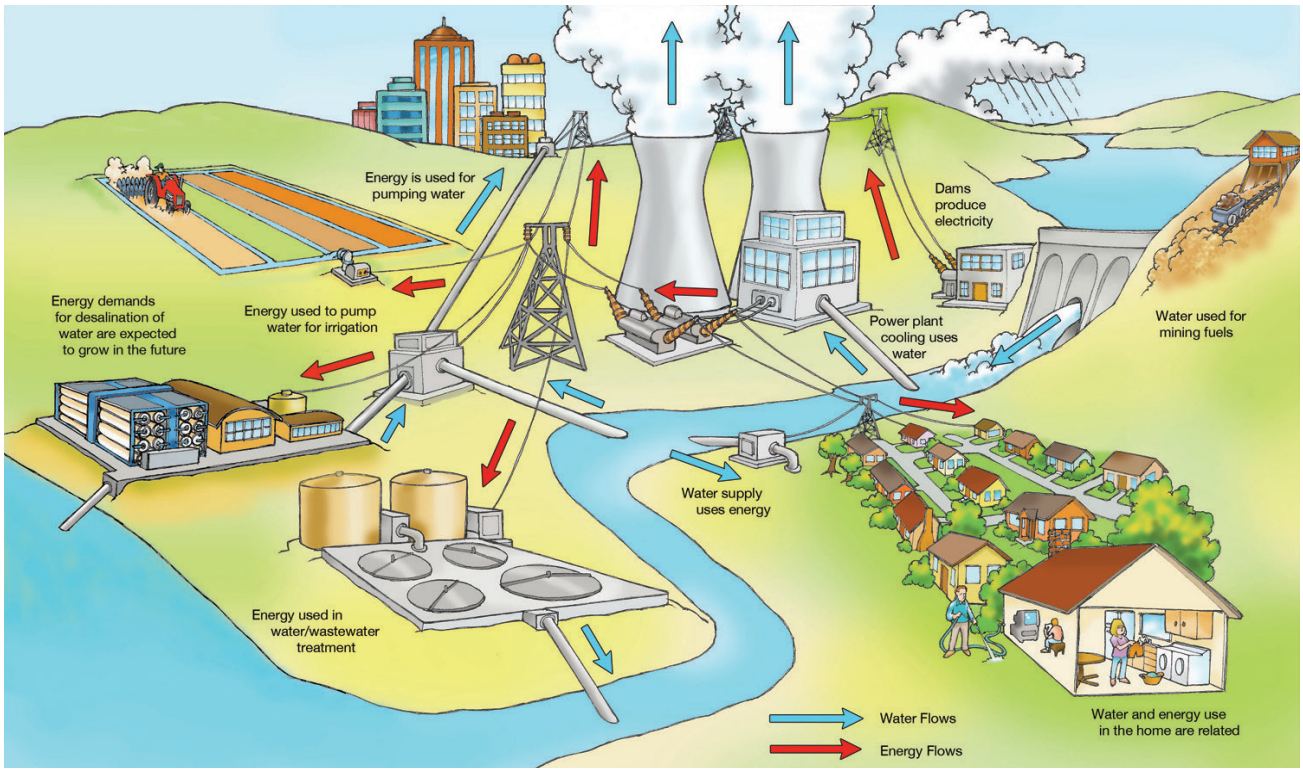


Figure 2, Water and electricity

Electric Power Research Institute (EPRI)

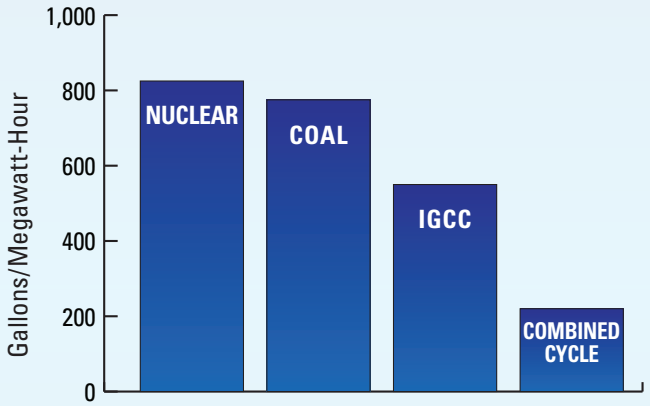


Figure 3, Representative water withdrawal using a closed-cycle cooling system (industrywide data)

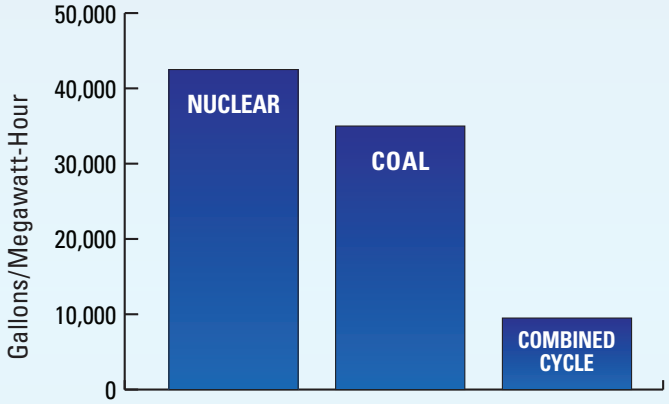


Figure 4, Representative water withdrawal using a once-through cooling system (industrywide data)

County IGCC energy facility will be the first Southern Company system facility to utilize this technology.

Nuclear plants also use cooling water to condense steam that exits the turbines, just as other thermoelectric plants do. All of the Southern Company system's nuclear plants use closed-cycle cooling water systems for main condenser cooling.

Figures 3 and 4, based on industrywide data from the Electric Power Research Institute (EPRI), show comparative water withdrawal for various power plant types.

To continue providing customers a balance of clean, safe, reliable and affordable energy while meeting all regulatory requirements, including those addressing the availability and quality of water, Southern Company subsidiaries must determine the best sources for future generation, taking into consideration many, sometimes competing, factors. While some generation sources and plant types are attractive for certain reasons, such as cost and fuel availability, they may be less attractive for others. Southern Company, through its subsidiaries, is developing a full portfolio of energy resources, including nuclear, 21st century coal, natural gas, renewables and energy efficiency. The full portfolio is sometimes referred to as an "all of the above" strategy.

UNDERSTANDING WITHDRAWAL AND CONSUMPTION[3]

"Water use" is a common term to refer to any water that has a role in production of electricity. Because of the essential cooling function of water in power generation, a plant must be located where there is a sufficient source of water supply to support the large volume of withdrawal. But there is a critical distinction between withdrawal and consumption of water by a power plant.

Withdrawal refers to water that has been brought inside the plant for use but does not indicate what happens afterward. Consumption refers to water that is evaporated into the atmosphere or remains as moisture in coal combustion residuals (CCRs) and therefore is not returned to the water source. Consumption is simply the difference between water withdrawn and water returned to the source. Water that is returned to the source is available for downstream water demands; water that is consumed is not.

With respect to power generation, water "used" does not necessarily mean it is consumed. Water in a thermoelectric plant's once-through cooling system flows through heat exchangers and is immediately returned to the source without diminishing the flow. However, a

[3] *CDP section W1, Company-wide Water Accounting*

source body of water must be capable of supporting the total withdrawal amount, even though the net effect on the body of water may be negligible.

Water that is not consumed, but returned to the source or discharged, may have an increase in temperature. The National Pollutant Discharge Elimination System (NPDES) permit program ensures water quality is maintained by regulating point-source discharges into U.S. waterways. Between 2011 and 2015, Southern Company system thermoelectric plants withdrew on average a total of 4.5 billion gallons of water per day, returning 94 percent to the source – rivers or lakes.

Figure 5 shows actual total surface water withdrawal and consumption for Southern Company system plants over a five-year period.

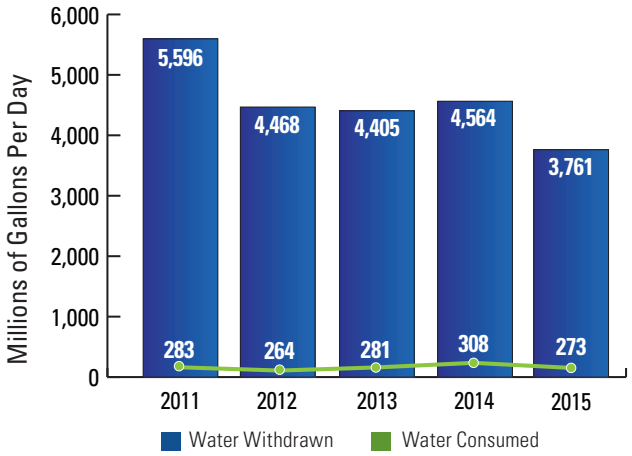


Figure 5, Withdrawal/consumption (Southern Company system)

ISSUES AND CHALLENGES

Given the significance of water's role in power generation, the Southern Company system must address issues associated with the quantity of water withdrawn and consumed from rivers, lakes and estuaries, the quality of water returned to the source and potential effects on aquatic life.

Major challenges related to water include:

- Variability in surface water flows due to drought, increasing demand for water and operation of reservoirs
- Regulatory changes associated with cooling water intake structures and the discharge of cooling water
- Wastewater discharges from coal-fired power plants

Cooling Water Intake Structures

The U.S. Environmental Protection Agency's (EPA) final rule establishing standards for reducing effects on fish and other aquatic life caused by new and existing cooling water intake structures at existing power plants and manufacturing facilities became effective in October 2014. The effects of this final rule will depend on the results of additional studies and implementation of the rule by regulators based on site-specific factors. NPDES permits issued after July 14, 2018, must include conditions to implement and ensure compliance with impingement mortality and entrainment standards, including any measures to protect federally listed threatened and endangered species and designated critical habitat.

This rule did not mandate cooling towers as the best technology available. Instead, the rule established seven options for impingement control with a site-specific entrainment determination. The focus on protection of threatened and endangered species has increased with more involvement from the U.S. Fish and Wildlife and National Marine Fisheries services.

Southern Company supports reasonable regulations that take into account the great variation of impacts from plant to plant. The company continues to research technologies – including fish-return systems and "fish-friendly" or modified traveling screens – to minimize the impact of power plant intake structures on aquatic life. In fact, subsidiary Alabama Power received a 2014 Technology Transfer Award from EPRI for the first installation of Hydrolox™ molded-polymer "fish friendly" traveling screens in its cooling water intake structure at Plant Barry.

Thermal Impacts

Different types of cooling water systems at thermoelectric power plants involve trade-offs between consumption of water and potential impacts to local aquatic ecosystems from discharged water, which becomes heated in the cooling process. The discharge of heated water is subject to the Clean Water Act and addressed as part of the NPDES permitting process.

Where thermal discharge, e.g., heat, issues are involved, the company has either demonstrated alternative thermal-effluent limits can assure the protection of a balanced, indigenous aquatic community or has negotiated solutions involving retrofits with closed-cycle cooling. Managing thermal discharge issues in the future will require that water needs of the growing population and ecosystems are balanced with the availability of water supplies and storage capacity for closed-cycle cooling.

Wastewater Discharges

On Nov. 3, 2015, EPA published a final effluent limitations guidelines rule, which imposes stringent technology-based requirements for certain waste streams from steam-electric power plants. The revised limits and compliance dates will be incorporated into future renewals of NPDES permits at affected units and may require the installation and operation of multiple technologies sufficient to ensure compliance with applicable new numeric wastewater compliance limits. Compliance deadlines between Nov. 1, 2018, and Dec. 31, 2023, will be established in permits based on information provided for each applicable waste stream.

The Southern Company system is evaluating the feasibility and costs of available treatment technologies for compliance with the rule. The company seeks to ensure compliance in the most cost-effective and efficient manner, while providing for continued protection of water quality and aquatic resources.

THE REGION'S WATER RESOURCES

The Southern Company system's southeastern retail service territory possesses abundant surface waters, significant lengths of coastline and diverse wetland systems ranging from bottomland forests along river floodplains to longleaf pine savannas and coastal marshes.

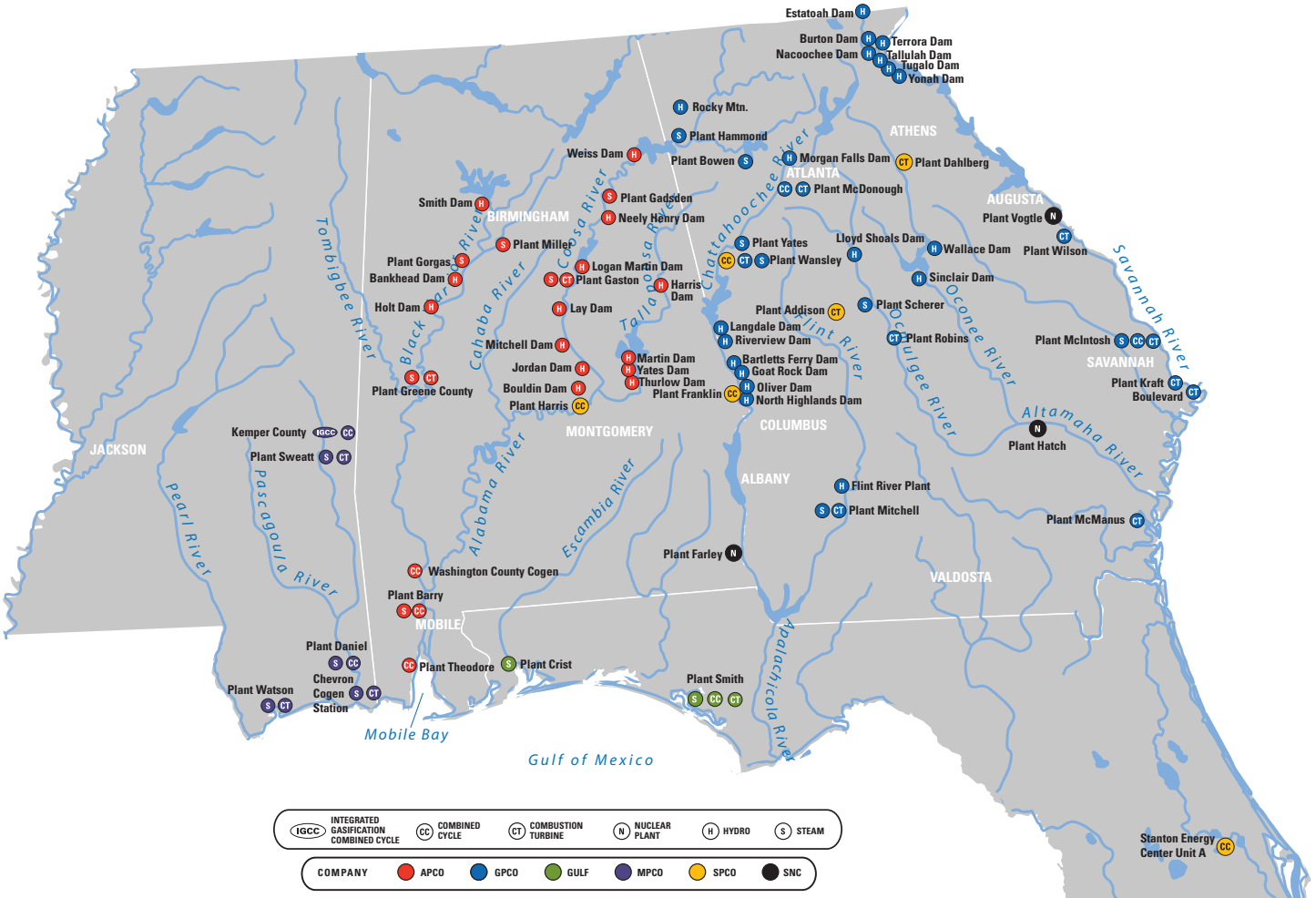


Figure 6, Fossil and hydro plants and watersheds

The Coosa River

The region covers 120,000 square miles spanning most of Georgia and Alabama, southeastern Mississippi and northwestern Florida. Numerous rivers and streams drain the region, flowing mainly south to the Gulf of Mexico and southeast to the Atlantic Ocean. This area is referred to as the South Atlantic-Gulf watershed region. The larger rivers, lakes and tributaries supply water to communities and larger cities throughout the region. In addition, much of the region, particularly in the Coastal Plain area, relies primarily on abundant groundwater from aquifers for freshwater.

The Southern Company system's retail service territory extends from the Pearl River watershed in southeastern Mississippi eastward across more than 15 river basins and bays to the Savannah River along Georgia's eastern border. These watersheds encompass diverse land forms ranging from mountainous terrain of the southern Appalachians in north Georgia and northeastern Alabama, to the rolling hills of the surrounding Piedmont area, to the broad, sandy lowlands of the Coastal Plain extending to the Gulf and Atlantic coasts. Figure 6 shows approximate locations of the system's fossil and hydro power plants and key watersheds in its traditional southeastern service territory.

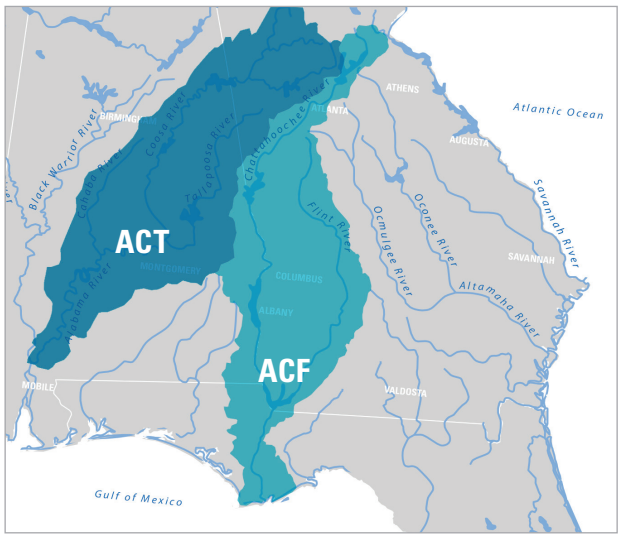
Rivers and Streams

The largest river basins in the region – the Mobile, Apalachicola, Altamaha and Savannah rivers – provide diverse aquatic ecosystems supporting numerous species of freshwater fish, mussels and other plant and animal life. The Mobile Basin drains the largest area, including more than 60 percent of the land area of Alabama and parts of northwestern Georgia and northeastern Mississippi. The Tombigbee, Black Warrior and Mobile rivers comprise the western portion of the Mobile Basin. The Alabama, Coosa and Tallapoosa (ACT) rivers and the Cahaba River drain the eastern portion. The Apalachicola River Basin drains north-central and western Georgia, and portions of eastern Alabama and the Florida Panhandle. Its three main rivers collectively are referred to as the Apalachicola-Chattahoochee-Flint (ACF) Basin. The Altamaha River and its major tributaries, the Ocmulgee and Oconee rivers, are located entirely within Georgia. The Savannah River Basin originates in the Blue Ridge Mountains and drains eastern Georgia and southwestern South Carolina on its journey to the Atlantic Ocean.

The other drainage basins within the service territory are smaller rivers and bays contained entirely or mostly within the Coastal Plain.

Lakes and Reservoirs

Large dams operated by the U.S. Army Corps of Engineers, hydroelectric dams operated by the Southern Company system and other nonfederal dams create many lakes in the region that fulfill a variety of purposes and offer abundant recreational opportunities. For example, the Mobile Basin contains more than 250,000 surface acres of man-made lakes and reservoirs. Thirty-one lakes in



Both the ACT river basin and ACF river basin flow through the Southern Company system.

Alabama and Georgia lie behind the system's hydroelectric plants. These lakes provide renewable hydro power, flood control, navigational support, irrigation, drinking water, fish and wildlife habitats and recreation on more than 200,000 acres with 5,000 miles of shoreline.

Coastal Water Resources

Tidal rivers, estuaries and wetlands occur extensively along the Gulf and Atlantic coasts within the service territory and provide essential nursery habitats for commercial and recreational marine fish and shellfish, birds and other wildlife. The length and variety of coastlines and bays support extensive freshwater tidal swamps and estuarine tidal marshes.

Groundwater Resources

In addition to the South Atlantic-Gulf region's abundant surface water resources, groundwater from principal aquifer systems plays a major role in providing water for public supply and industrial and agricultural uses. The principal aquifer systems in the region underlie the Coastal Plain and include the uppermost surficial aquifer system and sand and gravel aquifer, Floridan aquifer system and Southeastern Coastal Plain aquifer system. The Floridan aquifer system is the most productive water-yielding aquifer, providing water for cities such as Savannah and Brunswick in Georgia and numerous smaller communities and rural areas throughout the Coastal Plain. Locally, the Floridan aquifer is pumped for industrial and irrigation supplies, such as in southwestern Georgia for agricultural irrigation.

Watershed Locations of Southern Company System Generation Facilities

The Southern Company system's fossil, hydro and nuclear generation facilities are widely distributed in watersheds throughout the southeastern service territory. Table 1 on page 18 lists each facility by watershed location from west to east across the South Atlantic-Gulf region. Each facility's water source is generally within the identified watershed location, with the exception of a few that use either groundwater or municipal water sources. The system's fossil-fueled facilities occupy the greatest variety of watershed settings, encompassing the full spectrum of land forms and source waterbody types. However, many of these facilities use combustion turbines and combined-cycle natural gas turbines involving only limited withdrawal of surface water or groundwater. The three nuclear plants are located exclusively along larger rivers in the Coastal Plain of Georgia and Alabama. The hydroelectric facilities are distributed on rivers and streams mainly in the higher-gradient, upland physiographic provinces in the northern halves of Alabama and Georgia. Southern Power's wholesale generation facilities in the region are located in central Florida and North Carolina, as well as in the South Atlantic-Gulf watershed region.

LEVERAGING TECHNOLOGY IN WATER MANAGEMENT

COOLING SYSTEMS

Different types of cooling systems are available for power plants, with varying dependence on water withdrawal. Table 2 on page 20 provides the type of source water and cooling system used in each of the Southern Company system's thermoelectric power plants.

Wet Cooling (Once-Through and Cooling Tower)

Wet cooling systems withdraw water to absorb heat via indirect contact with steam in a condenser. These systems are divided into two types based on the manner in which the cooling water is used: once-through systems and closed-cycle systems with cooling towers or ponds.

Once-through cooling systems pump cold water from a large source, such as a river, lake or ocean, through the condenser tubes and directly to discharge, usually back into the original water body at a point some distance downstream from the initial intake. Heat absorbed in the condenser is transferred by conduction to the cooling water, which is then discharged into the larger, colder body of source water, where some heat is released by normal surface evaporation and radiation.

Because of its relative simplicity, the capital and operating costs for once-through cooling systems are usually less than those for closed-cycle cooling systems with a cooling tower. But because once-through cooling operates with water passing through the system only one time, it requires a large amount to be withdrawn, almost all of which is returned to the original source.

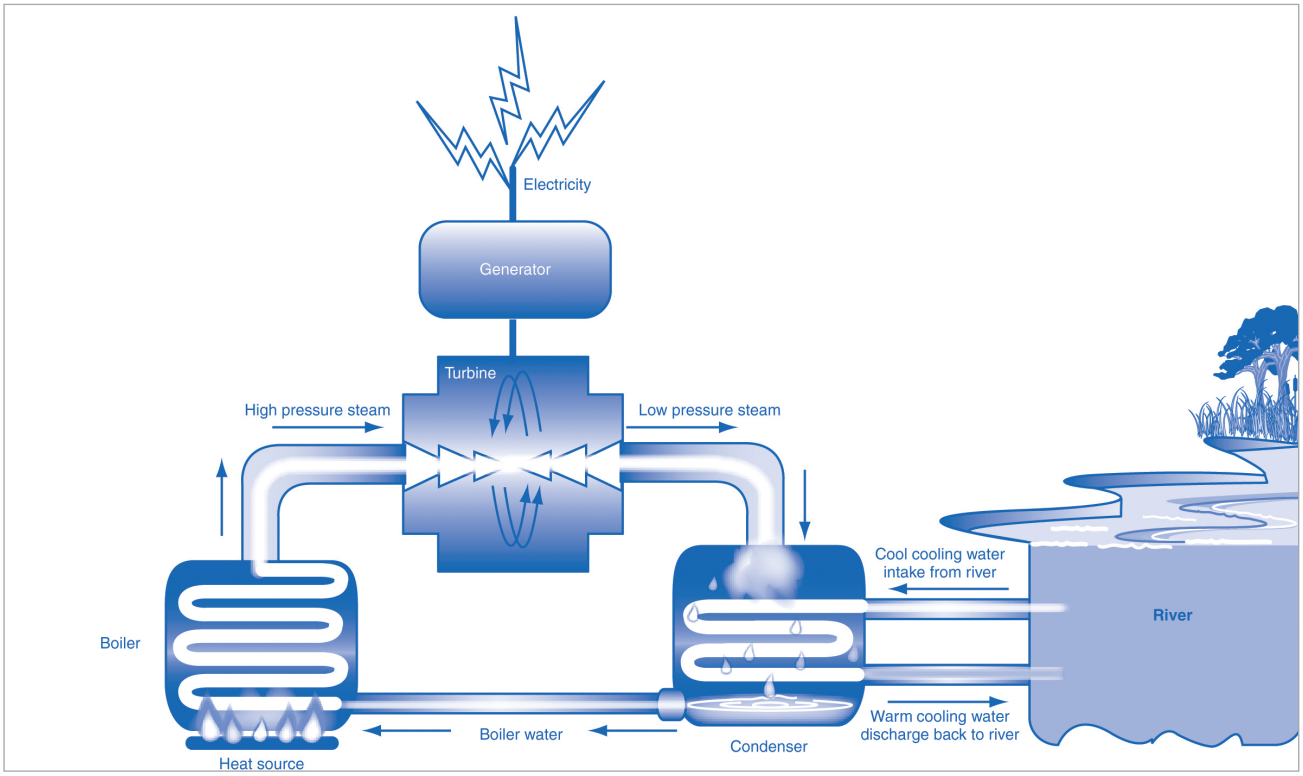


Figure 7, Once-through cooling system

U.S. Government Accountability Office (modified)

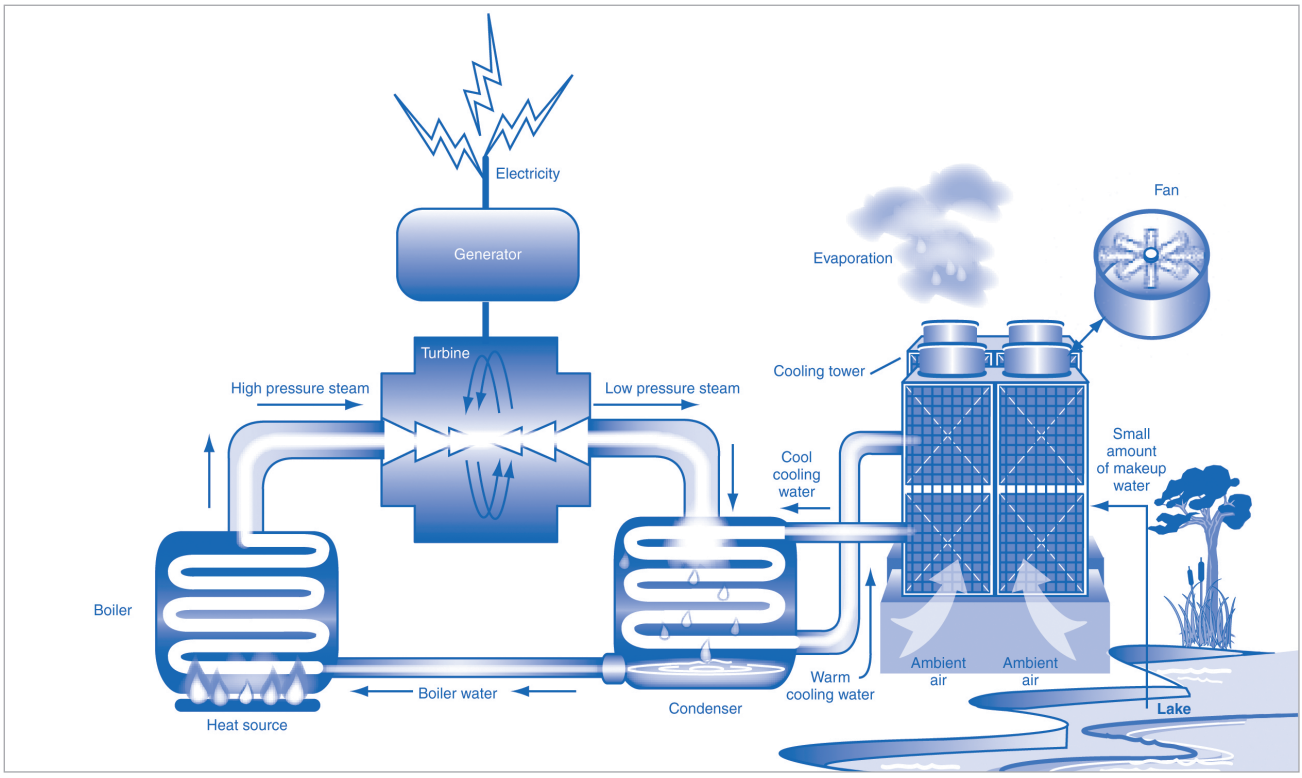


Figure 8, Closed-cycle cooling system

U.S. Government Accountability Office

Unlike once-through systems that continuously draw fresh cold water from a large water source, closed-cycle systems pump cooling water in a recycle loop through the condenser. By doing so, such systems significantly reduce the amount of freshwater required to cool and condense the steam-turbine exhaust. But in order to reduce the temperature of the cooling water – so it can be returned to the condenser as recycled cold water – these systems must rely on some means for rejecting heat. The most common means of heat rejection is a cooling tower, although cooling ponds and spray ponds may also be used.

In a cooling tower, heat absorbed by cooling water in the condenser is released to the air that passes through the cooling tower. This process lowers the temperature of the cooling water entering a tower so that it can be recirculated back to the condenser to be used once again for cooling. This heat transfer drives evaporation that typically consumes up to 75 percent of the cooling water that is not returned to the source.

Figures 7 and 8 on page 9 illustrate how once-through and closed-cycle cooling systems operate.

Dry Cooling and Hybrid Systems

Dry cooling systems transfer heat to the atmosphere without loss of water through evaporation. Cars, for example, use a form of dry cooling (the radiator) to control engine temperatures. A hybrid system incorporates elements of both wet and dry cooling systems in an attempt to maximize the benefits of each. These types of systems can reduce some evaporation over time by reducing the amount of time the wet cooling tower is in service.

Neither dry cooling nor hybrid systems are currently considered an economically viable option for the Southern Company system.

Thermal Impact of Once-Through Cooling Technologies

Thermal discharges and other power plant discharges are regulated by the NPDES program. All Southern Company system plants with once-through cooling have NPDES permits that set temperature limits on the effluent, or water outflow, to ensure state water quality standards applicable to the receiving water bodies are achieved. Permit levels vary from site to site.

The Southern Company system has 12 power plants with once-through cooling that withdraw and return approximately 3.5 billion gallons per day from lakes, rivers and estuaries. Once-through cooling is highly efficient as plants withdraw surface water, pass it through the condenser to cool steam and return the water to the original source. The typical condenser cooling-water discharge temperature varies with electric load and at normal full-load operation is approximately 20 degrees warmer than the water source. This added heat dissipates in the river or lake. These plants were primarily constructed prior to the mid-1970s and have undergone numerous studies to ensure their thermal discharge does not have an adverse impact as it is returned to the body of water. A number of older plants with once-through cooling systems were retired in 2015.

INNOVATIONS IN WATER SOURCES AND OPERATIONS

A growing number of initiatives are being applied at Southern Company system plants to improve water utilization.

Reclaimed Water

Gulf Power has partnered with Emerald Coast Utility Authority (ECUA) to develop a sustainable system to incorporate treated wastewater into the electric generation process, resulting in an award-winning project that has saved billions of gallons of this precious natural resource.

Gulf Power has surpassed 11.6 billion gallons in the amount of treated water used at Plant Crist. The plant uses reclaimed water as a coolant during the electricity generation process and to operate the advanced scrubber system that reduces air emissions.

This partnership streamlined ECUA's efforts to close its aging wastewater treatment facility that was located in a storm flood zone in downtown Pensacola, Florida – a plant that was permitted to discharge 18 million gallons of treated effluent per day into Pensacola Bay.

By using the water from the nearby ECUA advanced wastewater reclamation facility that was built near Plant Crist, Gulf Power, on average, conserves millions of gallons of water every day that would have been withdrawn from

Reclaimed water is used at Plant Crist to operate the scrubber system, which reduces air emissions.

the Escambia River, and establishes the ECUA Central Water Reclamation Facility as zero discharge.

Gulf Power is preparing a system at Plant Smith to operate with reclaimed water. The system will enable area utilities to reduce their discharge and conserve natural resources.

Biological Treatment

Alabama Power uses biological treatment systems that work much like water filtration in natural wetlands to provide low-maintenance, chemical-free water treatment at several of its plants. The process was researched and developed at Plant Gorgas to treat coal-pile runoff. A similar system is installed at Plant Barry to treat water used by the plant's environmental control system. This biofilm treatment system for scrubber wastewater received the 2013 Southeastern Electric Exchange Chairman's Award, the highest honor at the Industry Excellence Awards program.

Kemper County Zero Discharge

The Kemper County IGCC energy facility is designed to be a zero-liquid discharge facility – meaning there will be no discharge of industrial process wastewater from the plant into surrounding streams and rivers under normal conditions. Mississippi Power will purchase and reuse the city of Meridian's treated effluent, known as gray water, for plant cooling.

ENVIRONMENTAL CONTROLS

Environmental controls help reduce air emissions and produce cleaner energy, but some controls can significantly increase water withdrawal and consumption.

Scrubbers

Flue-gas desulfurization systems (FGDs), or scrubbers, are used to reduce sulfur dioxide emissions from coal-fired generation. Water in wet scrubbers is the medium for the

Kemper County IGCC project

chemical reaction that combines limestone with the flue-gas sulfur dioxide to yield gypsum.

After that chemical reaction occurs in the scrubber reactor vessel, the resultant gypsum slurry is pumped to a dewatering system. The gypsum slurry can be dewatered either mechanically or in a settling pond. Most of the water is recycled back into the scrubber system as make-up. However, a significant amount is consumed as vapor in the effluent gas stream that exits the scrubber and is emitted from the stack. A typical consumption rate for the Southern Company system's FGD plants is about 1.5 million gallons per day for an 800-MW plant. The system currently has wet scrubbers at 10 plants.

Carbon Capture and Storage

Carbon capture and storage (CCS) is a technology that has potential to reduce greenhouse gas emissions from power plants. Southern Company has the largest demonstration of carbon capture on a pulverized-coal power plant in the U.S. at Alabama Power's Plant Barry. In addition, the Kemper County IGCC energy facility will include carbon capture and reuse, which is expected to result in carbon emissions better than a comparably sized natural gas plant.

Currently, CCS significantly increases water consumption because of additional energy required for the process, although future technology improvements could reduce consumption.

FINDING SOLUTIONS THROUGH RESEARCH[4]

Southern Company is a recognized industry leader in conducting robust, proprietary research and development – a commitment that dates to the 1960s. The company fosters innovation throughout the Southern Company system and industry, focusing not just on the here and now, but on what may be, in order to solve not only current issues but future ones. The company works on its own and with partners to explore new and improved energy technologies – including major emerging water conservation technologies and initiatives.

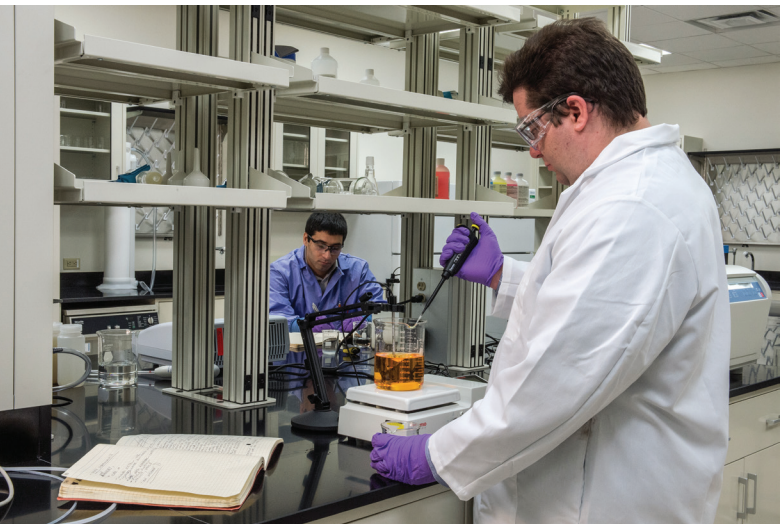
WATER RESEARCH CENTER

In 2012, Georgia Power's Water Research Center opened at Plant Bowen. A first-of-its-kind power generation water research hub, the Water Research Center provides a site for developing and testing technologies to address power plant water withdrawals and consumption by focusing on recycling, reuse and treatment to improve water quality. The Water Research Center began as a joint effort between Southern Company, Georgia Power, Southern Research and EPRI, which assembled a research and development collaborative of 13 additional partners.

The center is designed to accommodate development and evaluation of power plant water-management technologies in seven focus areas:

- Cooling tower and advanced cooling systems – Explores ideas such as increasing cooling tower cycles of concentration, diversion/reduction of cooling tower heat loads, feasibility and applicability of hybrid/dry cooling systems, wet surface air coolers, reducing parasitic load and use of nontraditional water sources.
- Moisture recovery – Focuses on researching innovative technologies and methods to recover moisture that would otherwise be consumed or lost through processes such as scrubber and cooling tower plumes and flue gas.
- Zero-liquid discharge – Explores technologies that separate pollutants into a solid material and high-quality distillate. Distillate waters created could be reused within the plant boundaries for purposes such as scrubber prequench, boiler feed water, service water and ash wetting.
- Solid landfill water management – Explores water issues related to managing on-site landfills with the addition of new solids such as zero-liquid discharge salts and sludges to existing landfills containing bottom ash, fly ash and gypsum.
- Low-volume wastewater treatment – Focuses on technologies to treat water from various waste streams throughout the plant, such as floor drains and stormwater runoff, which enable use of these waters in various processes within the plant.
- Carbon technology – Develops models to determine

[4] *CDP section W4, Water Opportunities*



Testing at the Water Research Center at Plant Bowen

the impacts of retrofitting various post-combustion carbon capture technologies on the use of water at the plant site, reducing the impact of carbon capture on plant water usage.

- Water modeling, monitoring and best management practices – Results from each focus area are used to model strategies for managing water balances and to explore tools for evaluating overall water use (baseline and real time), process and wastewater rerouting, reuse/recycling and conservation/recovery methods and impacts.

The emerging technologies being developed and explored at the Water Research Center may be implemented by the electric generation industry worldwide to address future water issues and also will educate students and community leaders about the importance of water conservation and the technologies being developed to reduce water consumption.

EXTERNAL WATER DRIVERS[5]

In addition to the impacts of generation, cooling and environmental control technologies, other external factors affect water resources. Population growth, increased demand for energy, new regulations and periods of drought all play important roles.

EMERGING REGULATIONS

It is likely that water needs for power plants will change as a result of federal environmental regulations.

Shifting to more water-intensive energy technologies at existing and new power plants may substantially increase future water consumption from power generation. Although future freshwater withdrawal for U.S. thermoelectric generation is expected to decline, freshwater consumption would increase if federal regulations require conventional once-through cooling systems to be replaced by closed-cycle cooling systems such as cooling towers.

EPA's water-intake rules under section 316(b) of the Clean Water Act could drive some existing generating units with once-through cooling and all new units to install cooling towers. Cooling towers withdraw less water than once-through systems but consume substantially more.

DROUGHT AND FLOODS

During more than a century of operation, the Southern Company system has accumulated vast knowledge and experience in managing its assets and resources in the southeastern climate and in times of extreme weather. The system's facilities have been designed to be resilient when faced with extreme conditions such as flood and drought.

Regional drought and seasonally low stream flows will continue to periodically challenge water withdrawal and consumption.

Severe drought conditions reduce availability of freshwater stream flows and can restrict or prevent operation of certain generation facilities. The Southern Company system's hydroelectric facilities are used less during severe drought as a direct result of reduced stream flow. During the most extreme summer conditions, operation of some thermoelectric generation facilities could become constrained by warm ambient water temperatures and the need to reduce thermal discharges in order to meet water quality criteria. The system's proactive water management

[5] *CDP section W3, Water Risks*

and community engagement activities during droughts in Georgia and Alabama, and the lessons learned, have helped in planning for drought and changes in seasonal availability of stream flows.

Water in the Southeast is, on average, extremely plentiful compared with other regions due to generous and relatively uniform precipitation throughout the year. On average, the southeastern states in which the Southern Company system operates receive approximately 55 inches of precipitation per year, compared with the contiguous U.S. average of 30 inches per year.

However, seasonal and multiyear droughts, coupled with large vegetative water consumption in the growing season, can significantly reduce stream flow. Conversely, because of proximity to the Gulf of Mexico, which can be an abundant source of atmospheric moisture, the Southeast can experience excessive rainfall, causing flooding.

During periods of drought, actions can be taken to ensure the availability of generating capacity. For example, three of the largest fossil generating facilities in the Southern Company system's fleet (Georgia Power's plants Scherer and Wansley and Alabama Power's Plant Miller) have storage reservoirs that provide reserve water capacity during periods of low-source stream levels.

Ample precipitation is essential for hydroelectric operations, but timing is also important. During the spring, reservoirs in the region are replenished. If spring precipitation is well below normal, it becomes a challenge to fill and maintain reservoirs at levels necessary during the remainder of the year for generation, recreation, navigation and other needs. The Southern Company system works closely with federal, state and local agencies to ensure good communication and coordination are maintained for sound reservoir management.

The Southeast is exposed to a number of meteorological phenomena that can cause or lead to flooding, including large-scale precipitation events, hurricanes and tropical storms, as well as flash flooding from severe thunderstorms. The Southern Company system's hydroelectric facilities follow Federal Energy Regulatory Commission guidelines to ensure they can withstand the most extreme situations. Alabama Power and Georgia Power have established flood control plans to address the operational challenges that occur in large floods.

DEMAND FOR WATER RESOURCES

While distribution of water withdrawal by sector across the southeastern states of the Southern Company system mirrors national patterns, each state has unique characteristics that could affect demand in the future. So far, demand for limited water resources has been an issue primarily in areas that are experiencing the most population and economic growth. The ACF River Basin is an example of a river system managed to support multiple, sometimes conflicting, needs such as flood control, hydropower generation, navigational support and agricultural and domestic water supply, as well as environmental flows for aquatic resources. This creates a dynamic situation because this same growth also creates additional power generation demands and associated environmental control upgrades that must be considered.

The Southern Company system has continued to take a balanced, active role in the ongoing Georgia water planning process and interstate negotiations to ensure stakeholders understand the key role water plays in its ability to supply the electricity needed to support economic growth.

AQUIFER SALT WATER INTRUSION

Salt water intrusion into the Upper Floridan Aquifer in coastal Georgia has led regulators to reduce existing groundwater permits and limit additional withdrawals. Population growth along the South Carolina and Georgia coasts has resulted in excessive groundwater withdrawals that have caused intrusion of salt water into this shallow aquifer. The aquifer is the source for groundwater withdrawal for wells at several Georgia Power plants. Without adversely affecting operations, Georgia Power has voluntarily surrendered a portion of the permitted withdrawal quantities to contribute to solving the problem.

SUPPLY CHAIN CONSIDERATIONS[6]

Generating electricity with a diverse fuel mix depends on reliable, cost-competitive sources of fuel supply and associated transportation services. The Southern Company system's fuel supply chain consists of reputable suppliers of coal, natural gas, oil and uranium.

Southern Company recognizes that fuel extraction, depending on the type of process used, may be accompanied by environmental impacts that in some cases include water. These potential environmental impacts are regulated by federal and state governments to ensure protection of public health and ecosystems. While Southern Company does not currently track water issues related to individual suppliers, the fuel source supply chain is continually evaluated to identify potential problems related to availability and cost, including water-related risk.

RISK[7]

The World Resources Institute Aqueduct Water Risk Atlas is a publicly available database and mapping tool that provides information on water-related risks worldwide. Aqueduct uses 12 global indicators to provide companies, investors and other audiences with information about geographic exposure to water-related risks.

The Aqueduct Water Risk Framework uses research, data and hydrological modeling techniques. Indicators are provided in three categories of water risks: physical risks (quantity), physical risks (quality) and reputational and regulatory risks.

The Aqueduct overall estimated water risk for each steam electric generating plant in the Southern Company system is indicated in Figure 9. None of the system's steam electric generating facilities is located in the high-risk category.

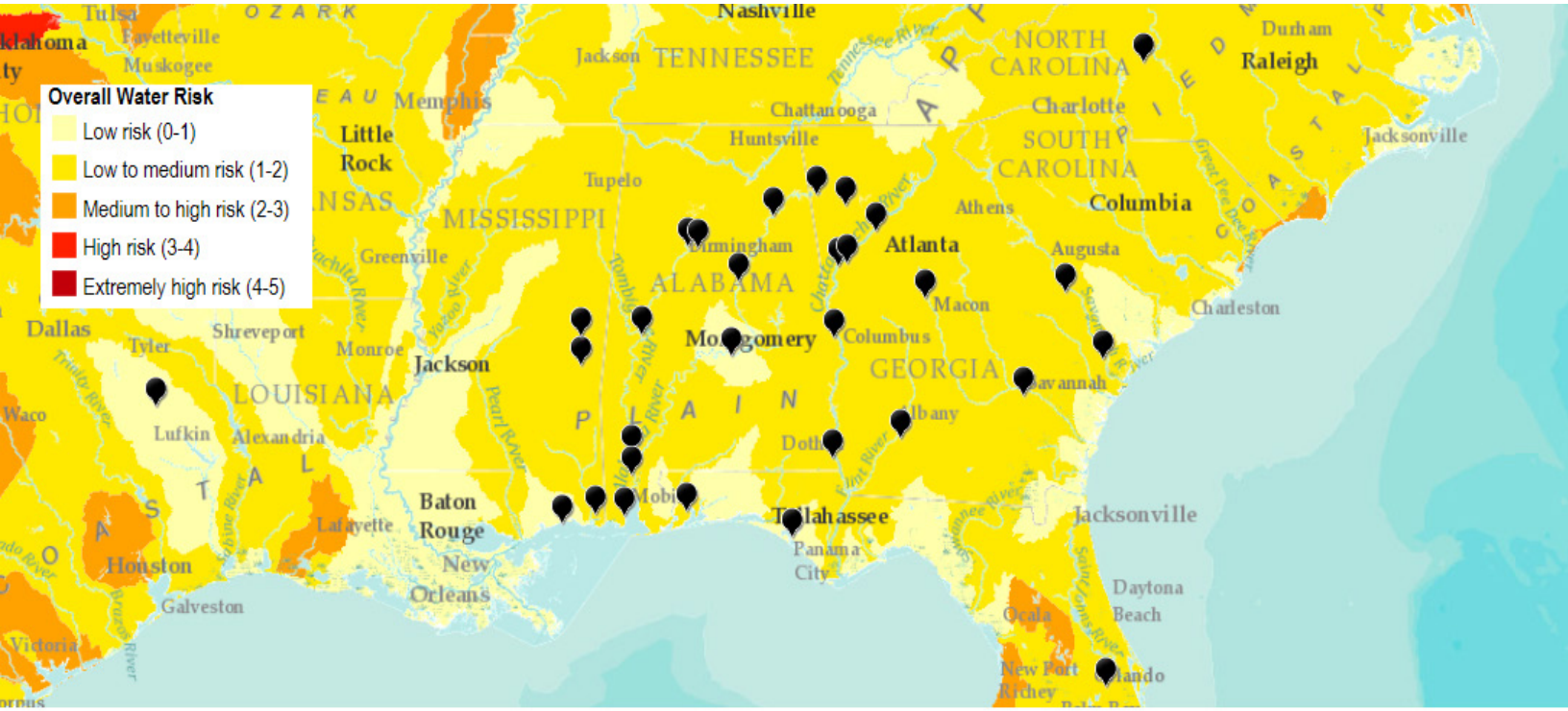


Figure 9, Aqueduct Water Risk Atlas map

[6]CDP Section W1, Supplier Reporting ; [7]CDP Section W2 Risk Assessment

Source: Reig, P., T. Shiao and F. Gassert. 2013. "Aqueduct Water Risk Framework." Working Paper. Washington, D.C.: World Resources Institute. Available online at http://www.wri.org/publication/aqueduct-water-risk-framework.

STAKEHOLDER EFFORTS

Southern Company has an active role in resource planning efforts at the watershed level and establishes partnerships and stewardship programs to conserve and protect the region's natural resources. This engagement ensures proper consideration of the importance of the continued availability of reliable freshwater supplies to meet the region's power generating needs in the future.

STATE WATER PLANNING

Of the four states served by the Southern Company system, Georgia and Florida have the most comprehensive state or regional water resource planning and regulatory processes. The Georgia Comprehensive Statewide Water Management Plan, adopted in 2008, provides for development of water-resource and quality assessments, water-need forecasts and regional water plans. Georgia Power participated in the process, including serving on regional councils and providing input to a technical memorandum that evaluated long-term energy-sector water withdrawal and water consumption needs.

Gulf Power's service territory is located within the Northwest Florida Water Management District, one of five water management districts in Florida responsible for water-resource planning. The effort includes a process to project water needs to 2030 and seeks to identify areas of concern.

Water planning for Alabama Power's service territory was initiated in 1993 with passage of the Alabama Water Resources Act, which established a mechanism to develop strategies for managing the state's waters. The program was enhanced in 2008 when the legislature established the Permanent Joint Legislative Committee on Water Policy and Management. Alabama Power provided technical support to the committee. In April 2014, the governor of Alabama published the Alabama Water Agencies Working Group Report outlining a future comprehensive water management plan for the state.

Since 2003, Southern Company has invested more than $11.9 million in wildlife and environmental stewardship programs in the Southeast.

ENVIRONMENTAL STEWARDSHIP AND EDUCATION

The Southern Company system's environmental stewardship program, which includes watershed protection as well as education as a major focal point, is making an important contribution to conservation in the Southeast.

Partnerships and projects to protect waterways, wildlife and natural habitats through financial, technical and hands-on volunteer support form the backbone of the stewardship program. The watershed component includes company-led and external collaborative efforts.

The company is the driving force behind Renew Our Rivers, which began in 1999 as a small community cleanup in Alabama initiated by one employee and has since grown into a large grassroots volunteer effort that has spread to Florida, Georgia and Mississippi.

To date, more than 101,000 Renew Our Rivers volunteers have removed approximately 14.2 million pounds of trash and debris from waterways in the four states, and

the program has garnered numerous local and national environmental awards. Through educational components such as the "Message in the Bottle" coloring book and lesson plan, Renew Our Rivers has helped educate children on conservation and environmental stewardship.

The Southern Company system's commitment to clean water impacts more than just people. Well-managed systems provide habitat for plants and animals, and some imperiled species are finding respite as a result of work by the company to collect information and protect them. For example, plants such as the Georgia alder, which grows only in the Drummond Swamp of Georgia, along with other rare plants are being monitored and studied. A variety of endangered mussels, fish and other aquatic animals, as well as several bird species, have also been protected as a result of the company's environmental stewardship strategy.

In cooperation with the National Fish and Wildlife Foundation (NFWF) and five federal agencies – including the EPA, U.S. Fish and Wildlife Service, U.S. Department of Defense, U.S. Forest Service and Natural Resources Conservation Service – as well as other partners, Southern Company offers grants through three conservation programs: Power of Flight, Longleaf Stewardship Fund and Five Star and Urban Waters Restoration. Through these public-private partnerships, Southern Company has been a leader in conserving birds, expanding the longleaf pine ecosystem and catalyzing community-based stewardship of local watersheds. These collaborative efforts continue to achieve measurable conservation outcomes within the Southern Company system's service territory in Georgia, Alabama, the Florida Panhandle, southeast Mississippi and beyond.

The Southern Company system has invested $18.2 million from 2003 through 2018 to fund imperiled longleaf pine restoration, bird conservation and community-based wetland restoration through its NFWF partnerships. Nearly $12 million of this investment – when combined with partner and grantee-matching contributions – has already resulted in an on-the-ground conservation impact of more than $112 million, which has translated to more than 1.3 million acres of critical habitat restored and enhanced.

CONCLUSION

Water has been a constant in Southern Company's more than century-long history. And while the lessons of the past inform us, 21st century thinking is needed to tackle today's challenges. That's why technology innovation, including water management, is a major focus for the company.

This report is part of an ongoing effort to engage in meaningful discussions about the best ways to provide energy in a fast-changing world. Water is an important part of these discussions. Southern Company welcomes your comments, questions and suggestions. Please send feedback to WaterReport@southernco.com.

Additional information on water and other environmental matters can be found in the Southern Company Corporate Responsibility Report at southerncompany.com/corporate-responsibility.

Renew Our Rivers cleanup in Alabama

TABLE 1*

Southern Company System Southeastern Service Territory Generating Facilities by Watershed Location

Plant	County	State	Watershed Location	Nameplate Capacity (MW)	Primary Fuel Type
FOSSIL					
Watson	Harrison	MS	Biloxi Bay	901	Gas
Sweatt	Lauderdale	MS	Chickasawhay River	119	Gas
Kemper	Kemper	MS	Chickasawhay River	582	Gas
Daniel	Jackson	MS	Pascagoula River	2,070	Coal, Gas
Chevron Cogen	Jackson	MS	Pascagoula River	147	Gas
Miller	Jefferson	AL	Black Warrior River	2,640	Coal, Gas
Gorgas	Walker	AL	Black Warrior River	1,021	Coal
Greene County	Greene	AL	Black Warrior River	1,220	Coal, Oil, Gas
Washington County	Washington	AL	Tombigbee River	123	Gas
Bowen	Bartow	GA	Etowah River	3,160	Coal, Oil
Hammond	Floyd	GA	Coosa River	800	Coal
Gadsden	Etowah	AL	Coosa River	120	Gas
Gaston	Shelby	AL	Coosa River	1,900	Coal, Oil
Harris	Autauga	AL	Alabama River	1,319	Gas
GE Plastics	Lowndes	AL	Alabama River	105	Gas
Barry	Mobile	AL	Mobile River	2,370	Coal, Gas
Theodore	Mobile	AL	Mobile Bay	236	Gas
Crist	Escambia	FL	Escambia River	970	Coal
Pea Ridge	Santa Rosa	FL	Escambia Bay	15	Gas
Smith	Bay	FL	St. Andrew Bay	890	Coal, Oil, Gas
McDonough	Cobb	GA	Chattahoochee River	2,599	Oil, Gas
Wansley	Heard	GA	Chattahoochee River	2,852	Coal, Oil, Gas
Yates	Coweta	GA	Chattahoochee River	700	Gas
Franklin	Lee	AL	Chattahoochee River	1,858	Gas
Addison	Upson	GA	Flint River	669	Gas, Oil
Mitchell	Dougherty	GA	Flint River	204	Coal, Oil
Scherer	Monroe	GA	Ocmulgee River	3,272	Coal
Robins	Houston	GA	Ocmulgee River	158	Oil, Gas
Dahlberg	Jackson	GA	Oconee River	756	Gas, Oil
McManus	Glynn	GA	Turtle River	482	Oil
Wilson	Burke	GA	Savannah River	354	Oil
McIntosh	Effingham	GA	Savannah River	2,122	Coal, Oil, Gas

**This presentation has been adjusted to reflect generating facilities owned and/or operated and may not reflect applicable operating company ownership percentages. Does not include solar, wind, biomass or landfill-gas facilities.*

Plant	County	State	Watershed Location	Nameplate Capacity (MW)	Primary Fuel Type
Boulevard	Chatham	GA	Savannah River	20	Oil, Gas
Kraft	Chatham	GA	Savannah River	22	Oil, Gas
Rowan	Rowan	NC	Yadkin River	986	Gas, Oil
Cleveland County	Cleveland	NC	Broad River	720	Gas, Oil
Intercession City	Osceola	FL	Kissimmee River	143	Oil
Oleander	Brevard	FL	St. Johns River	791	Gas, Oil
Stanton	Orange	FL	Econlockhatchee River	659	Gas, Oil
NUCLEAR					
Farley	Houston	AL	Chattahoochee River	1,720	Nuclear
Hatch	Appling	GA	Altamaha River	1,796	Nuclear
Vogtle	Burke	GA	Savannah River	2,320	Nuclear
HYDRO					
Smith (Dam)	Walker	AL	Black Warrior River	158	Hydro
Bankhead	Tuscaloosa	AL	Black Warrior River	54	Hydro
Holt	Tuscaloosa	AL	Black Warrior River	47	Hydro
Rocky Mountain	Floyd	GA	Oostanaula River	215	Hydro
Weiss	Cherokee	AL	Coosa River	88	Hydro
Henry	St. Clair	AL	Coosa River	73	Hydro
Logan Martin	Talladega	AL	Coosa River	135	Hydro
Lay	Chilton	AL	Coosa River	177	Hydro
Mitchell (Dam)	Chilton	AL	Coosa River	170	Hydro
Jordan	Elmore	AL	Coosa River	100	Hydro
Bouldin	Elmore	AL	Coosa River	225	Hydro
Harris	Randolph	AL	Tallapoosa River	132	Hydro
Martin	Tallapoosa	AL	Tallapoosa River	182	Hydro
Yates (Dam)	Tallapoosa	AL	Tallapoosa River	47	Hydro
Thurlow	Elmore	AL	Tallapoosa River	81	Hydro
Morgan Falls	Fulton	GA	Chattahoochee River	17	Hydro
Langdale	Harris	GA	Chattahoochee River	1	Hydro
Riverview	Harris	GA	Chattahoochee River	0.5	Hydro
Bartlett's Ferry	Harris	GA	Chattahoochee River	173	Hydro
Goat Rock	Harris	GA	Chattahoochee River	39	Hydro
Oliver	Muscogee	GA	Chattahoochee River	60	Hydro

Plant	County	State	Watershed Location	Nameplate Capacity (MW)	Primary Fuel Type
North Highlands	Muscogee	GA	Chattahoochee River	30	Hydro
Flint River	Dougherty	GA	Flint River	5	Hydro
Lloyd Shoals	Butts	GA	Ocmulgee River	14	Hydro
Wallace	Hancock	GA	Oconee River	321	Hydro
Sinclair	Baldwin	GA	Oconee River	45	Hydro
Estatoah	Rabun	GA	Tennessee River	0.3	Hydro
Burton	Rabun	GA	Tugaloo River	6	Hydro
Nacoochee	Rabun	GA	Tugaloo River	5	Hydro
Terrora	Rabun	GA	Tugaloo River	16	Hydro
Tallulah Falls	Rabun	GA	Tugaloo River	72	Hydro
Tugalo	Habersham	GA	Tugaloo River	45	Hydro
Yonah	Stephens	GA	Tugaloo River	23	Hydro

TABLE 2

Southern Company System Thermoelectric Cooling System Source and Type

Plant	Source of Cooling Water	Type of Condenser Cooling
Alabama Power		
Barry Units 1,2,4,5	Freshwater	Once-Through
Barry Units 6-7	Recycle	Cooling Tower
Gadsden	Freshwater	Once-Through
Gaston	Freshwater	Once-Through and Cooling Tower
Gorgas	Freshwater	Once-Through
Greene County	Freshwater	Once-Through
Miller	Freshwater	Cooling Tower
Theodore	Municipal Water	Cooling Tower
Washington County	Groundwater	Cooling Tower
Georgia Power		
Bowen	Freshwater	Cooling Tower
Hammond	Freshwater	Once-Through
McDonough	Freshwater	Cooling Tower
McIntosh Unit 1	Freshwater	Once-Through

Plant	Source of Cooling Water	Type of Condenser Cooling
Georgia Power (continued)		
McIntosh Units 10-11	Recycle	Cooling Tower
Mitchell	Freshwater	Once-Through
Scherer	Freshwater	Cooling Tower
Wansley	Freshwater	Cooling Tower
Yates	Freshwater	Cooling Tower
Gulf Power		
Smith Units 1-2	Brackish	Once-Through
Smith Unit 3	Recycle	Cooling Tower
Crist Units 4-5	Brackish	Once-Through with Helper Cooling Tower
Crist Units 6-7	Municipal Wastewater	Cooling Tower
Mississippi Power		
Daniel Units 1-2	Freshwater Cooling Pond	Once-Through
Daniel Units 3-4	Freshwater Cooling Pond	Cooling Tower
Kemper 1	Municipal Wastewater	Cooling Tower
Sweatt	Groundwater	Cooling Tower
Watson Units 3-4	Brackish	Once-Through with Helper Cooling Tower
Watson Unit 5	Brackish	Cooling Tower
Southern Nuclear		
Farley	Freshwater	Cooling Tower
Hatch	Freshwater	Cooling Tower
Vogtle	Freshwater	Cooling Tower
Southern Power		
Harris Units 1-2 CC	Freshwater	Cooling Tower
Franklin Units 1-3 CC	Freshwater	Cooling Tower
Nacogdoches	Freshwater	Cooling Tower
Stanton Unit A CC	Municipal Wastewater	Cooling Tower
Rowan Unit 4 CC	Municipal Water	Cooling Tower

Cautionary Note Regarding Forward-Looking Statements

Certain information contained in this report is forward-looking information based on current expectations and plans that involve risks and uncertainties. Forward-looking information includes, among other things, statements concerning expected environmental attributes of ongoing construction projects, future water consumption, current and proposed environmental regulations and related compliance plans, economic growth and capital and other expenditures. Southern Company cautions that there are certain factors that can cause actual results to differ materially from the forward-looking information that has been provided. The reader is cautioned not to put undue reliance on this forward-looking information, which is not a guarantee of future performance and is subject to a number of uncertainties and other factors, many of which are outside the control of Southern Company; accordingly, there can be no assurance that such suggested results will be realized. The following factors, in addition to those discussed in Southern Company's Annual Report on Form 10-K for the fiscal year ended Dec. 31, 2015, and subsequent securities filings, could cause actual results to differ materially from management expectations as suggested by such forward-looking information: the impact of recent and future federal and state regulatory changes, including environmental laws regulating emissions, discharges and disposal to air, water and land, and also changes in tax and other laws and regulations to which Southern Company and its subsidiaries are subject, as well as changes in application of existing laws and regulations; current and future litigation, regulatory investigations, proceedings or inquiries; variations in demand for electricity; available sources and costs of fuels; the ability to control costs and avoid cost overruns during the development and construction of facilities; the ability to construct facilities in accordance with the requirements of permits and licenses, to satisfy any environmental performance standards and the requirements of tax credits and other incentives, and to integrate facilities into the Southern Company system upon completion of construction; advances in technology; state and federal rate regulations and the impact of pending and future rate cases and negotiations; actions related to cost recovery for the IGCC facility under construction in Kemper County, Mississippi ("Kemper IGCC"), including the ultimate impact of the 2015 decision of the Mississippi Supreme Court, the Mississippi Public Service Commission's ("PSC") December 2015 rate order and related legal or regulatory proceedings, Mississippi PSC review of the prudence of Kemper IGCC costs and approval of further permanent rate recovery plans, actions relating to proposed securitization, satisfaction of requirements to utilize grants, and the ultimate impact of the termination of the proposed sale of an interest in the Kemper IGCC to South Mississippi Electric Power Association; the ability to successfully operate the electric utilities' generating, transmission and distribution facilities; the ability of counterparties of Southern Company and its subsidiaries to make payments as and when due and to perform as required; the direct or indirect effect on the Southern Company system's business resulting from cyber intrusion or terrorist incidents and the threat of terrorist incidents; and the direct or indirect effects on the Southern Company system's business resulting from incidents affecting the U.S. electric grid or operation of generating resources. Southern Company expressly disclaims any obligation to update any forward-looking information.

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